การวิเคราะห์เชิงประเมินและการพัฒนาข้อกำหนดการแสดงฉลากและเอกสารกำกับชุดทดสอบทางการแพทย์สำหรับผู้บริโภคใช้ด้วยตัวเอง

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EVALUATIVE ANALYSIS AND GUIDELINE DEVELOPMENT OF CONSUMER-BASED LABELING FOR HOME-USE IN-VITRO DIAGNOSTIC TEST KIT

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A Dissertation Submitted in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy Program in Social and Administrative Pharmacy
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ปัจจุบัน ประเทศไทยไม่มีการควบคุมที่เข้มงวดในฉลากและเอกสารกำกับชุดทดสอบทางการแพทย์สำหรับผู้บริโภคใช้ด้วยตัวเอง ไม่มีมาตรการเกี่ยวกับการทดสอบในผู้บริโภคและไม่มีการคำนวณระดับความยากง่ายในการอ่าน การศึกษานี้จึงมีวัตถุประสงค์เพื่อบ่งชี้ปัญหาและทราบข้อกำหนดที่จำเป็นต่อการพัฒนาแนวทางและการประเมินการแสดงฉลากและเอกสารกำกับเพื่อผู้บริโภคด้วยชุดทดสอบการตั้งครรภ์ การศึกษาแบ่งเป็น 3 ระยะประกอบด้วย การวิเคราะห์ปัญหา การพัฒนาและประเมินข้อกำหนดการแสดงฉลากและเอกสารกำกับ โดยระยะแรกเป็นการทดสอบในผู้บริโภครายใหม่จำนวน 90 คนด้วยเทคนิคไดแอกนอสติกเทสติง การวิเคราะห์ข้อมูลในฉลากและเอกสารกำกับชุดทดสอบการตั้งครรภ์จำนวน 20 ยี่ห้อรวมทั้งการวิเคราะห์ข้อกฎหมายระหว่างประเทศ ผลการศึกษาในชุดทดสอบการตั้งครรภ์จำนวน 20 ยี่ห้อ พบปัญหาการออกแบบด้านคุณภาพงานพิมพ์ ภาพและตัวอักษรเล็กสีจาง ส่วนปัญหาเกี่ยวกับข้อมูล พบว่า ระบุข้อมูลที่จำเป็นไม่ครบถ้วน ข้อมูลในตำแหน่งต่างๆของเอกสารไม่สอดคล้องกัน ระบุ 2 ชื่อการค้าในเอกสารกำกับ 1 ฉบับ สินค้าและฉลากฟอยล์เหมือนกันแต่ระบุประเทศเจ้าของผลิตภัณฑ์ต่างกัน ระบุข้อความส่งเสริมการขายหลากหลาย และจากการคำนวณหาดัชนีฟอกซ์พบว่า ผู้บริโภคต้องมีระดับการศึกษาอย่างน้อยชั้นมัธยมศึกษาปีที่ 1 จึงจะสามารถอ่านและเข้าใจฉลากและเอกสารกำกับของทุกผลิตภัณฑ์ ส่วนผลการทดสอบในผู้บริโภค 90 คนดังกล่าวข้างต้น พบว่าไม่มีผู้ใดผ่านเกณฑ์เทคนิคไดแอกนอสติกเทสติง และมีเพียงข้อมูลจำนวน 4 จาก 29 รายการเท่านั้นที่ผ่านเกณฑ์ดังกล่าวซึ่งได้แก่ ชื่อการค้า วิธีทดสอบ การอ่านผลการตั้งครรภ์และไม่ตั้งครรภ์ ทั้งนี้คะแนนเฉลี่ยผลการรับรู้รูปแบบ เนื้อหาและความเข้าใจในเอกสารใกล้เคียงกันและค่อนข้างต่ำโดยเฉพาะในส่วนของความเข้าใจ นอกจากนี้ยังพบว่าการใช้ข้อความที่ต้องตีความก่อนจะเข้าใจรวมทั้งรูปแบบคำถามคำตอบและกรอบเพื่อระบุข้อมูลที่จำเป็นนั้นไม่เหมาะสมกับผู้บริโภคคนไทย อนึ่ง จากการเปรียบเทียบข้อกำหนดการแสดงฉลากและเอกสารกำกับของประเทศแคนาดา สหรัฐอเมริกา สหภาพยุโรปและออสเตรเลีย พบว่า สินค้าที่จำหน่ายควรแสดงข้อมูลจำเป็นที่เพียงพอ โดยใช้ภาษาเจ้าของประเทศที่ง่าย กระชับและเห็นได้ชัดเจน รวมทั้งมีรูปแบบการแสดงข้อมูลที่เหมาะสม สำหรับระยะที่สองซึ่งเป็นการพัฒนาข้อกำหนดและตัวอย่างการแสดงฉลากและเอกสารกำกับนั้น ข้อกำหนดที่ประเมินโดยผู้เชี่ยวชาญแล้วได้ถูกนำไปใช้เป็นแนวทางในการพัฒนาตัวอย่างฉลากและเอกสารกำกับ ซึ่งได้มีการประเมินโดยผู้เกี่ยวข้องในระยะที่สาม โดยภายหลังการปรับปรุงตามข้อคิดเห็นดังกล่าว ได้มีการทดสอบในผู้บริโภคด้วยเทคนิคไดแอกนอสติกเทสติง 2 รอบๆละ 22 คน พบว่า ในรอบแรกร้อยละ 50 ของผู้บริโภคและข้อมูลในหัวข้อ"ข้อห้าม ข้อผิดพลาดที่อาจเกิดขึ้น ข้อจำกัดการทดสอบและแหล่งข้อมูลเพิ่มเติม"ไม่ผ่านเกณฑ์ที่กำหนด ส่วนรอบสอง มีผู้บริโภคเพียง 4 จาก 22 คนและข้อมูล 5 จาก 29 หัวข้อที่ไม่ผ่านเกณฑ์โดยมีคะแนนเฉลี่ยการรับรู้คุณภาพเอกสารสูงมาก แต่ผู้บริโภคยังย้ำถึงความจำเป็นที่จะต้องมีฉลากและเอกสารกำกับภาษาไทย ทั้งนี้ฉลากและเอกสารกำกับในรอบสองมีระดับความยากง่ายในการอ่านเทียบเท่าชั้นประถมศึกษาปีที่ 5 ซึ่งต่ำกว่าระดับการศึกษาภาคบังคับของคนไทย ดังนั้น ผู้ที่เกี่ยวข้องควรตระหนักและเร่งปรับปรุงนโยบายและข้อกำหนด รวมทั้งมีการพัฒนาวิธีการที่ง่ายและน่าเชื่อถือในการประเมินคุณภาพการแสดงฉลากและเอกสารกำกับเพื่อผู้บริโภคของอุปกรณ์เครื่องมือแพทย์ และผลิตภัณฑ์สุขภาพอื่นๆที่ผู้บริโภคสามารถใช้ได้ด้วยตัวเอง ทั้งนี้ เพื่อเพิ่มประสิทธิภาพงานคุ้มครองผู้บริโภค

สาขาวิชา เภสัชศาสตร์สังคมและบริหาร ลายมือชื่อนิสิต.....

ปีการศึกษา 2549 ลายมือชื่ออาจารย์ที่ปรึกษา.....

4676965933: MAJOR SOCIAL AND ADMINISTRATIVE PHARMACY
KEYWORD: CONSUMER-BASED LABELING / HOME-USE IN-VITRO DIAGNOSTIC TEST KIT / GUIDELINE DEVELOPMENT

SUMALEE PORNKITPRASARN: EVALUATIVE ANALYSIS AND GUIDELINE DEVELOPMENT OF CONSUMER-BASED LABELING FOR HOME-USE IN-VITRO DIAGNOSTIC TEST KIT. THESIS ADVISOR: ASST.PROF.RUNGPETCH SAKULBUMRUNGSIL, PH.D. 349 pp.

At present, Thailand has neither stringent control on labeling for home-use IVDs nor requirement on user or readability test. This study thus aimed at identifying problems and necessary requirements for labeling guideline development and validation through home pregnancy test kit (HPT) labeling. The study comprised 3 phases of problems identification, home-use IVD labeling guideline development, and guideline validation. Problem identification was conducted using Diagnostic Technique on 90 novice target consumers and content analysis on 20 labeling and international regulations. The domestic problem assessment by content analysis on 20 samples of HPT product labeling revealed problems related to design quality and content. Problems on design quality included small pale prints and drawings as well as poor print quality. Content problems were found on non-indicated contents, different claims in same labeling, 2 trade names in 1 leaflet, different claims for foreign sources of 2 products having same appearance and inner label along with too many promotional claims. The Fox readability assessment demanded above 8th grade education to comprehend these labeling. The consumer Diagnostic Test confirmed that no user among 90 recruited could pass the test. Contentwise, analysis pronounced the acceptable scores for 4 out of 29 content questions including HPT name, test method, positive and negative result reading. The perceptions on utility, design quality, and comprehensibility aspects were comparable with lowest mean score on comprehensibility. The use of Q&A part, a "box", and indirect indication for important contents was found inappropriate for Thai lay users. The comparison on labeling regulations of Australia, Canada, EU, and U.S.A suggested sufficient with valuable and visible placement under normal sale conditions of simple concise contents in official language with proper design quality. Phase II study involved labeling guideline and HPT labeling prototype development. The developed guideline evaluated by experts' panel could be used as the standard or reference in developing the home-use IVD labeling. The outcome from phase II was used as an input into Phase III study of which purpose was to validate the developed labeling guideline by all stakeholders and adapted before consumer testing on the HPT labeling prototype. The Diagnostic Testing was conducted twice with 22 newly recruited lay consumers each. The 1st round result revealed that 50% of users failed the consumer testing whereas 13 from 29 contents did not reach the acceptable score. After revision, the improvement of labeling in the 2nd round validated the guideline. Only 4 out of 22 users could not pass the consumer test and contentwise analysis detected only 5 nonpassing contents. The user perceptions on such labeling prototype showed much improvement from the 1st round to be very high mean score in the 2nd round testing. However, Thai labeling was still emphasized as essential. The readability level of the 2nd round labeling prototype needed at least 5th grade education which was less than obligated minimum education level for Thai people. In conclusion, the policy with regulation amendment and simple reliable means for labeling quality evaluation of other home-use medical devices and health products should be strengthened and realized by all stakeholders for more consumers' protection.

Field of study Social and Administrative Pharmacy. Student's signature S. Pornkitprasarn
Academic year 2006 Advisor's signature R. Sakulbumrungsil

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LIST OF ACRONYMS

AHEC	Maine Area Health Education Centre (checklist)
BALD	Baker Able Leaflet Design (assessment form)
CBRE	Center for Biologics Evaluation and Research (US)
CDRH	Center for Devices and Radiological Health (US)
CDER	Center for Drug Evaluation and Research (US)
CEO	Chief Executive of Organization
CIRF	Consumer Information Rating Form
CFR	Code of Federal Regulations (US)
CPAP	continuous positive airway pressure (devices)
CPHA & NLPH	Canadian Public Health association & National Literacy and Health Program
CRIA	Communication Research Institute of Australia
DDUPSA	Division of Device User Programs and Systems Analysis
EU	European Union
FDA	Food and Drug Administration
FFD&C	Federal Food, Drug & Cosmetic (US)
FD&C	Food, Drug & Cosmetic (US)
FDAMA	FDA Modernization of Act (US)
GHTF	Global Harmonization Task Force
GPs	General Practitioners
HIV	Human Immunodeficiency Virus
hCG	hormone Chorionic Gonadotropin
HPT(s)	Home Pregnancy Test kit(s)
HSRI	Health Research System Institution
IVD(s)	In Vitro Diagnostic test kit(s)
NALS	National Adult Literacy Survey
MDCD	Medical Device Control Division
MIDAS	Medication Information Deign Assessment Scale
OTC	Over-the-Counter
OHIP	Office of Health and Industry Program
PI	Package Insert
PILs	Patient Information Leaflets
POC	Point of Care
RAIN	readability assessment instrument (tool)
SAM	Suitability Assessment of Materials (Instrument)
SMDA	Safe Medical Devices Act
SMOG	Simplified Measure of Gobbledygook (readability index)
TENS	Transcutaneous Electrical Nerve Stimulation
TGA	Therapeutic Goods Administration (of Australia)
Thai FDA	Thai Food and Drug Administration
USFDA	United State Food and Drug Administration
USA	United State of America
WHO	World Health Organization

CHAPTER I

INTRODUCTION

1. Background and Rationale

Quality of home-use medical devices particularly the in-vitro diagnostic test kits (IVDs) are not only determined by the medical device itself but also depends on the information passed on to targeted customers. Consumers' understanding of the purpose, procedures, benefits, and risks associated with the utilization of home-use in-vitro diagnostic test kits is a prerequisite for reliable diagnosis of health condition.[(1)]

Misunderstanding on directions of such devices can lead to the inappropriate operation and misdiagnosis which will impact the consumers' health safety and economics. Compared to those who have poor understanding of instructions, patients who understand information well are more likely to use test kits properly, and therefore are able to make a good decision on their health care and avoid opportunity costs due to untreated diseases.[(1)] Thus, such information communication through the patient labeling (outer and inner label as well as leaflet) is vital for all home-use medical devices operated by lay users.

The communication of such health care information is expected to achieve the real and lifelong benefits to the consumers, and the wide public. It will generate significant direct benefits to the consumers by strengthening the quality and availability of information presented to them, and increasing the capacity for their collective influence and public health decision-making. Co-operation with consumer group is one mechanism of social support to empower them to take more responsibility for the concern of their health conditions. This initiative might reflect the growing consciousness as well as the significance of civil society mechanisms in health policy. Furthermore, it could provide indirect benefits through improving the function of vigilance system for in such labeling information to create the on-going safety of home-use medical device in the market.

Labels and leaflets are crucial for consumers in identifying types of medical devices and providing instructions as well as information for their proper use. Mislabeling and non-appropriate package inserts of medical devices can result in adverse consequences for the consumers. Consumer with insufficient comprehensible information will bear risks of making wrong decision on product choices and proper usage, leading to inability to achieve the desired outcomes. Thus, adequate directions for operating the devices and other important related information, such as hazard warnings/cautions and clear instructions for use, are needed to make devices safe and effective.

According to Kenny T. and colleagues, the labels and leaflets could benefit not only the patients but also the physicians if they could enhance the levels of patient understanding and education. They could help recall verbal advice which might improve patient compliance and treatment concordance. Their re-consultation rates were also found to be reduced resulting in lower the prescribing and physician burden on health services. Additionally, junior doctors, students, and seasoned health care professionals alike also learned from patient leaflets to increase their own understanding and to find out way of explaining conditions which they could later use with patients.[(2)] The leaflet increased patient satisfaction and was more effective with shorter consultation.[(3)]

Over the past few years, medical devices including medical test kits have been sold more over the counter (OTC) in pharmacies. The more people are health conscious, the more development of home-use medical device is rapidly expanded.[(1)] These products continue to empower patient and increase control over their healthcare experiences. Therefore, higher level of consumers' knowledge and understanding would assure safe and effective operation of the product.

In Thailand, the labels and leaflets of home-use IVD are suggested to be translated into simple Thai language for easily understood by a lay person.[(4)] The Thai FDA actually evaluates only the accuracy of the label and leaflet content complying with the law using the expert review, not user test nor any readability test. Moreover, there is no requirement in separating the patient information leaflets (PILs) from

medical professional leaflets. Hence, it is an urgent situation for Thai FDA to drive the policy assuring safe and effective use of home-use IVD.

The issue of knowledge and understanding of lay users on test kit labeling in Thailand becomes increasingly important as the amount and values of medical test kits market continuously increase over years. This study refers the outer and inner label as well as leaflet as “labeling” and uses them interchangeably throughout the paper. Evidence shows that the imported value of IVD has been increased dramatically from 348.8 million baht in 1995 to 1,554.4 million baht in 2002.[5] The growing market of OTC products enables users to test for various medical conditions at home. The two most prominent examples are home pregnancy test (HPT) and urinary sugar test kit.[4] There are more examples and the number is growing all the time. As this trend continues, there will be a shift from institution- or clinic-based professional users to lay users.

Several factors are driving this trend. First, technological progress has made OTC medical tests easier to understand and less expensive.[6, 7] Second, population shifts have increased the desire and need for such products.[7] Baby-boomer consumers have embraced wellness and fitness and they want to have a greater say in their own medical care. The increasing proportion of the elderly in the population has improved the market for such products. Third, the better-educated general population is more capable of understanding proper use of medical devices.[7] Privacy, convenience, rapid results and control are the other factors.[1] The rising cost of traditional health care has also provided an opportunity for less-expensive, self-administered testing.[7] Based on so many positive factors; it is unlikely the trend will reverse any time soon.

The above factors encourage companies to merchandise more through specialty retailers and pharmacies than through traditional medical facilities. Such trend has created a need to assure consumer protection in the market place particularly the labeling control for the lay users. Besides, it will be more benefits if pharmacists can give some contributions to the consultations of lay users.

Community pharmacists have to widen their roles from offering routinely HPT kit services for many years to some extension of such services in other home tests. They can advise on the importance and the appropriate use of such kit instructions. Pharmacists are in an ideal position to perform such services. Most importantly, they can encourage people to return to the pharmacy to discuss their results.[8] Thus, the government and the profession should have advocated a broader remit for community pharmacists[9] to strengthen their activities.

Home-use medical devices including home-use IVD have both kinds of the low risk and high risk ones. Some IVD e.g. home pregnancy test kit, ovulation test kit, etc. are not seriously required to seek advice from a doctor. Many self-test kits e.g. HIV test kit, Drugs of Abuse test, etc. are obliged to consult with medical professionals due to their high sensitive impacts on the consumers. In Thailand, such sensitive tests are recommended not to be sold in the retail pharmacies. However, most of them are available over-the-counter at the local pharmacies. Accordingly, the verbal and documental information are both important to the successful utilization of such devices. The written or printed information is the most ordinary instructional means used by health professionals and is the approach preferred by the most customers[10] due to their most cost-effective and time-efficient means of community health messages.[11]

Printed materials especially patient labeling of above products should be emphasized on quality to enhance the levels of consumers' understanding and education. Their labeling control must be maintained for correct product representation especially in accurate description of products and instructions for use, as well as safety and performance-related information. Accordingly, the labels and leaflets must be read, understood, and acted upon to give beneficial outcomes to the users. Such messages for consumers need a specialized blend of medical information, regulatory requirements, marketing techniques, health literacy principles, patient compliance strategies, behavioral medication techniques, and translation to simple patient-friendly language.[12] Therefore, the translation of user manual and technical documentation into national language is a process critical for product quality. The EU requirements of translation the labeling information for users into their members' state official language is for example.[13] Furthermore, the Canadian regulation need

as minimum both official languages, English or French, for the directions for use and all warnings and contraindications in the labeling of all medical devices sold to the public; and the other required contents could be in either one but both of them must be readily available for the users at the request of product purchasing.[14]

The communication of the above message may take place only if it is effectively and completely transferred from one person to another. This may mean that messages will have to be simplified[15] and translated to serve user/consumer comprehensibility. Consequently, the trend in many countries such as Australia, Canada, EU, and USA has emphasized readability of labels and leaflets of medical products.[16] These concepts have been labeled “Readability”, “Readability Tests” and “Readability Formulas”.

Readability Formulas are used as the objective quantitative analysis tools of Readability Tests that can predict the readability or reading difficulty of a passage or reading grade level required to read the content by providing a score or index number.[10] However, Readability can increase patients’ knowledge, compliance, and satisfaction, but can also give anxiety/ premature end of therapy due to fear of possible side effects.[17] It is necessary that the reader must actually read the text to determine if it is readable.[18]

A review of the above analyzed tests shows that there have seldom been any important differences between the testing results from the same Readability Formulae in different countries so the above testing of various language versions should be expanded to draw conclusion from the results.[19] The Gunning’s Fog Test is a widely used readability formulae in the health care[20-24] and has been also proposed to U.S.F.D.A. in the evaluation of written prescription information provided in community pharmacies.[25] Additionally, it was rendered to assess the readability of selected Thai statistic texts used in the Faculty of Education, Chulalongkorn University.[26] However, readability is only one aspect of reading comprehension.[27]

A leaflet with a low readability score may not have sufficient depth to meet the quality of information needs of patients. Excess significance positioned on readability score may cause the practitioner to neglect other important factors in the

reading process. Therefore, the qualitative factors or analysis should be used in concert with readability formulas to see if the consumers comprehend the package inserts patient information leaflets or package inserts of the devices[18] and to enhance the quality of such documents.

The assessment of labeling quality by both reader-based (user test) and text-based (expert) evaluation methods[28] are increasingly emphasized in several countries. The vital issues in the preparation of patient information leaflets those have long been recognized are readability and comprehensibility.[15] The availability and accessibility of information as well as its overall designs including content, language, and design; are also important factors influencing the labeling quality.[10]

Tests of labels and leaflets of home-based medical devices in one country at any given time would be a very great attempt depending on each culture and education of the patients.[29] The experts may be the best position to judge the scientific accuracy, timeliness, and comprehensiveness of medication information.[30] Readability and comprehension of consumers particularly the lay users can be barriers and crucial in healthcare system[29] due to their effects on consumer's awareness and consideration. Therefore, the user test is required in many countries especially in developed countries for more consumer protection. Trying to develop an appropriate and useful guideline used for constructing, evaluating, and monitoring labeling of such home-used medical device information will be the challenge to benefits of consumers all over the world.

According to Arcarese J.S., such trend in healthcare delivery has put increasing pressure on the regulatory agencies to adjust their policies and procedures[31] to assure consumer protection via good quality products. It also places the stress on the manufacturers to decide what is needed at home for lay users to operate the device safely, to clarify the conditions for safe use in the home directly on the device labeling, and to design devices to the least common denominator.[31] The quality of home-use medical devices or medical self-tests to screen for different types of diseases or conditions in many countries including Thailand, has been controlled as medicines or medical devices under drug law or medical device law or IVD Directive to protect their consumers.

In the past, many countries defined home-use in vitro diagnostic test kits including HPT kit as medicine that could be bought from the pharmacies. At present, most countries have reassigned the classification and accountability of such products to be under the regulation of medical device or separate IVD directive. The in-charge organizations of home-use IVDs of most countries are the Health Authorities. They are accountable for controlling the quality of such products including their labeling.

The trend of such regulations on labeling quality in developed countries from different parts of the world such as Australia, Canada, EU, USA; is emphasizing on more consumer protection, particularly on readability, content, language and design of labeling for lay consumers through requirements in both expert and user testing.

World Health Organization emphasizes that the vending of home-used medical devices might end up in the hands of a layperson, special instructions for the proper use and maintenance of the devices are thus needed.[1] It is certainly known that there are usually poor labeling quality, inadequacy controlling for consumer protection, and the possibility of greater risks of home-use devices than those in clinical environment due to poor understanding of available labeling instructions.[31] In this situation, this information must not be neglected in labeling design to be heeded by the lay users. The efforts must be made to provide non-technical instructions and to educate and help the customers.[1] The labeling should be simple, clear, and easy to understand for lay users' competency in operating the devices spontaneously.[31]

Home-use natures are different from clinical laboratory and medical environments and have posted potential risks on safety of IVD.[32] These natures are consumers' lacking of necessary training to collect the urine sample and interpret the result, less ability to understand and interpret directions for correctly conducting the test, and the possibility to carry out or not perform the follow-up action on the basis of false result.[32] The consequences of inappropriate labeling may give a false-positive or a false-negative result. A false-positive result may lead a person to believe that they have a serious or fatal illness, while a false-negative may mislead a person to delay or ignore seeking proper treatment for a serious or fatal illness.[32] Therefore, the clear demonstrating unacceptable product by showing a test-method failure and

avoiding the potential for false results must be obvious to the consumers from the packaging instructions.[33]

In the United States, the Food and Drug Administration (USFDA) requires labeling for lay users to be completely comprehensive language and in simply readable format.[34] All new patient leaflets should declare an objective score of readability using a standard formula and then should be peer reviewed by lay people, general practitioners (GPs) and self-help groups.[2] USFDA has provided the Guidance on Medical Device Patient Labeling to assist manufacturers in their development and assist authorized reviewers in their evaluation of labeling to make it understandable and usable by the lay persons.[18]

The In vitro Diagnostics Directive 98/79/EEC indicate the contents necessary to be labeled and require the instructions of self-test devices to be written in terms easily to understand and apply by the users. The manufacturers of self-test IVDs have to include user control and ensure the suitability of their products for non-professional users.[13] The directive requires the appraisal of labels and leaflets with content-based evaluation taken by regulatory authorities, and performance-based assessment involving the Readability Tests and the Usability factor.[35]

In Asia, most of the countries have not yet regulated medical devices including IVD test kits and some are in preparation stage to implement the control but some do nothing.[36] Australia will soon be changing to the new regulations on IVDs. The Asian countries that regulate very rigorously include China, Japan, and Taiwan. Thailand is an example of countries already having a regular framework for IVDs, with no current plan to change their requirements.[37]

Thai situation concerning IVD regulation is inaccurately presented. In reality, Thailand has been in a phase of developing new Medical Device Act since 2002 and it is now in a state of approval by the parliament. The IVDs will still be defined as medical devices in the new directive. The labeling regulations in such new draft Act do not specify detailed items of content required in such labeling as the other countries e.g. Australia, Canada, E.U., U.S.A., and GHTF. It does not ask for the translation into the national language as the present Thai law and other countries e.g.

Canada, E.U. countries, etc.. Moreover, there is no part directly emphasized on home-use medical devices labeling. It allows Thai FDA to later issue definite requirements for each kind of medical devices.

The Thai Food and Drug Administration (Thai FDA) is the government agency that has a continuing responsibility in consumer protection of health products including home-used medical devices. One of the strategies is to control the quality of labeling and package inserts of such devices. IVD is currently controlled under the Medical Device Act 1988. As prescribed in the Medical Device Act 1988, the medical devices for sale or in possession for sale must have labels and leaflets bearing the information in Thai with clear display and easy to read content.[38]

The reading behavior of both home-used medical devices including IVDs and drug labeling are all considered as health information acquisition behavior due to their health benefits and risks. There are vast amounts of literature on patient information leaflets of medicinal products, but few studies have evaluated quality of the labeling or leaflet of medical devices including patient package inserts. However, there is no study on the labeling of medical devices in Thailand and few studies were conducted on medicinal products labels and leaflets. There are few publications relating to how health workers or manufacturers perform their evaluation on package inserts/ information leaflets of medical products by users' test. Some research findings, principles and strategies in drug labeling evaluation were thus applied to this study.

Many studies have shown that patient leaflets are difficult to read which may be due to their preparation by highly educated people and utilization by those with less education.[39] Studies revealed significant differences in the reading level of leaflets from different pharmaceutical companies.[40] Rayner D.K. and Knapp P. have shown that nearly 20% of patients failed to notice the package inserts, and only 60% of patients who received such leaflets read part or all of the text.[41] In Thailand, they found that only 17.5% of freshman students of a university in the Northern part of Thailand regularly read drug leaflets.[42]

Most of studies concerned about the sufficiency, accuracy, and format of the content in medicinal labeling. One study illustrated that official stringent approval and

control were needed due to insufficient and inconsistent content topics of drug information on many labels and leaflets in Thailand.[43] Additionally, OTC drug labels in Thailand needed more readability and attractiveness to enhance consumers' efficiency and benefits, and further studies of format and accuracy of information were recommended.[44] The other study pointed that both format and content of warning particularly on effectiveness had to be improved due to their different impact on consumers' information processing.[45] Problems learned from medicinal labeling could be applied to home-based medical devices since the readability, content, and overall designs of labels and leaflets were subjected to the same principles.

Most of the present labels and packaging inserts of home-use medical devices including home-use IVDs are for professional uses which are definitely difficult to read and understand by lay consumers. Although some labeling is translated into Thai language, it is still complicated to comprehend due to medical terms. These are the negative consequences of labeling developing without user-based guideline. Most of such labeling is not required to be evaluated by responsible authorized regulators. Consequently, there is no assurance in quality of labels and leaflets of self-testing or home-based medical devices especially the in-vitro diagnostic (IVD) test kits in Thailand. The evaluation of both labels and leaflets of such products is necessary for consumer protection.

Though the user test is the gold standard in assessing such label and leaflet, the evaluation by the experts and well labeling development by entrepreneurs to fit the lay users is still considered necessary. They are prerequisite to user test and need appropriate guideline. At present, Thailand have no guideline on labeling of home-use IVDs and the user test has not yet required by law due to many limitations and some difficult situations. To perform such test to ensure users' comprehensibility is complicated and difficult to be standardized.[46] Consequently, this study will be the first time in Thailand for consumer-based labeling evaluative analysis and guideline development emphasizing on labeling quality of home-used medical devices including IVDs for lay users.

A Guideline is a tool that several developed countries use in evaluating and improving quality of both drug and medical device labeling. Hence, labeling problem

evaluative analysis and guideline development as well as validation on labeling prototype of home-used IVD test kits are expected to be the best intervention in providing many contributions to consumer protection at present situation. The comparison of labeling regulations of different countries will provide inputs and benefits to labeling guideline development. The validation of developed guideline to serve the need of consumers will be conducted through an example of home-use IVDs. HPT labeling prototype is selected to be developed and evaluated by consumers, authorized regulatory reviewers including external experts and Thai FDA regulators with their decision-makers, and entrepreneurs. It confirms the suitability of implementation of such guideline.

HPT kit is an example of how self-testing can become a normal part of the health service.[6] This simplest test is popular because it allows women in reproductive age range (15-49 years old)[47] the inexpensive and rapid access to highly sensitive and personal information without the need to go to a clinic. The accuracy of HPT depends on how well the users follow the instructions and interpret the results.[48] Therefore, it is essential that HPT kits provide adequate instructions that are easy to read and understand.[49] Reagents intended for self-testing should include an explanation of the measurement of results and the follow-up action required.[13] The figures to illustrate the method in utilization and interpretation of such tests are also recommended to be supplementary to the required texts for enhancing the understanding of consumers particularly the lay ones.

Many researches reasons have shown that the inclusion of pictograms and other symbols as part of the patient leaflet may complement or enhance written information, but they have not been shown to replace it because some pictograms require an educational process to become more universal, even within a culture.[50] Thailand has been induced by GHTF to use symbols in labeling of medical devices instead of translation contents into Thai language.

There are some efforts from several muti-national companies to influence Thai government not to issue any requirements for translation their labeling into Thai language, especially the medical devices for professional use. Whereas in EU, the companies must translate all user documentation, labeling, and packaging of medical

devices into the official language of each European member country in which the product will be used.[13] One of their reasons supporting using symbols in place of translation is to avoid responsibilities of making translation mistakes. The professional team works in Thailand consist of personnel with different education levels. Therefore, it is not reasonable and violates Thai consumers' right, particularly the lay users who are the ultimate users or victims of the errors.

The companies should realize in their responsibilities for the content accuracy and appropriate readability level of their labeling for their home-use devices. Hence, labeling control at least by experts' evaluation and guideline development to be referenced for both authorized regulatory reviewers and entrepreneurs need urgent action from Thai government. This is to help assure safe and effective utilization that will benefit Thai consumers particularly the lay users. The ultimate holistic outcome of this study is expected that it might contribute towards enhancing the quality and comprehensiveness of the health care system.

At present, the policy in medical devices legislation in Thailand prefers to control the items gradually as the need demonstrated and as available resources for the monitoring and enforcement. This is due to our culture and legal system as well as the current Medical Device Act (1988). Such Act requires all labeling to bear specified items but there was no punishment on the violation of most medical devices. In term of legal enforcement, the current Medical Device Act (1988) is considered the least stringent control. Consequently, the labeling of Home-use IVDs was not strictly enforced, thus affected optimal provisions of written information and its availability as well as accessibility.[30] Problems on quality of labeling have been detailed in the prior section of the result.

In general, it was revealed that labeling provided with the products could not ensure the safety and effective use of the lay users. Consequently, the relevant policy and regulation as well as the Act should be reviewed and created to support this problematic issue. However, the Act and the regulation are the higher order of law that need quite a long period of time to modify. Therefore, the policy and guideline of labeling management would be preferred because they do not require a legal and lengthy process to achieve policy objectives. Guideline can be written as a policy

supplement to include more detailed information on means and procedures to achieve policy objectives.[1]

The labeling control of this group of product with fair and clear management to all stakeholders is necessary with healthy cooperation to promote the safe and effective use of products, and to correct the product representation. Therefore, the consumer-based guideline development using international trend for labeling requirements and its validation by all relevance parties were performed to facilitate the responsibility of the entrepreneurs, regulatory authorities, and to ensure the ultimate beneficiary of Home-use IVDs sold in Thai market. The Home Pregnancy Test kit was selected as the representative of Home-use IVDs due to the product availability with easy to access, its popular use, and its easiness to use by the lay customers. Such labeling prototype of HPT was then developed to support the practical use of the formulated guideline of home-use IVDs in Thailand.

2. Research Questions

2.1. What are the problems on Thai labeling of home-use IVDs marketing in Thailand?

2.2. What is necessary information for consumer-based labeling of home-use IVDs?

3. Research Objectives

3.1. To identify problems on labeling of home-use IVDs,

3.2. To identify labeling information necessary for lay consumers in proper and efficient utilization of home-use IVDs, and

3.3. To develop and validate a consumer-based guideline of home-use in-vitro diagnostic (IVD) test kits.

4. Scope of the Study

4.1. Varieties of home-use medical devices have different appearances and principles. Some are difficult to operate and need special training in their utilization. Consequently, urine HPT kit is considered to be the most appropriate home-use IVD selected to be studied.

4.2. GHTF and four different countries e.g. Australia, Canada, E.U., U.S.A. which are the originators of Global Harmonization Task Force (GHTF) were chosen to be compared against Thailand in this study. All of them except Thailand, have already set up the guideline and controlling system for consumer protection on labeling of home-use medical devices including home-use IVD test kits. Moreover, they are in different regions such as America, Asia, Australia, and Europe.

5. Expected Benefits/ contribution of the study

5.1. This developed guideline will facilitate production of appropriate labels and leaflets of home-use IVD to enhance proper and efficient utilization to ensure safety and effectiveness of lay Thai consumers.

5.2. The result of their research will reflect how easily patients find and how well they understand the content of the information labels and leaflets for proper performance. This may facilitate the compliance of the patients and influencing the success of treatment.

5.3. The strength and weakness of regulations from different countries as well as the problems learned from this study will enhance the lay consumer protection by:

5.3.1. reflecting the limitation of Thai labeling regulations that need Thai FDA to emphasize and support the urgent amendment of evaluation criteria for home-use IVD products to pave up international trend, and

5.3.2. encouraging the entrepreneurs to improve their products labeling quality to better served general public health by the availability of reliable, useful, and adequate labeled home-use IVD products.

5.3.3. adopting the developed guideline and labeling prototype in the field of other home-used medical devices to be practically implemented by

5.3.3.1. the entrepreneurs in developing and improving their labels and leaflets,

5.3.3.2. the authorized regulatory reviewers in evaluating and monitoring the content, language, and design of all home-use health products labeling to achieve the optimal readability of the document that will lead to user/consumer comprehensibility.

5.4. The results of this research may encourage the improvement of reference guidelines in evaluating the information and readability of the labels and leaflets of drug-medical device combination products, medicines, and other health products.

6. Definitions

6.1. Labeling refers to any image, design, symbol, or statement displayed on the medical device, its container or package.[38] In this study, labeling would include the outer and inner/immediate labels as well as the leaflet or packaging inserts of home-use IVD.

6.2. Readability level refers to level of reading difficulty of a given passage that was determined by sentence length, word length and vocabulary used.

6.3. Lay user/consumer/person refers to the general person or individual who does not have specific medical information or is not in the related field.

6.4. Entrepreneurs refer to manufacturer, importer, or distributor.

6.5. Aspects of labeling quality:

6.5.1. Design quality: print size & quality, line spacing & length, info. clear & organize, attract, drawing quality

6.5.2. Contents/utility: enough & complete & reliable information for users

6.5.3. Comprehensibility: easy/hard to locate, read, understand, remember, and keep info. for reference

6.6. Type of information:

6.6.1. Buying decision information: information for users at the point of sale e.g. product name, quantity/pack size, intended use, lot number or manufacturing date, expiry date, manufacturer, distributor, etc.

6.6.2. Product utilization information: information for users at the point of use e.g. storage and maintenance, precautions, limitations or possible false errors, components, urine collection, testing procedure, result interpretation, claims for product performances, source of further information, etc.

6.6.3. Education information: information for educating the users e.g. Introduction and test principles, Q&A part, revision date, pregnancy knowledge, etc.

CHAPTER II

LITERATURE REVIEW

The literature reviews of this study were performed to assist the developing of guideline and labeling prototype for manufacturers as a standard for labeling improvement, and for the authorized regulatory reviewers in evaluating the quality of leaflets of home-use IVDs. Home pregnancy test kit was the selected product to be studied on their labeling quality. The contents of this chapter are aimed at home-use IVD not only HPT and are proposed in six parts as the labeling importance and controlling situation in different countries, the details of labeling evaluation and other related terms, the methods in labeling evaluation, related research works and requirements in labeling developing and evaluation, introduction to print media, and the modified conceptual framework for this study.

1. The labeling importance and controlling situation in different countries

The labeling is just one part of an information system from which patients draw what they need and want to know. Their needs for device and procedure information depend on where they are in the decision making and treatment process and on their personal learning preferences.[51] Good information leaflets can reduce anxiety and do not result in an increase of side effects from treatment. The roles of printed information such as improving patients' satisfaction, and reducing anxiety are more successfully than verbal communication. Evidence also suggests that information leaflets give a better outcome of illness in better informed patients.[2] Consequently, a variety of direct and indirect methods have been used to evaluate written medication information from the consumer's perspective.[30]

In most of the previous studies, their readability has been determined using standardized assessment techniques to obtain a grade level indication of the reading difficulty. This was conducted to develop and improve labeling because patient information leaflets do affect health outcomes. Patients want them and use them.

However, many leaflets have been poorly written, but there is now ample advice on how to remedy this.[2]

According to Cheryl Twomey, a high quality patient information leaflet (PIL) needs good information design, well text, evidence-based information, and consumer testing. Additionally, the design of readable PIL is a complex process so consumer participation is essential and advice from a professional designer highly desirable.[52] Furthermore, Morris and Aikin recently summarized that a complicated interaction between the patient and the amount of "activated" information of printed material influence the patients' ability to process printed medical information which lead to great variability in the use of the patient information leaflets to guide behavior.[53] Consequently, there is a trend that many countries emphasize on the quality of labeling especially home-use medical devices including home-use IVD or self-test.

1.1. WHO[1]

WHO recommended that the labeling of home-use medical devices including IVDs should be simple, concise, easy to understand, make liberal use of illustration and drawings, use bold prints or other methods to highlight warnings and precautions, and provide color coding of reagent containers whenever practicable.

1.2. Australia[32, 54]

This country developed the Diagnostic Test which has been adopted for evaluation of medicinal patient information leaflets. Such test is very popular and adopted to be used in many countries such as Australia, Canada, EU, etc. According to Therapeutic Goods Administration (TGA) under the Commonwealth Department of Health and Ageing of Australia, there are four important ways of consumers' deficiencies that may impact on the potential risks of home-used IVD test kits. They are that the consumers may lack necessary training to interpret a test result, may not understand and incorrectly conduct, may or may not carry out necessary follow-up actions the test on the basis of false result, and may lack technical training in collecting a sample.

TGA realizes that the performance of the in the hands of skilled users may not reflect the device's performance in the hands of consumers. Consequently, TGA gives the attention to criteria for safe use of home-used IVD test kits as follows:

- Analytical performance should be comparable to professionals in clinical setting.
- Device's performance should not be affected by user technique variation.
- It should include a simple method for user ability to verify its design specifications at the time of use.
- It should not pose any undue infective risk to the user or wider community.
- It should include sufficient information for the user to properly interpretation of the result and follow up action.

According to TGA under the Commonwealth Department of Health and Ageing of Australia; performance characteristics, usability and labeling are all critical to the safe use of home-used IVD test kits. The simple method and sufficient information for the users to properly conduct interpret the result and follow up action are two of the criteria for safe use of such products. Therefore, TGA requires a clinical study of the performance of the device when used by consumers, assisted by instruction provided in the labeling of the device. Consumers selected for study should be representative of target users of varied background, education levels, and age groups. Number of subjects selected based on a statistically valid sampling of relevant lay users should take into account appropriate demographic factors. Test results should be analyzed using appropriate statistical methods to demonstrate correlation of results obtained by the lay users and trained technologists performing the test.

1.3. the United States of America (U.S.A.)

The United States Food and Drug Administration (USFDA) is responsible for the evaluation of quality of labeling information intended for a lay reader.[34] According to Guidance on Medical Device Patient Labeling; Final Guidance for Industry and FDA Reviewers, 2001; USFDA have given the recommendation about pre-testing with target audience and some techniques e.g. readability, comprehensibility, etc. to the manufacturers and FDA reviewers of medical devices to

make sure that the patient labeling accompany the device is written in simple, plain language.[18]

1.4. the European Union (EU)[13]

The labels and the leaflets are required to not only be scientifically correct but also tested for comprehensibility and relevance. The companies must translate all user documentation, labeling, and packaging of medical devices into each official language of European member country in which the product will be used.

1.5. Canada[14, 55]

The home-use IVDs labeling was control by the Guidance for the labeling of In Vitro Diagnostic Devices issued to serve the Section 21 to 23 of the Medical Devices Regulations (1998) under the Food and Drug Act, Ministry of Health.

1.6. Thailand

Thailand has Medical Device Act[38] as a regulatory framework to control all devices in 3 different levels since 1988 according to problematic situations in each period of time in Thailand. They are classified from the most stringent to the least one as Licensed Medical Device (condoms, syringes, medical gloves, HIV test kits for diagnostic purposes), Notified Medical Device (devices for physical therapy, HIV test kits for research and investigational purposes, surgical breast implants, breathing alcohol detector), and General Medical Device (all the rest of medical devices). Thailand has issued and improved several notifications as well as adjusted the level of some products classification to serve the problem situations since then. Moreover, all IVDs except HIV test kits are regulated as general control devices which are under the least strict level.

1.7. Other countries

Many countries paid the attention to the importance of IVD labeling as following evidences.[36, 37]

1.7.1. The Irish Medicines Board recently issued a guidance that warns healthcare personnel against off-label uses of medical devices. The serious consequences due to their uses outside the intended purposes in the labeling are advised to be concerned by the consumers.

1.7.2. The countries those have already the regulations on IVDs are such as USA, EU member countries, etc.

1.7.3. Some Asian countries are imposing particular stringent regulations on IVD manufacturers, while other regions are in a state of change.

1.7.4. Some Asian countries those still do not regulate IVDs, are such as Brunei, Bangladesh, Cambodia, Fiji, Laos, Malaysia, Myanmar, Nepal, New Guinea and Pakistan.

1.7.4.1. Hong Kong and New Zealand will soon regulate IVDs for the first time. The countries that regulate very stringently include China, Japan, and Taiwan.

1.7.4.2. India, Indonesia, Korea, the Philippines, Singapore, Sri Lanka and Thailand, are the examples of countries those have already a regular framework for IVDs, with no current plan to change their requirements.

1.7.4.3. The involvement in developing and improving regulations by the manufacturers were recommended by an official of IVD manufacturer to the participants at the Advanced Medical Technology Industry Association's recent annual meeting in Washington D.C. to prevent losing out on valuable healthcare products from onerous or difficult regulations.

2. The details of labeling evaluation and other related terms

2.1. The evaluation of patient information leaflets (PILs)

It is the process in evaluation or assessing the quality of the patient information leaflets (PILs) which there are several perspectives as follows:

2.1.1. It should be evidence based as far as possible, peer reviewed, contain references, be dated, give an objective measure of readability and be evaluated.[2]

2.1.2. According to Meredith P and colleagues, 1995, the clinical content of a leaflet should be corrected, balanced and unbiased and should be "developed independently of commercial interests. A formal testing of a new leaflet is acceptable

in content and style. Identification of good practice relating to the content and readability of leaflets is discussed.[2]

2.1.3. According Krass I. and colleagues[30], Morris and colleagues provided three issues to ensure optimal provision of written information were

2.1.3.1. the information must be readily available or disseminated to patients,

2.1.3.2. the content must be comprehensive, accurate, and specific enough to be useful to patients, and

2.1.3.3. the information must be designed or formatted in a way that is easily to read and understood by patients.

2.1.4. In the 1996 Action Plan[30], a number of criteria for evaluating written medication information were two issues as follows:

2.1.4.1. the contents or information according to regulation should be scientifically accurate, timely, unbiased, sufficient comprehensive, and specific to be useful to patients, and

2.1.4.2. layout and language (design/ format) should achieve the readability or reading comprehension level.

2.1.5. According to Women's Health, Victoria, consumers preferred PILs that were easy to read, avoided technical/ medical jargon, and were not patronizing. PILs should be easy to understand, cover the appropriate depth and breadth of issues to consumers, and have instructional graphics to improve appeal and usability.[29]

2.2. Readability[18, 56]

It is defined as the ease of understanding or comprehension achieved by the style of writing.[18] Reading involves both decoding and comprehension. The reader must be able to recognize (decode) the words in the medical device patient labeling as well as comprehend the meaning of the text. Readability is the tool used to promote communication among patients, physicians, pharmacists; to assist correct medication taking, to promote compliance and provide side effect information to patient adequately confrontation.[56]

2.2.1. Concept of Readability[18, 57]

2.2.1.1. Readability is defined as the ease of understanding or comprehension due to writing style. Reading involves both decoding (recognize) and comprehension.

2.2.1.2. Assessing readability needs qualitative factors (e.g. explanation of jargon, careful organization) in concert with quantitative factors (e.g. readability formulas).

2.2.1.3. Level of reading difficulty of a given passage was determined by sentence length, word length and vocabulary used.

2.2.2. Readability Formulae[18]

It is a quantitative analysis to predict the reading level of the text of medical device patient labeling. It uses semantic (vocabulary difficulty) and syntactic (sentence length) factors. All new patients' leaflets should declare an objective score of readability using a standard formula. However, readability formulae and reading age measures are weak as they use such criteria as sentence length, syllable count or vocabulary indexes.[2]

2.2.3. Comprehensibility

2.2.3.1. It is the interaction between reader and text. (Franz Lahner)[58]

2.2.3.2. It means being easy to understand due to not complicated information and very clears language. (Longman Language Activator)[59]

2.2.3.3. According to Morris & Aikin[53]

"Comprehension" refers to what the patient "knows". This naturalistic concept does not determine whether patient accurately understands the information presented on product documents. Moreover, it can be indexed by

(1) the content and organization of the mental representations formed when patients read and process product information

(2) their ability to retrieve information from these mental representations

2.2.4. Understandability

It is the reading or language level and format (including multimedia) that is appropriate for a specific audience.[59]

2.2.5. Literacy (the fact of being able to read)

According to Morris & Aikin and Hardin, L.R.[53, 60]

2.2.5.1. The U.S. National Literacy Act 1991 defines "Literacy" as it is an individual's ability to read, write, and speak English; and to compute as well as solve problems at levels of proficiency necessary to function on the job and in society to achieve one's goals, and to develop one's knowledge and potential.

2.2.5.2. According to the 1992 National Adult Literacy Survey (NALS)

The definition of literacy was further developed by a panel of experts in preparation for NALS as "Using printed and written information to function in society, to achieve one's goals, and to develop one's knowledge and potential". It endorsed the notion that literacy is an ordered set of skills necessary to accomplish a diverse set of tasks. The task force suggested three broad literacy domains as follows:

(1) Prose literacy: ability (knowledge and skills necessary) to understand simple prose and editorial

(2) Document literacy: ability (knowledge and skills necessary) to understand (locate and use information from) graphs, maps, forms, tables, etc.

(3) Quantities literacy: ability (knowledge and skills necessary) to perform or apply simple arithmetic operation.

2.2.6. Health Literacy

It is "the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions ". (Ratzan and Parker)[61]

2.2.7. Legible: It is the ability in being written clearly enough to read. (Longman Language Activator)[59]

2.2.8. Labeling

Most of the countries include label and leaflet as labeling (e.g. Australia, Canada, EU, GHTF, WHO, etc.). USA actually refers to package insert but it can sometimes including label. For Thailand, we usually use label and leaflet separately according to the law. However, the details in each country will be as follows:

2.2.8.1. Australia[32, 54]

For IVD, labeling includes, but is not limited to individual IVD labels, outer packaging, container label and the instructions for use. Instructions for use are commonly provided in the form of a package insert.

2.2.8.2. Canada[14, 55]

Labeling included, but is not limited to, the immediate device container label, the reagent/component label and package insert. The information required in labeling shall be expressed in a legible, permanent and prominent manner, in terms that are easily understood by the intended user. The information must be conspicuous and clear enough to read as well as intended to last for the life of the device. Moreover, it must be set out on the outside of the package and be visible under normal conditions of sale.

2.2.8.3. EU[13]

Labeling usually refers to outer container and immediate container, but sometimes they include package insert or user instructions/ manual.

2.2.8.4. GHTF[62]

"Labeling" or "Information supplied by the manufacturer" refers to

"Written, printed or graphic matter

(1) affixed to a medical device or any of its containers or wrappers, or,

(2) accompany a medical device,

related to identification, technical description, and use of the medical device, but excluding shipping documents.

Note: Some regional and national regulations refer to 'Labeling' as 'Information supplied by the manufacturer' (Source – ISO 13485)"

2.2.8.5. USA[63]

It is defined as all labels and other written, printed, or graphic matter:

(1) On the device or any of its containers or wrappers, or

(2) Accompanying the device (The meaning is extended to posters, tags, pamphlets, circulars, booklets, direction sheets, fliers, etc. that may be displayed in proximity to the article or shipped to the user before or after shipment of the device) [section 201(m) of the FD&C Act]

Labeling has the concept of "adequate directions for use", which means the need for the labeling of home-use IVDs to be simple, concise, easy to understand, make liberal use of illustrations and drawings, use bold print or other methods to highlight warnings and precautions, and provide colour coding of reagent containers whenever practicable.

2.2.8.6. WHO[1]: Labeling refers to both label and package insert.

2.2.9. Label

2.2.9.1. Thailand[38]:

"Label" is any image, design, symbol or statement displayed on the medical device, its container/package.

2.2.9.2. Australia[32]

"Label" is a display of printed information

(1) On or attached to the goods; or to a container or primary pack in which the goods are supplied; or

(2) Supplied with such a container or pack

2.2.9.3. Canada[14, 55]

"Label" includes any legend, word or marked attached to, included in, belonging to or accompanying any food, drug, cosmetic, device or package. It is an actual label and its extension e.g. packaged inserts, information in prescribing, etc.

2.2.9.4. EU[13]

"Label" covers the display on the immediate container, and outer container which protect the content from contamination, and/ or damage.

2.2.9.5. USA[63]

(1) "Label" is a display of written, printed, or graphic matter upon the immediate container or any article.... [Under Section 201(k) of the FD&C Act]. Any word, statement, or other information appearing on the outside container or wrapper, if any, of the retail package or be easily legible through the outside container or wrapper. Labels shall be designed and applied to device and container so that the labels will remain in place and legible during the customary conditions of distribution, storage, and use [under Section 820.120(a) of the FD&C Act]. The label is not required to appear on the shipping carton.

(2) The definition of "label" is sufficiently flexible to include "packaged inserts, brochures or leaflets" that accompany the device.

2.2.9.6. Global Harmonization Task Force (GHTF)[62]

"Label" is "Written, printed or graphic information provided upon the medical device itself. Where physical constraints prevent this happening, this term includes information provided on the packaging of each unit or on the packaging of multiple devices".

2.2.10. Leaflet/ Package insert

Each country names leaflet/ package insert in different terms.

2.2.10.1. Thailand[38]: leaflet or accompanying document

It is an accompanying document (paper or any other material) on which information about the medical device is displayed by and image, design, symbol or statement, inserted or included in the container or package of the medical device, including the user manual.

2.2.10.2. Australia[32]**:** Package Insert (PI)

2.2.10.3. Canada[14, 55]**:** Package Insert (PI)

2.2.10.4. EU[13]**:** Patient Information Leaflets (PILs); or Package Insert ; or instructions for use; or User's Manual/ Operation Manual

2.2.10.5. USA[63]: Package Insert (PI)

2.2.11. "In-vitro diagnostic (IVD) test kit"; and "Home-use In-vitro diagnostic (IVD) test kit" or ""Device for self-testing" or "Near patient in vitro diagnostic device"

2.2.11.1. Thailand[38]

There is not any specific definition. It is classified as medical device under the definition of "Equipment, products or articles used in the medical profession; the profession of nursing and midwifery, or the clinical practice of medicine or of veterinary as prescribed by the legislation concerned". Therefore, home-use IVDs refer to IVDs or one kind of medical device which is available to be sold in the market usually in the pharmacies.

2.2.11.2. Australia[54]

Home-use IVDs are those intended for supply to a person for either:

(1) Diagnose or monitor a medical condition in that person or the immediate family of that person - the person collect a sample, conducts the tests and interprets the results of the test, with no involvement of a health care professional; or

(2) Use in the collection of a sample that is forwarded and tested by a laboratory/ health care professional.

In lay term, it refers to any IVD or test that is performed outside a health-care setting or it can refer as an IVD supplied to lay persons: for use or interpretation in diagnosing, monitoring or identifying risk factors for a condition or state; or for collecting a sample for analysis in a testing facility.

2.2.11.3. Canada[14, 55]

It is a medical device or a product to be used in vitro for the examination of specimen derived from the human body. It consists of reagents or articles or any combination of these and that is intended to be used to conduct a specific test or assay. Such analysis is aimed to determine the presence, absence or quantity of a specific chemical or substance.

2.2.11.4. EU[13]

According to the In vitro Diagnostics Directive 98/79/EEC; IVD is any medical device which is a reagent, reagent product, calibrator, control material, kit, instrument, apparatus, equipment or system, whether used alone or in combination, intended by the manufacturer to be used in vitro for the examination of specimens

(including blood and tissue donations) derived from the human body, solely or principally for the purpose of providing information:

(1) concerning a physiological or pathological state, or

(2) concerning a congenital abnormality, or

(3) to determine the safety and compatibility with potential recipients,

(4) to monitor therapeutic measures.

"Device for self-testing" means an in vitro diagnostics medical device which is intended by its manufacturer to be able to be used by a member of the public in a home environment. The examples are such as blood grouping reagents, pregnancy testing, HIV test kit, and Hepatitis B test kits.[13] However, pregnancy test kit is classified as Self-Testing device which has a significant risk. Therefore, the production of such HPTs needs a Notified Body to certify their performance in order to achieve Certificate of Conformity.[64]

2.2.11.5. U.S.A.[65]

According to 21 CFR 809.3(a), are those reagents, instrument, and systems intended for use in the diagnosis of disease or other conditions, including a determination of the state of health, in order to cure, mitigate, treat, or prevent disease or its sequelae. These products are intended for use in the collection, preparation, and examination of specimens taken from the human body. A measurement used in-vitro to indicate the presence or absence of a specific disease or condition in a patient from a specific patient population.

Notes: The definitions of "Home use in-vitro diagnostic devices" had somewhat same and different points from "In-vitro Diagnostic reagent/test kit/medical devices/ products" [IVD] and or "device for self-testing" or "near patient in vitro diagnostic device" as illustrated in table 2.1.

Table 2.1: Definitions of IVD and Home-use IVD in different countries

No.	Countries	Definitions
1	**Thailand** "medical device"[38]	IVDs were classified as medical devices, and have no specific definition. "Medical Device" means **1.** Equipment, products or articles used in the medical profession; the profession of nursing and midwifery, or the clinical practice of medicine or of veterinary as prescribed by the legislation concerned; **2.** Equipment, products or articles that have effects on the health, the structure or any function of human or animal body;

No.	Countries	Definitions
		3. Constituents, components, accessories or part of the equipment, products or articles under above matter; **4.** Other equipment, products or articles prescribed by the Minister as medical device by publication in the Government Gazette.
2	**Australia**[32, 54]	
2.1	"In-vitro diagnostic devices"	
2.2	"Home use in-vitro diagnostic devices" or "In-vitro diagnostic goods for home use"	An IVD supplied to lay persons: • For use or interpretation in diagnosing, monitoring or identifying risk factors for a condition or state; or • For collecting a sample for analysis in a testing facility [NB] different from "point of care (POC IVDs): traditional & rapid tests designed to be carried out by a health care professional at the bedside, or in a doctor's office.)
3	**EU**	
3.1	"In-vitro diagnostic medical devices" (IVD)[13]	• Any medical device which is a reagent, reagent product, calibrator, control material, kit, instrument, apparatus, equipment, or system, whether used alone or in combination, intended by the manufacturer to be used in vitro • For the examination of specimens, including blood and tissue donations, derived from the human body, solely or principally for the purpose of providing information: - concerning a physiological or pathological state or - concerning a congenital abnormality, or • To determine the safety and compatibility with potential recipients, or • To monitor therapeutic measures.
3.2	"Device for self-testing"[13]	An IVD intended by the manufacturer to be able to be used in a home or similar environment by lay persons who will relate the result of the test to him- or herself.[13]
4	**U.S.A.**	No specific definition of "home use in-vitro diagnostic devices"
	"In-vitro diagnostic products" (IVDs)[65]	Those reagents, instruments, and systems intended for use in diagnosis of disease or other conditions, including a determination of the state of health, in order to cure, mitigate, treat or prevent disease or its sequelae. Such products are intended for use in the collection, preparation, and examination of specimens taken from the human body.
5	**Canada**[14, 55]	
5.1	"In-vitro	A medical device or a product to be used in vitro for the examination of

No.	Countries	Definitions
	diagnostic devices" (IVD)	specimen derived from the human body. It consists of reagents or articles or any combination of these and that is intended to be used to conduct a specific test or assay. Such analysis is aimed to determine the presence, absence or quantity of a specific chemical or substance.
5.2	"Near patient in vitro diagnostic device" or "near patient IVDD"	An in vitro diagnostic device that is intended to use outside a laboratory, for testing at home or at the point of care, such as a pharmacy, a health care professional's office or the bedside.
6	**GHTF**[62]	
	"In-vitro diagnostic device" (IVD)	A medical device intended for the in vitro examination of specimens derived from the human body.

2.2.12. Instructions/Directions for use

2.2.12.1. Canada[14, 55]

They are full information as to the procedure recommended for the achieving of optimum performance of the device and include cautions, warnings, contraindications and possible side effects.

2.2.12.2. U.S.A.[18]

They are the procedural steps to follow in setting up, using, cleaning, trouble shooting, and storing a device (Guidance on Medical Device Patient Labeling).

2.2.12.3. GHTF[62]

Information provided by the manufacturer to inform the device user of the products proper use and of any precautions to be taken.

2.2.13. Performance Evaluation (of IVD Device)[62]

A pre-market study of a medical device intended for the in vitro examination of specimen derived from the human body, undertaken in specialist laboratories for medical analysis or in other appropriate environments, outside the manufacturer own premises, in order to demonstrate the device conforms to all relevant Essential Principles and Safety and Performance.

3. The methods in labeling evaluation[16, 18, 30, 31, 66, 67]

According to the safety and effectiveness of home-use medical devices, the significance of real data for valid feasible problem reflection and their incidence

quantification were a serious necessitates to be required by the evaluation of consumer potential.[31] Such user-oriented testing can help to find places where the patient labeling may be inaccurate, uncomprehending, or poorly organized. The 3 recommended aspects in the above problems exploration were as follows.[31]

- User factors – cognitive training and physical capabilities
- Design factors – manufacturers responsibilities and regulations compliance
- Documentation and support factors – Use warnings, instructions – need usability testing for the labeling and documentation intended for lay instruction.

The usability testing from the consumer's perspective in assessing written medication information composed of a variety of direct and indirect methods. These techniques can be used to check the potential users' comprehension and their ability to follow instructions in order to operate the devices. The details of these schemes would be as follows.

3.1. Direct methods

They include focus groups, individual interviews, self-administered questionnaires, and focus testing or usability testing. They have been used by the researchers to study consumers' evaluation of written prescription information. They provide insights into consumer perceptions, beliefs, comprehension, recall and behavior. However, each of them also has some limitations.

3.1.1. Focus Group

According to Dick Sawyer and colleagues[66], Focus Group sessions are group interviews of a few individuals from a specified population. The sessions are conducted to obtain opinions and ideas regarding a product concept. A focus group typically consists of about 6-8 healthcare practitioners or lay users. These individuals should be prospective users of the new device under consideration. Such sessions are best conducted by experienced moderators working from scripts prepared in concert with the design term. Well-conducted sessions yield numerous ideas about user-interface design alternatives and user requirements. Remember that users generally have limited knowledge of design alternatives and principles. Thus, the best approach is to weigh subjective data against known interface characteristics, human factors

expertise, and user performances data. Finally, because dominant individuals can bias findings, it may be wise to also consider one-on-one sessions.

According to CRIA[67]and Krass I. and colleagues[30], a focus group is a small group of potential users, usually 8-10 people; discusses their perceptions, opinions, beliefs, and attitudes (POABs) toward the labeling. The discussion is guided by a skilled moderator. Even though, it is efficient as they obtain qualitative information from several respondents at once, but small sample sizes make it difficult to generalize and develop norms.

3.1.2. Individual interviews or in-depth interviews

3.1.2.1. According to Krass I and colleagues[30], potential user provides ideas and impressions of possible ways that the labeling could be most effective written. They allow researcher to gather quantitative data, but very labor intensive and costly.

3.1.2.2. According to Dick Sawyer, and colleagues[66], interviewing is a flexible way of obtaining opinions about specific devices, problems, and user preferences and ideas about improving user-interface design. Interviews also can be conducted quickly and in conjunction with observations. Below are a few ideas about interviewing personnel in medical facilities.

3.1.3. Self-administered questionnaires

According to Krass I and colleagues[30], potential users are asked to review the labeling, complete the questions in the questionnaire about labeling, and return it within a specified time. There is less labor intensive and less expensive but they may be subject to response bias and variable exposure of respondents to test materials.

3.1.4. Focus Testing or Usability Testing

According to C.D.R.H. under the U.S.F.D.A[18] and Krass I and colleagues[30], the concept of usability refers to the extent to which the people who use a product can use it quickly and easily to accomplish specific tasks. The usability of a product is composed of the combined usability of the products' sub-components, which can include hardware, software, menus, icons, messages, labels, manuals, reference materials, and software-based help. Consideration of the usability of a product may focus on all or some of these sub-components. For IVD test kits, patient labeling including label and packed insert is often an important sub-component of usability consideration. It is desirable to demonstrate that labeling materials can be used safely and effectively through the application of focus testing or usability testing.

According to CPHA and NLHP[16], Focus Testing or Usability Testing is a technique designed to determine how usable the product is. This technique engages systemic observation of actual users trying out a product (or sub-component) and the collection of information from the users about aspects of product that are difficult for them. The process involves the use of test subjects who, individually or in group, are presented with the materials and invited to response to a series of interview questions to determine whether they understood the information presented. Test subjects may be representative of specific user groups or selected at random. Data are then collected on how well the labeling materials support the users, how effectively they are able to use the device, how many and what kind of errors they make, and any difficulties they encounter. They have provided insights into consumer perceptions, beliefs, comprehension, recall, and behavior.[30] The examples of Focus Testing or Usability Testing are such as Cloze Procedure, Diagnostic Testing, and the Consumer Information Rating Form (CIRF).[16, 30]

3.1.4.1. Cloze Procedure was developed in the early 1950s by a psychologist, is a technique in which words are deleted from a passage according to a word-count formula, such as every fifth word, or various other criteria. The passage is presented to test subjects who, as they read, insert words to complete and construct meaning from the text. This procedure can be used as a diagnostic reading assessment technique, or to help assess the readability of text for readers with varying levels of literacy.

(1) Purposes

The purposes were to determine the readers' system in the construction of meaning from print, to assess readers' vocabulary and knowledge, and to encourage the critically and analytically thinking about text and content.

(2) Methods

Sound text, logical sequence, proper construct sentences, implies vocabularies are utilized to administer the text to be tested.

(3) Scoring

Exact replacement (≤40% suitable) and Synonymous replacement (≤70% suitable) indicate that the materials is inappropriate and frustrating for the reader.

(4) Interpreting the results

Scores and completion times can be used to determine the suitability of reading material for the individual and/or group of test subjects.

3.1.4.2. Diagnostic Testing[16, 67]

It was developed by Australian Communication Research Institute (CRIA). It is a method for diagnosing faults in information design. It has been developed to provide information designers with a robust method which can be integrated into routine information design process.

(1) Purposes

It is a method for diagnosing faults in the information design. It is for testing the subjects or users in reviewing materials. It is used at the benchmarking stage to find out if the existing label performs, at the testing and refinement stage to find out if a label improved, and at the monitoring stage to check continued performance. It is not a stand-alone scientific test. It can be retested several times. The issues will be about how quick and easy in finding information in patient leaflets, and the ability the users to understand and act properly.

(2) Process

The process consists of asking users to carry out the task in a normal, non-test environment; observing and recording users' detail action; probing their interpretation and utilization of reading information.

(3) Methods

CRIA recommends that the persons who write the information leaflet will be the best to perform the test to subsequent work. The observation and analyzing of the behaviors of population at risk or actual sufferers in documentation utilization will be conducted. The number of participants is recommended on 10 people per round of testing. The first 5-6 people will help you find 80% of the faults in the design. A greater number may help in identification of additional faults. The document should be tested in the layout and on the same paper stock as it will be presented to consumers. Avoid giving both options to the same subjects, as the information gleaned from the first document may assist them in interpreting the second.

(4) Test questions

Fifteen clear and concise key open-ended questions for 30-35 minutes are recommended by CRIA as a good number. Furthermore, they should avoid formal style or technical jargon; and started with easy, general questions, logical process. Do not answer the question in the question itself. Concluding with general questions will lead people to raise points not triggered yet. To get the minimum of 16 from 20 consumers answer the test questions correctly showed the tested document suitability.

(5) Conducting the test

The atmosphere should be relax and informal manner. Remind subjects that they are making an important contribution to the success of the document and emphasizing that the purpose is to assess the document, not them. Following the test session, make thorough note. Tape-record sessions and participants agreement may help in test conducting. Summarize the results can assist in leaflet improvement. Recruitment of new participants for each round will help in false indication of the success of the revised version of tested document.

(6) Measuring label performance[67]

According to the code of practice of CRIA in Australia, 81% is the minimum requirement that yield from the multiplication of 90% finding with 90% utilization. It means that the lay consumer could find the information at least 90% of what they look for, and can use at least 90% of what they find.

3.1.4.3. The consumer information rating form (CIRF)[30]

It is one example of direct measures of comprehensibility, utility and amount of information, and overall design quality. It is applied by a consumer panel that administered by the investigators. They developed a 2-page self-administered questionnaire for measuring the consumer's evaluation leaflets. The construct validity of CIRF scales will be explored using principal components factor analysis with oblimin rotation, and internal consistency will be examined with Cronbach's Alpha. Factor scales for each were computed by summing items values. The scale, called the CIRF, includes the following details.

(1) The comprehensibility section

It included 5 items scored from 1 (very hard) to 5 (very easy), asking about how easy or hard the leaflet is to read, understand, remember, locate information, and keep for future reference. Summing the 5 items to interpret as consumer comprehensibility will result in a mean comprehensibility score ranging from 5 to 25.

(2) The utility and amount of information section

Utility was a composite scale of the quantity and the usefulness of information. It listed six topics, including medication and its benefits, contra-indications, directions to use, precautions, side effects, storage, and general information. For each topic, the quantity score (too little or too much amount = 0, about right amount = 1) and usefulness score (not so useful = 1, somewhat useful = 2, very useful =3) will be summed to create a summary utility score (range 1-4).

Summing the six topics to interpret as consumer utility will result in a mean utility scale ranging from 6-24.

(3) The overall design quality section

It included 6 items with semantic differential scales scored from low quality (1 point) to high quality (5 points). They are poorly-well organized, unattractive-attractive, poor-ideal print size, alarming-encouraging in tone, unhelpful-helpful, and poor-ideal spacing between lines. Summing the six items to interpret as consumer design quality will result in a mean design quality score ranging from 6 to 30.

3.2. Indirect methods or Standardized Readability Assessment Tools

They include a readability test, and a design assessment tool[30] These tests involve analyzing the text using formulas and calculations to come up with an indicator, usually grade level, to measure the readability of the information.[16] In addition, they involve scoring leaflets in terms of design characteristics identified by researchers as enhancing comprehension in certain populations and the general public.[16] They are applied directly to the text and do not involve readers.[30]

3.2.1. Readability Test

It is one of the most widely used methods for assessing patient information leaflets.[30] It is tested with a series of PIL's questions of factual content and general structure.[16] They involve the computation of scores using formulae based on word and sentence length to predict the reading comprehension level. There are approximately 40 Readability Tests/ Formulas exist, but nine of them are the most widely used supporting the assessment of written materials-primary through college level. Most literacy experts recommend no higher than an 8th grade reading level for written materials for the general public.[68] In Canada, a Grade 6 reading level is the commonly accepted standard to reach the maximum audience.[16] PILs should accommodate themselves to the average reading age of the British public which is stated to be about nine.[2] However, there are still arguments about the concept of readability formulas in predicting reading ability necessary to understand a given piece of text. Though years of education may not necessarily be a good indicator of reading ability[10], the finding of Davis and colleagues in 1994 supported the concept

that lower grade level of written materials will be most beneficial to, and accepted by, a majority of clients.

According to Wilson FL and Williams BN, Readability Formulas consider about the vocabulary and sentence structure affecting the difficulty in text comprehension; not consider the format, the layout, the subject complexity, the reader familiarity with subject, and the reader interest.[68] They are limited to linguistic surface structure of text, and are available for several languages other than English & French.[16, 30] According to TechSmith, readability formulas are popular because they reduce to simple formulas and complex work of writing. They provide a convenient check and measure of the level of one's writing. Moreover, they have the glitter of mathematical exactness, and can be calculated by word processing software. However, their limitations are that the low writing styles can result from a boring use of readability indexes-a repetitive sequence of short sentences and simple words can make the writing dull and uninteresting to read. Furthermore, indexes frequently give conflicting results. Consequently, formulas will not replace the clear and logical thinking that is the foundation of all clear writing.[69] However, the examples of some general formulas used in healthcare are as follows:

3.2.1.1. The Gunning's Fog Test (Index)

It is one of the best known and measures the level of reading difficulty of any document.[69] The Fog Index level translates the number of year's education a reader needs to understand the material easily, quickly and completely, not include kindergarten. For a lengthy document, select several different passages and average the Fog Index. The formula and its details are as follows:

Fog Score = 0.4 * (average Sentence Length + number of words having 3 or more syllables in the sample)

[NB] The ideal score is 7 or 8; anything above 12 is too hard for most people to read. However, the general index is about 12 (average score in tabloid press).

- Average Sentence Length = $\frac{\text{total words in passage of ~100 words}}{\text{Total number of sentences}}$
- A sentence includes any grammatically independent unit ending with a period (.), question mark (?), exclamation point (!), semicolon (;), or colon (:).
- Count hyphenated words as a word; abbreviated words, and Roman or Arabic numbers as words.

- Do not count capitalized (e.g. brand or generic name), combined-word (e.g. overdose), verb form “ed” & “es” that make the word have a third syllable.

3.2.1.2. The Simplified Measure of Gobbledygook (SMOG) index

It can predict 90% to 100% comprehension and has been used extensively to analyze health oriented literature.[40] It is a simple technique that can be used to assess the grade level of a document. The formula requires a sample of text with at least 100 words and uses 3 samples of 10 consecutive sentences. The total number of polysyllabic words (words with 3 or more syllables) is counted for the sample, the square root is taken, and “3” is then added to this figure. However, the SMOG Conversion Table might be used to get the approximate grade level of a document. The method is as following:

(1) Version: regular (≥30 sentences), short (<30)

(2) Select 30 sentences; 10 consecutive sentences from beginning, middle, and the end of document (not include Brand/Generic name)

(3) Count tot. no. of words > = 3 syllables (multisyllabic words) & used with a SMOG conversation table to get grade level)

(4) Predictive > diagnostic; general grade level = < 8

3.2.2. The examples of the tools to assess design factors or Standardized Readability Assessment Tools, are as following

3.2.2.1. “User-friendliness” index was based on subject characteristics such as print size, graphic, colour printing, amount of white space, and paper quality.[30]

3.2.2.2. The eight-item readability assessment instrument (RAIN) tool was based on characteristics such as global and local coherence, unity, audience appropriateness, adjunct questions, writing style, illustrations, and typography.[30]

3.2.2.3. The Baker Able Leaflet Design (BALD) assessment form[39] was used to assess the layout and design of the leaflets. It considers 16 characteristics as

(1) The score are based on length of the line, distance between the line, letter font size, graphics used, percent of white space, paper quality.

(2) The document scores 25 or more considered as the document with good layout and design.

3.2.2.4. The medication information deign assessment scale (MIDAS)[30] is the instrument enables researchers or investigators (IK) to quantify the extent to which a given leaflet meets various design characteristics recommended in the 1996 Action Plan and several attributes adapted from the Baker scale. Investigators

developed a 13-item scale for measuring the design quality of PILs. They are type size (≥ 10 point), Serif style letters in text, sharp contrast between ink and paper colors, line spacing (≥ 2.2 mm), margins (≥ 0.5 inch sides and bottom, ≥ 0.25 inch at the top), true heading (separate line), upper and lower case in the text and headings, line length (≤ 40 letters), bullet points, bolding/box or summary to highlight important points, no watermarks under the text, relevant pictures/illustrations, and mean MIDAS score. The scale was based on specific language and format guideline. The scoring system assigns 1 point for the presence of each attribute, with a maximum score of 13.

3.2.2.5. The Suitability Assessment of Materials (SAM) Instrument was developed by C.C.Doak, L.G. Doak and J.H. Root in 1995. It can be used to evaluate written materials against factors known to enhance people's understanding of such documents.[11] Such factors include readability, cultural appropriateness, and how well they enhance the reader's self-efficacy.[70] The SAM rates written materials is unique among readability tests because it consists of 22 items grouped under 6 areas to be assessed. The 6 variable categories and their subsections are as follows: Content, Literacy Demand, and Graphics: Layout and Typography, Learning Stimulation and Motivation, and Cultural Appropriateness.

3.2.2.6. In-depth analysis of materials based on content, format, layout, language, legibility, and illustrations[10]

3.2.2.7. The Maine Area Health Education Centre (AHEC) checklist[30]: assess design factors of organization, Writing style, Appearance, and Appeal.

4. Related research works and requirements in labeling developing and evaluation

There are many articles or research studies reviewing the usefulness and importance of written information, specifically leaflets, being given to the patients. Most of them relate to the medicinal products and very few in medical devices including home-used IVD test kits. Consequently, the development of indicators for evaluation of leaflets quality of home-used IVD test kits will be derived from most of the literatures reviews on pharmaceutical products and some on health promotion as well as patient-health professional communication as follows:

4.1. Ines Krass, Bonnie L. Svarstad, and Dara Bultman. Using alternative methodologies for evaluating patient medication leaflets[30]

They studied about the using of alternative methodologies for evaluating patient medication leaflets. They reported on two new instruments. The first was the medication information design assessment scale (MIDAS), an indirect measure of design quality administered by the investigators. The other was the consumer information rating form (CIRF); a direct measure of comprehensibility, utility and amount of information, and overall design quality applied by a consumer panel.

4.1.1. Process

They used these two methods to assess 2 types of patient information leaflets (PILs). They were 36 different CP-PILs from community pharmacies and 3 Model-PILs developed by investigators to include recommended design characteristics. Before conducting consumer evaluation panel, an investigator computed a MIDAS score for each of the 36 different CP-PILs and 3 Model-PILs. The designers and publishers of all PILs were blinded to minimize bias.

4.1.1.1. Sample selection and Data collection

A snowballing method was used to recruit a convenience sample of 24 individuals to serve on a consumer evaluation panel. They had college and high school education in each one-half. Each consumer was paid US$ 40 as honorarium money for attending a small group session to read and evaluate selected PILs. Four PILs, including 1 CP-PIL for each of 3 drugs and one Model-PIL for one of these drugs, were distributed to each consumer to be read and evaluated independently using questionnaire called “CIRF”.

4.1.1.2. MIDAS

It is a 13-item scale for measuring the design quality of PILs. It was based on specific language and format guideline as well as several attributes adapted from the Baker scale. The scoring system assigned 1 point for the presence of each attribute, with a maximum score of 13.

4.1.1.3. CIRF

It is a two-page self-administered questionnaire for consumers to evaluate independently after reading the leaflet, asking the questions about

(1) Comprehensibility: “how easy or hard the leaflet is to read, understand, remember, locate information, and keep for future reference”

(2) Utility and amount of information: “how much information about benefits, contraindications, directions, precautions, side effects, storage; was

provided" and "how useful the information would be if they were taking the medicine for he first time"

(3) Overall design quality: organized, attractive, print size, spacing, tone, unhelpful/helpful

4.1.2. Scoring

Each of the 36 different CP-PILs was individually rated by two consumers producing 72 rating scores. Each of the 3 Model-PILs was individually rated by 8 consumers, resulting in a total of 24 rating scores. Score range is from 6-30.

4.1.3. Data analysis

Construct validity, concurrent validity, reliability, and the Student's independent t-test were employed in this study.

4.1.3.1. Concurrent validity of the MIDAS scale was examined by non-parametric correlation (Spearman's ρ) between the CIRF design quality and MIDAS scores.

4.1.3.2. Construct validity of CIRF scale was explored using principal components factor analysis with oblimin rotation.

4.1.3.3. Internal consistency will be examined with Cronbach's Alpha.

4.1.3.4. The Student's independent t-test was employed in the analysis of comparing mean consumer ratings for pharmacy leaflets that were read before versus after reading the model leaflet.

4.1.4. Results

The validity of the MIDAS was demonstrated in 2 ways. They found the more positively rating in the Model-PILs by consumers, and a significant positive correlation between the number of design criteria incorporated in both tools, MIDAS and CIRF. Moreover, there were no order effects. There was no significant difference in mean factor rating scores for consumer receiving CP-PILs before (versus after) Model-PILs. In other words, consumer rated the model leaflets higher than the actual pharmacy leaflets independent of the order in which the leaflets were assessed.

4.2. Janelle Griffin and colleagues. Written health education materials: Making them more effective[10]

4.2.1. Process

Reviewing the literatures on written health information was conducted to provide an overview of the issues necessary in developing or evaluating written materials. The study purposes were to provide both content and design guidelines for occupational therapists involving the selection and developing customized materials for client education functions.

4.2.2. Results

They concluded that effective customized written information that occupational therapists designing and providing to educate or direct clients to the materials from other sources, were needed to be suitable to their reading and understanding ability levels. Furthermore, the mindful of appropriateness of clients' literacy levels, the readability level of the written information, and the overall design characteristics of the materials can facilitate such effectiveness. The simple readability formulae could be applied to materials to predict the approximate reading grade level required to read their content. The content of written materials should be clear, simple and concise; and the layout should be legible and structured. Consideration based on such above three relevant issues, they proposed the principles for designing effective written education materials as follows:

4.2.2.1. Aim for a grade 5/6 reading level

4.2.2.2. Keep content clear, simple and concise; avoid jargon, define medical terminology; ensure accuracy by involving experts and using good evidence

4.2.2.3. Acknowledges sources of information; providing balance information and all relevant details

4.2.2.4. Ensure currency by including publication date and regularly reviewing and updating; ensure relevancy by considering the information needs of the target audience

4.2.2.5. Present the 'what, why and when', use clients' questions to frame information; use short sentences and one or two syllable words, with one idea to a sentence; use short paragraphs and discuss important points first; include a summary section, bullet points may be helpful

4.2.2.6. Use a structured format with clear and obvious headings; use adequate spacing between lines; use dark print on a light background; use at least a 12 point type font; restrict upper case lettering to headings and sentence beginnings; use bold print to highlight headings

4.2.2.7. Use illustrations that are recognizable, clearly labeled, informative and complementary to text

4.2.2.8. Use non-patronizing, non-alarmist language in active voice

4.2.2.9. Involve the target client population from initial development to evaluation stages.

4.3. Gutman and Ritcher. FDA Regulation of home-use in-vitro diagnostic (IVD) devices[71]

The key parameters of importance in the FDA review of home-use devices are the evaluation of home-use performance, benefits and risks in the hand of lay or home users as follows:

4.3.1. The accuracy and precision of documentation must include testing in the representative population to use such devices, a special training (if necessary and observation study or focus testing with small group of such users. This is to ensure

4.3.1.1. performance is adequately characterized,

4.3.1.2. design features is understood, and

4.3.1.3. labeling is optimized for correct use.

4.3.2. The benefits and risks of the devices require clinical evaluation of the test and an intensive review of proposed labeling to ensure

4.3.2.1. clearly communication to lay users,

4.3.3. Actions lead to promote personal or public health, and minimize illness.

4.4. Morris & Aikin. Pharmacokinetic Communication Model[53]

The drug risks, benefits, and directions for use are usually communicated in printed materials. Patients' understanding of such information can influence the safety and effective utilization of pharmaceuticals. Patients' information processing is considered as a form of health information acquisition actions. It can be affected by the motivation and ability of patients to process information, as well as situational factors. However, the parts that make communication problematic are their willingness and ability to process written information, not the information itself. The

reason is rather be the interaction between the patients and the printed materials that determine the nature and amount of information communicated.

4.4.1. The researchers assume that the processing of drug information is similar to drug pharmacokinetics. Therefore, the Pharmacokinetic Communications Model was proposed by applying the knowledge of drug pharmacokinetics to explain how patients process written information. They overviewed the

4.4.1.1. factors involving message transferring from document to patients;

4.4.1.2. way information is cognitively processed by

(1) patients: their main intrapersonal factors (motivation and ability factors) and situational factors (opportunity) that influence information processing, and both willingness to process and actual processing; and

(2) Document-design factors (e.g. communication design and the conditions under which the information is read): Those influence the direction and extent of information processing; and comprehension.

4.4.1.3. Whether patient's comprehension is sufficient must be defined operationally, usually based on expert analysis of what patients need to know to use a drug safely and effectively. According to Morris and colleagues (1998), the sufficiency of comprehension can be measured by

4.4.1.4. asking questions that require patients to retrieve information from these mental model

4.4.1.5. Comparing the provided answers with the intended meaning.

4.4.2. Sufficiency of comprehension is considered as the aspects of

4.4.2.1. an educational outcome (e.g. does the patient comprehend important communication objectives?) which depend on the presented text and the document designers' development of text that assure important messages are likely to be processed sufficiently,

4.4.2.2. linguistic outcome (e.g. does the patient correctly decode the messages?), and

4.4.2.3. Cognitive outcome (e.g. what is the form of the patient's mental representation of the presented material?).

The Pharmacokinetic Communications Model views the interaction between document characteristics, and the patients (involvement patient's goals,

literacy of patients, situational limitations); as the primary determinant of successful communication. Some examples of the above issues are the patients' perceptions of the product and the document; and the patients' beliefs, expectations, and goals. This relationship can affect decision making to guide users' behavior in reading about and using the product. Consequently, they also discussed whether document testing is needed to assure that intended critical messages have a greater probability of being communicated.

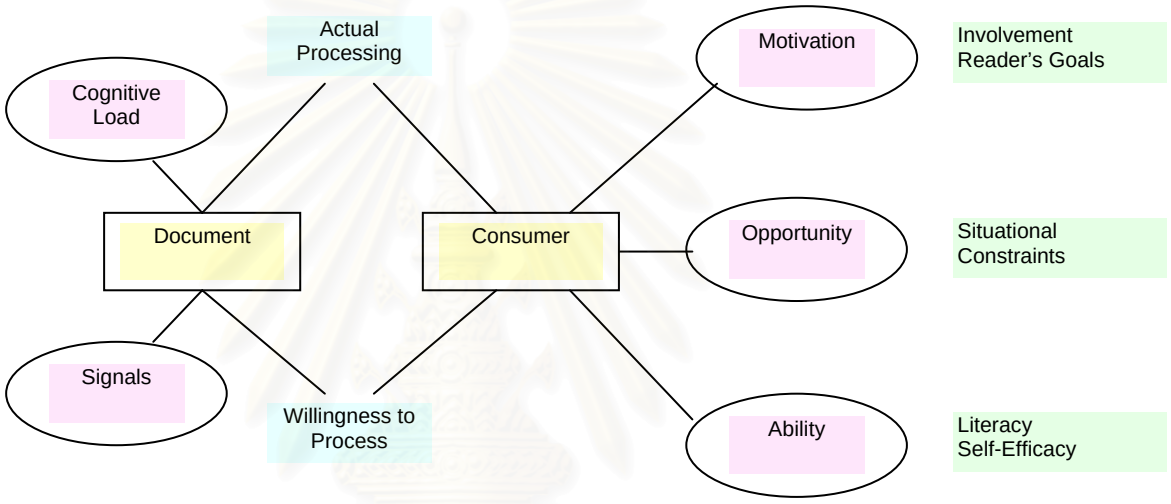


Figure 2.1. The pharmacokinetics communications model

Source: Morris & Aikin (2001)

4.5. Prepared for CDRH by Patricia A Kingsley: FDA/CDRH/ OHIP/ DDUPSA, 16 February 1999. Draft Report on Medical Device Labeling: Patients' and Lay Caregivers' Medical Device Information and Labeling Needs, Results of Qualitative Research[51]

4.5.1. Purposes

This project was conducted to determine the perceptions, opinions, beliefs and attitudes of patients and lay users of medical devices about the written information for those devices. The specific purposes were the seeking information on

4.5.1.1. what device information they need, want and don't want in writing

4.5.1.2. what determines when the information presented is "enough"

4.5.1.3. potential differences in preferences when the information presents risk/ benefit information versus user instructions

4.5.1.4. preferred order, if any, for information presentation, and

4.5.1.5. effects of text enhancers, such as graphics and highlighting techniques on usefulness of written information.

4.5.2. Methodology

Focus groups and individual interviews of users with recent device experience were conducted in 2 phases to gain information on lay user preferences for the content and formatting of the patient labeling of medical devices.

4.5.2.1. Phase 1: Four focus groups of users were divided into 2 groups of devices needing primarily risk-benefit information and the other 2 groups of devices with complex instructions/ directions for use. A proposed content and order for the presentation of

(1) Group 1 had 6 participants: half were spouses of individuals with pacemakers, the other half were diabetics using blood glucose meters

(2) Group 2 had 8 participants: 2 had laser surgery, 3 had hearing aids, 1 had knee replacement, and 2 had dental implants

(3) Group 3 had 9 individuals (patients and caregivers)with experience of devices requiring instructions for use, apnea monitors, continuous positive airway pressure (CPAP) devices, ventilators, oxygen equipment, infusion pumps, and peritoneal dialysis equipment

(4) Group 4 had 9 participants with experience of blood glucose monitor, TENS devices, orthopedic braces, and OTC in vitro diagnostic test kits.

Note: The questions to address the above 5 goal issues were as follows:

- What parts of the patient labeling did they read and why?
- What didn't they read and why?
- What do they expect and need from patient labeling?
- Where else do they get this information?
- What topics are most/least important to them?
- What gets their attention and motivates them to read something?
- In what order should information be presented?
- How should the information be laid out?
- Is consistency important?

- When and from whom should they get this information?

The list of 21 topics were developed from current labeling practices, risk communication and health education literature, and patient labeling testing done by the CDER. It was used as a framework for the discussion of what topic areas should and should not be included in patient labeling. A content and order for the presentation of that information were also proposed. Then the participants were asked to develop "ideal labeling" from the topics they determined to be important. The 5 goals were the basis for the discussion. From the information gained, a template for patient labeling was developed for specific but fictitious products, to avoid a focus critique of the patient labeling of one product.

4.5.2.2. Phase 2: One mini group of 4 participants for OTC IVD kits and 2 individual interviews for the orthopedic implant group and the infusion device group were conducted to get the participants reactions and to readdress some of the issues from the initial groups in phase 1. This was to get more clearly define the purpose, content and format of effective patient labeling. Moreover, they intended to refine the model and their recommendation to patient labeling developers; and identify issues in need of further research. The participants had recent device experience or were in the process of deciding to use or not use a particular device. The following is the outline for that model.

(1) Descriptive information (name, other specific identifiers, purpose, description, risk benefit information, expectations of device and procedure associated with device, general warnings)

(2) Operating information – as applicable, set up +, instructions for operation, maintenance, etc.

(3) Troubleshooting

(4) Additional information for interested readers (could be provided separately), scientific information/clinical studies, self care, disease information

(5) Customer assistance number (1-800#)

4.6. Kim Sydow Campbell, Linda L. Mothersbaugh. A Review of Research on Written Patient Information[72]

This study intended to inspire and aid researchers in developing proposals for future research in written patient information. The search in ERIC, Medline and

uncover databases was conducted to locate 65 research articles relating to written patient information from 24 different medical research journals. The results from such review support the positive effect of written patient information in improving health care outcomes. Financial support for this type of research appears relatively low compared to other areas of health care. However, no well established method for defining the "quality" of patient information is currently available. Therefore, there are the limitations of both the implementation of research findings in clinical practice and further research itself. Three distinct outcomes or measures appear in the identified studies (cognitive, behavioral, and effective) to judge the quality of patient information as follows:

4.6.1. Cognitive measures assess patient knowledge and perception such as asking patients to answer multiple choice questions about their diagnosed condition and its treatment, face-to-face interviews involved presenting a medical term, etc. Nearly 62% of all identified studies (n=40) used some forms of cognitive measure to assess the "quality" of patient information.

4.6.2. Behavioral measures assess patient compliance (or adherence) by

4.6.2.1. Auditing patient records about following appointments. Some called patients on the phone to ask for their compliance with advice during an emergency room. The use of multiple compliance devices developed specifically for tracking medication errors.

4.6.2.2. Questioning the use of adherence

4.6.2.3. Written surveys or oral interviews

4.6.2.4. Observation and artifacts

4.6.2.5. Self-reports to measure behavior

4.6.3. Affective measures assess anxiety, satisfaction, or certainty such as asking the patients about their feeling of satisfaction with written patient information. They found just only over one-fourth of the identified studies (n=18) those used this measure. Patient satisfaction was most often determined with statistical analysis of responses from surveys. The method of affective measures is the least used measure of the "quality" of patient information, but it will be increasingly recognized as an essential measure.

4.6.4. Combined measures can enhance the potential validity of their results such as testing 2 versions of patient package insert to collect information on patient

behavior and satisfaction. There is only 5% of the identified studies (n=3) used 3 types of measures.

4.7. Home pregnancy tests (HPT) kit

At present, HPTs are controlled as general medical device that need Certificate of Free Sale from the country of origin. Otherwise, they can not be imported into Thailand. Furthermore, locally manufactured HPTs can be sold in Thailand without any licenses or notifications, except advertisement licensing. Nevertheless, the local manufacturers and importers have to be responsible for the standard quality and safety of products marketed. They have some duties and other responsibilities to follow the regulations and requirements in consumer protection as prescribed by law, but not being rigorous as the above mentioned licensing and notification controlling ones. Accordingly, the quality of such labels and leaflets is worthy to be emphasized to assist in consumer protection.

Home pregnancy tests (HPT) kit is as the qualitative tests of hCG (hormone Chorionic Gonadotropin) in urine. It has been assumed that hormone hCG is the key marker for pregnancy.[73] Pregnancy testing is now so sensitive that hGC can be detected in urine about 2 weeks after conception. Consequently, women become aware of early miscarriages that might otherwise have passed unnoticed.[6] The most common kits use a test strip or dipstick. The chemical reaction produced shows a color change, which the user can compare to a chart for interpretation.[48] Generally, HPT are less accurate when performed by consumers comparing to professional laboratory testing.

HPTs is become broadly accepted as the preliminary mean of early pregnancy detection without the need to go to a clinic, and reduces costs.[9] The other advantages of HPTs are privacy and fast result in knowing whether a desired or an unintended conception has occurred. Consequently, these HPTs are still among the most commonly purchased over-the-counter (OTC) disposable health kits. It has been most continuously used for nearly 3 decades in obstetricians' offices, clinical and professional laboratories.[73] Currently, it is common for doctors not to repeat a home pregnancy test.[6] Therefore, the importance of information in using such kit should be emphasized to obtain the correct result.

In many situations some brands of HPTs yield negative or faintly positive results (even though the user may be pregnant). This may be due to their sensitivity not enough to detect the low HCG levels associated with very early pregnancies or that report at the onset of a missed period. In addition, some HPTs may give falsely positive result, false pregnancy detection as a result of pregnancy loss, and problems with interpretation. This might generate false hope and great confusion among users. Therefore, these issues need to be considered to prevent delays in detection of pregnancy, for early beginning of prenatal care, to allow appropriate changes in medication and behavioral regular with healthy pregnancy, or to seek earliest pregnancy termination if needed for their feasibility and safety. Moreover, a clearer understand of diagnostic accuracy can be reported on each brand package insert rather than the printing boldly "over 99% accuracy" on the outside of the package.[74]

5. Introduction to print media[75]

5.1. The characteristics of good information

5.1.1. Correctness: accurate and up-to-date according to the references

5.1.2. Appropriateness: proper to the target group of reader or user

5.1.3. Legally: not violate the law especially about the copyright or the patent

5.1.4. Theme: interesting, updated, obtaining much social merit, well organized, and not confuse the reader

5.1.5. Reasonable: rational proposed to make reliability to the reader

5.1.6. Information explanation: clear and completed in their meaning to ease the reader understanding after reading.

5.1.7. Language and wording: proper to the kind of information, concise but meaningful, and easy to comprehend

5.1.8. Construction of sentence

The sentences should not be too long or too short. Moreover, it should be grammatically correct, and employ foreign language as less as possible. The other issue to be concerned is that the print size of the same points in Thai is much smaller than in English. Therefore, the presentation of the prints in both languages together must be well considered. For example, the Thai print in 12 points is nearly the same size as the English print with 10 points.

5.2. The design of print media for the specific purpose (e.g. leaflet, etc.)

5.2.1. The format and size of leaflet

The popular format of leaflet is a single A4 paper size with twice folding.

5.2.2. Information organization

Proper ordering to the unfolding of the package leaflet would be needed.

5.2.3. Printing

The technical contents should be in quite formal print size and simple type, and it should be proper to the age and gender of the reader. It should be separated in columns to ease in reading such information.

5.2.4. Spacing

Proper spacing in labeling was needed because too tightened in labeling might discourage the reading. Not too small or large line spacing was suggested.

5.2.5. Main heading and miniature title

The dissimilar font type of prints should be rendered to emphasize the importance of information in different parts and details.

5.2.6. Illustration or Drawing

The attractive, beautiful, tender figure should induce the reader to positive response harmonization in handle and reading such print media. Moreover, the print type and proper size of the media should be related to the theme of the contents.

5.2.7. Paper quality

The paper quality depends on the printing work type. The grain, the moisture, and the color of paper affected the printing quality. The standard weight and strength of paper, the white color smooth paper, and the balance of paper moisture comparing to the environment (easy to absorb and dry); would give nice printing work.

5.2.8. Color printing

The use of corresponding or opposite colors would promote the quality and value of such printing. The color printing would provide the nice, lively and factual looking to the reader. In addition, it gives the interesting and encourage to reading.

5.3. The modern marketing concept

Besides the production approach for reasonable price, and the selling concept by advertising and promotion, as well as the product concept of good quality; the

modern marketing comes into interesting of the manufacturer or the entrepreneur. This concept concerns about the customer's need more than the personal need of the above commercial personnel as the concept of "customer is the King". Therefore, the research works in the survey of consumer's need in any products or services are necessary to conduct before launching into the market.

5.3.1. The importance of printing design

The good print media should be evaluated in its ability to well communicate the printing information to the reader or customer. The step in designing would be as

5.3.1.1. Ability to encourage readers' interesting by knowing the target users;

5.3.1.2. clear and proper communicate to the information receiver by systematic principle and steps, selection the compositions (e.g. print type, drawings, etc.), balancing;

5.3.1.3. dignity in printing design, and the proper information sequencing;

5.3.1.4. conduct the impression to the reader and help in remembering such communicated information by well creating specific dignity of such printing media.

5.3.2. The components of leaflet

5.3.2.1. The headline

It is usually in concise detail about product benefits for rapidly notify the reader.

5.3.2.2. Illustration/ drawing

This would help the headline in more attractive and proposing the benefits to the reader. The 5.3.2.1 and 5.3.2.2 are usually presented in the front or main part of the leaflet to provoke the reader's interesting during unfolding the leaflet.

5.3.2.3. Contents/details

It is composed of the details about the product, service, or information related the organization which can be indicated as much as they like. The recommended characteristics of the texts would be as following:

(1) minimum 12 points of dark Thai print size on colorless background,

(2) Only 1 font type in printing except the main headline of the leaflet e.g. the product name at the beginning part of leaflet, etc.

(3) Illustration/drawing with texts to promote the reader understanding.

(4) Product or organization image/mark

This information will inform the reader about the authorized sponsor or entrepreneur of the product which is usually presented in the last fold of the leaflet.

6. The modified conceptual framework for this study

Before guideline developing, problem finding and analysis on document factors of such labeling were performed. Although the consumer perceptions testing were essential, assessment efforts that are best judged by professionals must be carried out to determine whether such labeling achieving other necessary requirements.[30] Moreover, the design factors and usability contents of labeling document were also concerned in this study. These involved with the regulatory compliance and responsibilities of stakeholders (e.g. manufacturers or distributors, regulators, etc.) for consumer protection activities. Hence, both analysis by consumer testing and other stakeholders were necessary for this study to obtain the coverage problems in existing HPT product labeling marketed in Thailand.

Conceptual Framework: The conceptual framework is adapted from the Pharmacokinetic Communications Model proposed by Morris & Aikin[53] and literatures review[10, 30, 40, 76]

Document factors (Label & leaflet) (independent variables)	+	Consumer factors (Patient & activated information) (control variables)	→	Consumer's perceptions involve decision making to guide the behavior (dependent variables)
• Availability and accessibility • Readability levels of materials • Document characteristics − *Content*: simple, clear, up-to-date, relevant, reliable, and accurate (consistent to regulations) − *Language & Design*: format, layout, legibility/ print, illustrations		• Motivation or maturity (reader characteristics) • Literacy level: reading & understanding ability (due to knowledge and beliefs); or ability to extract and infer meaning from presented materials • Situational factors/opportunity		• Perceived Design Quality (document) • Perceived Utility (product) • Perceived Comprehensibility (patients' beliefs, expectations, goals)

Figure 2.2.: Conceptual framework for variables in labeling development and evaluation

There are varieties of factors influencing the consumer's perceived quality of labels and leaflets. From consumers' perspectives, the perceived design quality, utility, and comprehensibility of the document depend on 2 major groups of factors including document related factors and consumer related factors. Document related factors encompass availability, accessibility of the document, readability of document material as well as document characteristics of labels and leaflets involving content, language, and design (format, layout, legibility/ print, illustrations).[10] Consumers' factors such as opportunity/situational (stress) factors, motivation/ maturity (reader characteristics) and literacy level of consumers (ability of reader to process information)[76], also have influences on overview understanding of the labeling.[40]

Document and consumer factors will interact with each other and affect the quality of labels and leaflets in the consumer perceptions.[53] It is not the amount of information presented in drug information documents that matters, rather it is the amount of activated information that is absorbed, maintained, and distributed through inference-making that determines what is comprehended and used in decision making to guide behavior.[53]

The motivation and literacy of the consumer are the intrapersonal factors. The intrapersonal and situational factors influence both the patient's willingness to process fully and carefully read, reread, and think about the document. They also involve actual processing due to the patient's ability to extract and infer meanings from the presented material. Moreover, the document design factors influence the direction and extent of information processing, and comprehension. The above interaction will lead to consumers' perception in product or perceived utility (how personally relevant or useful the information is from their perspective); perception in document or perceived design quality (their views on other attributes such as leaflet organization, attractiveness, print size, and spacing); and perceived comprehensibility (consumers can and should be consulted about how easy or hard it is for them to read and understand the information) or the patients' beliefs, expectations, and goals.[30] The above perceptions can influence the consumers' decision-making that may guide their behaviors.[53] Therefore, the appropriate guideline and labeling prototype of home-use IVDs in Thailand that can reflect the consumers' opinions is the target of this study.

7. Reasons and logic of this study

This research was the study on the problem of existing home-use IVDs in Thailand through home pregnancy test kit and the development of the user-based guideline on labeling of home-use IVD, as well as its validation through evaluating the developed HPT labeling prototype. The knowledge from the Pharmacokinetic Communications Model and reviewed literatures were blended to explain the Conceptual framework of this study as Figure 2.2.

The researcher aimed to illustrate troubles to the lay users caused by the product supplied documents over and beyond difficulties originated by their user factors and product complexity which involved user cognitive training and physical capabilities.[31] The HPT kit was thus the most appropriate home-use in-vitro diagnostic product to be selected for this study.

Home Pregnancy test (HPT) kit was chosen to be the representative of IVD for this study to illustrate the feasibility of the guideline. The HPT was the most popular and simple to use for lay users. The simplicity of HPT would minimize problems occurred from the product complexity that could confound the labeling quality evaluation. The HPT test kit was legally classified as a general medical device with the least stringent controlled group due to its low risk and easy to use device. Hence, the problematic issues found from this study would initiate the tighten regulation for labeling control on IVD by responsible government agency leading to more intensive consumer protection.

The HPT kit was the most prominent home test kit that was extensively used by different reproductive age groups ranging from 15-49 years old. They included teenagers, graduate students, and working women both un-married and married ones. From the in-depth interview of some chief executive officers (CEO) of the biggest local manufacturer, the importers as well as distributors of HPTs in Thailand, the trend in using and marketing of such test kits was increased dramatically especially in the group of students or young generation, and prostitutes.

The HPT kit was the simplest test which had been widely available or offered over-the-counter (OTC) in most retail pharmacies. This product consisted of chemical compositions as medicinal products and was likely to be used by lay persons. The developed labeling guideline concerning adequate directions for operating was essential for safe and effective uses by lay consumers.

8. The labeling regulations in 5 countries and 1 international organization

8.1. Australia had "The Therapeutic Goods Act 1989 and Therapeutic Goods Regulations", "In Vitro Diagnostic Goods for Home-use-draft Guidelines for Sponsors", "Communication Research Institute of Australia (CRIA) Labeling Code of Practice and CRIA Guidelines".[32, 54, 67] The control agency was Therapeutic Goods Administration (TGA).

The proposed labeling information requirements were as

- The outer and inner label
  - The device name
  - The name and quantity of all reagents
  - Infectivity warnings proper to the nature of the IVD
  - The name and address of the sponsor of the product
  - The batch or lot number
  - The AUST L number (Australian License number)
  - The expiry date and recommended storage conditions
- The package leaflet/insert: as outer and inner label and following additional details
  - Directions for use: simple, concise, easy to understand; make liberal use of illustrations or drawings, bold prints or other methods to highlight warnings and precautions; and sufficient safe product disposal
  - Results interpretation, implications of false results (false positive & negative results), follow-up action by consumer

8.2. Canada had 'Medical Device Regulations under the Food and Drugs Act", and "Guidance for the labeling of In Vitro Diagnostic Devices". The control organization was Medical Devices Bureau under Health Canada.[14, 55] Moreover, the

Official Languages Act is also required to ensure the availability for both English and French labeling at the time of purchase. This is because the absence of a “learned intermediary” (e.g. no health professional to assist in safe and effective use, etc.) and variety of ways (e.g. mail order, via internet, etc.) in the self-service of the devices sold to the general public.

The requirements and exemptions on labeling were as following:

8.2.1. General requirements

8.2.1.1. Legible, permanent and prominent manner, in terms easily to understand by the intended user

8.2.1.2. Information of medical devices intended to be sold to the general public must be set out on outer label and be visible under normal conditions of sale. The exemption for too small package, only package insert with reference statement linking to such leaflet on the outer label is needed.

8.2.1.3. All information should be in either English or French as a minimum except both languages of warnings and contraindications as well as directions for use

8.2.1.4. The availability for both English and French labeling at the time of purchase depending on the request of the purchaser

8.2.2. Labeling requirements for a package insert

8.2.2.1. Name of the IVDD

8.2.2.2. Name and address of the manufacturer

8.2.2.3. Intended use

8.2.2.4. Summary and explanation

8.2.2.5. Directions for use

(1) Components

(2) Warnings and precautionary statements

(3) Specimen collection and handling

(4) Test procedure

(5) Results

(6) Interpretation of results

(7) Limitations

(8) Expected values

(9) Disposal

8.2.2.6. Performance characteristics

8.2.2.7. Storage instructions

8.2.2.8. Identifier

8.2.2.9. Date of issue

8.2.2.10. Bibliography

8.2.3. Immediate container label requirements

8.2.3.1. Name of the IVDD

8.2.3.2. Intended use

8.2.3.3. Contents of kit

8.2.3.4. Warnings and precautions

8.2.3.5. Storage instructions

8.2.3.6. Explanation date

8.2.3.7. Name and address of the manufacturer

8.2.3.8. Control number

8.2.3.9. Identifier

8.2.3.10. Specific operating instructions

8.2.4. Reagent label requirements

8.2.4.1. Name of the IVDD and reagent

8.2.4.2. Contents

8.2.4.3. Warnings and precautions

8.2.4.4. Storage instructions

8.2.4.5. Expiration date

8.2.4.6. Name and address of the manufacturer

8.2.4.7. Control number

8.2.4.8. Identifier

8.3. EU had "The In vitro Diagnostics Directive 98/79/EEC". The control institute was the European Parliament and the European Union (EU) Council.[13] All member states had specified language requirements in their legislation.

The information required on home-use IVD labeling was separated for self-test reagents and instruments. However, "the information supplied by the manufacturer with in vitro diagnostic reagents for self-test reagents" is the European standard which require as following topics:

8.3.1. Outer container and immediate container

8.3.1.1. General requirements

(1) For outer container

- Statement “the instructions for use are to be read carefully”
- Need official community languages used, legally acceptable in the country in which the IVD reagent is distributed, bearing in mind of the anticipated users. Proper name, address, or symbol need not to be in multiple languages.

(2) For immediate container

- In legible characters
- Same as outer container except the exemptions on microbiological state, contents, intended purpose, storage and handling information (for too small available space on immediate container)
- For single measure or detection, describe components as required in package leaflet
- If immediate container is also the outer container, apply as requirement of outer label

8.3.1.2. Manufacturer

8.3.1.3. Product name

8.3.1.4. Microbiological state

8.3.1.5. Batch code

8.3.1.6. Expiry date (required format as “CCYY-MM-DD” or “CCYY-MM”)

8.3.1.7. Contents

8.3.1.8. Intended purpose

8.3.1.9. Storage and handling information

8.3.1.10. Warnings and precautions

8.3.2. Instructions for use

8.3.2.1. General requirements

(1) Instructions be easily understood and applied by the lay users

(2) Sufficient information to enable the user to know proper and safely use, and to understand the results

(3) Any symbols and identification colors shall be explained

(4) Need official/community languages, legally acceptable in the country which the IVD reagent is distributed, bearing in mind of the anticipated users.

Proper name, address, or symbol are not required to be expressed in multiple languages.

8.3.2.2. Manufacturer

8.3.2.3. Product name

8.3.2.4. Microbiological state

8.3.2.5. Intended purpose

8.3.2.6. Warnings and precautions

8.3.2.7. Composition

8.3.2.8. Storage and shelf life after first opening

8.3.2.9. Additional special equipment

8.3.2.10. Specimen

8.3.2.11. Procedure

8.3.2.12. Methodology: principle of the method, limitations and possible errors

8.3.2.13. Reading and interpretation of results

8.3.2.14. Follow-up action

8.3.2.15. Date of issue of or revision

8.4. U.S.A. had "Guidance on Medical Device Patient Labeling; Final Guidance for Industry and FDA Reviewers"[18]; Labeling Requirement – In Vitro Diagnostic Devices IVD"[77] of U.S.A., and "Guidance for Over-the-Counter (OTC) human Chorionic Gonadotropin (hCG) 510(k)"[78]. The control establishment was the Center or Devices and Radiological Health (CDRH) within the Food and Drug Administration (FDA), except the IVDs involving blood-borne pathogens which were under the Center for Biologics Evaluation and Research (CBRE).[50] These requirements also concerned the consumer protection on labeling.

The requirement and exemption of titles on labeling were as following:

8.4.1. The requirement for the inner and outer label as well as package leaflet (* refers to contents needed on only inner label; ** refers to contents needed on inner label, and outer label or package inserts; no * refers to contents needed on either outer label or package inserts)

8.4.1.1. Proprietary and established product name**

8.4.1.2. Intended use** e.g. the analyte being measured, type of specimen used, etc.

8.4.1.3. A statement of warnings and precautions*

8.4.1.4. Lot/control number*

8.4.1.5. Summary and explanation of the test e.g. description of how the test works, etc.

8.4.1.6. Principle of the procedure

8.4.1.7. Reagents e.g. common name**, quantity of active ingredients*, cautions & warning, preparation, storage instruction**, net quantity of contents*, means to assure product standard e.g. expiration date, statement of visual alteration indication, instruction for simple check to assure product usefulness, etc.*

8.4.1.8. Urine collection and preparation

8.4.1.9. Test method including

(1) List of material provided

(2) List of necessary material not provided

(3) Amounts of reagents and parameters (e.g. time, temperature, etc.)

(4) Statement related to final reaction stability and any time restrictions on accurate measurements

8.4.1.10. Quality control e.g. results interpretation, function of internal control, maximum time for interpreting results

8.4.1.11. Limitations of the procedure e.g.

(1) The test cannot be reused

(2) Do not use this test past the expiration date

(3) Pain relievers, oral contraceptives, antibiotics, and other commonly used medications (for example) should not interfere the test (studies should be performed to validate this claim)

(4) Certain health conditions e.g. ovarian cysts or ectopic pregnancy (pregnancy outside the uterus) can cause a false or irregular result

(5) The procedures should be followed precisely for accurate results

(6) A false negative result (negative when pregnancy exists) may occurred if the urine is too dilute or with a very early stage of pregnancy. If pregnancy is still suspected, retest using a first-morning urine.

(7) For in vitro diagnostic use (not for internal use)

8.4.1.12. Expected values

8.4.1.13. Performance characteristics e.g. sensitivity, accuracy

8.4.1.14. Bibliography

8.4.1.15. Name and place of business of the manufacturer, packer, or distributor**

8.4.1.16. Date of issuance of the last labeling revision by the firm

8.4.2. The exemptions for inner label, if labeling might

8.4.2.1. Not applicable or interfere with the product: it should be on outer label or be easily through the outside container or wrapper

8.4.2.2. Too small container: but it should be on outer label for intended use, statement of visual alteration indication, instruction for simple check to assure product usefulness

8.4.3. The exemptions for outer label or package inserts, if

8.4.3.1. Labeling might not applicable

8.4.3.2. It is specified in specific standard

8.4.3.3. It is intended as replacement in a diagnostic system: but adequate information to identify the reagent and to describe its use in the system

8.4.3.4. It is a multiple purpose instrument used for diagnostic purposes and not committed to specific diagnostic purposes or systems except product name, intended use, bibliography, name and place of business of the manufacturer, packer, or distributor, date of issuance of the last labeling revision by the firm.

8.5. Thailand had "Medical Device Act, 1988".[38] The control institute was Medical Device Control Division of Thai FDA under the Ministry of Public Health.

The section 33 and 34 under chapter V of the above Act indicate about the information and additional requirements in the label and package leaflet of medical device for sale or in possession for sale as following:

Section 33 The medical device for sale or in possession for sale shall have labels bearing the following information in Thai on its container or package:

(1) Name, category and type of the medical device;

(2) Name and premises of the producer or the importer as the case may be. In case of the importer, the name of the producer and the source of production of the medical device must be given;

(3) Content;

(4) The numbers or letters indicating its lot number of production;

(5) The number of the license;

(6) The use of, instruction for us and instruction for storage/maintenance of medical device;

(7) For disposable medical device, the word “for single use” in red must be clearly displayed;

(8) Warnings and precautions for handling the medical device as prescribed by the Minister by publication in the Government Gazette under Section 35(5);

(9) The expiry date of the medical device as prescribed the Minister by publication in the Government Gazette Under Section 35(8);

(10) Other information as prescribed by the Minister by publication in the Government Gazette.

The label may bear information in other languages than Thai but it must correspond with that in Thai and appears in size no bigger than the Thai.

Section 34: The accompanying document that comes with medical device shall bear the information as prescribed in Section 33(6) and (8) in legible print. If the information is in other languages than Thai, there shall also be corresponding Thai statements. The medical device that has the information under Section 33(6) given in it accompanying document may not display that same information in the label.

8.6. GHTF had “Labeling for Medical Devices (including In Vitro Diagnostic Devices)”[62]

CHAPTER III

METHODOLOGY

The research method of this study comprised of 3 phases corresponding to the research objectives. Each phase employed different methods and subjects. They were

Phase I: Problem Identification and Analysis;

Phase II: Development of Labeling Guideline for Home-use IVD; and

Phase III: Validation of Labeling Guideline for Home-use IVD Using HPT Labeling Prototype.

Phase I: Problem Identification and Analysis

This phase was focused on the regulatory requirements determining the quality of the labels and leaflets as well as the problems consumers faced during their uses of such labeling. The problem identification and analysis composed of assessing domestic problem and comparing international regulations.

1. Domestic problem assessment

Problems were evaluated on home pregnancy test kits (HPT) labeling quality using both indirect method by content analysis and direct method by consumer testing. The samples and sampling recruitment of both methods were the same.

1.1. The samples and sampling recruitment of HPT labeling based on their availability and accessibility

Only products accessible by consumers or those that could be acquired by consumers through retail pharmacies and supermarkets were selected as samples for this study. From the survey on the HPT products available in Thai market, there were more imported found than the locally manufactured products. It was discovered that there were some imported HPT products presented by different brand names available through the same distributor, but having the same appearances of inner package and

inner label. These findings were consistent with the result from the in-depth interview of the distributors who provided repacking services for some imported products. It was quite common practice among importers to repack one product into several brand names. Moreover, the information from Thai FDA revealed that there were 38 imported HPT brands from 23 importers. Among these imported products, there was only one available through retailed channel under the same imported brand name. Most of the products in the market were those repacked and named differently.

The researcher could acquire 26 HPT products through retail pharmacies and supermarkets across countries (e.g. Bangkok, Nakornprathom, Cholburi, Chacherngsoa, Prajeanburi, Chiangmai, Prajuabkirikhan, Sonkhanakarin, Nakornrajaseema, and Nakornpranom). Six products were discarded due to the same format and contents of package leaflets. For example, the package leaflet of brand G and brand N used the same package insert and a little difference on their outer label. The rests were 12 brands for imported HPTs and 8 brands for locally manufactured. Finally, the selected HPTs included 9 dipping type, 11 card type.

The details of accessible and selected HPT brands with dipping, and card type for this study were shown in Appendix A. Table 3.1 showed the distribution of accessible HPT samples across types, sources, and brands; and table 3.2 illustrated the distribution of HPT kits for content analysis and consumers testing across types, sources, and brands in Phase I.

Table 3.1: Types, sources, and brands of accessible HPTs from Thai market

Types / **Sources**	**dipping** (HPT brand)	**card** (HPT brand)	**midstream** (HPT brand)	**total**
locally manufactured	5 (B, F, U, V, I)	5 (C, D, E ,R, X)	0	10
Imported	5 (H, L, Z, W, S)	10 (A, O, J, Q, M, T, Y, G, N, P)	1 K	16
total	10	15	1	**26**

Brand E, G, J, P, I were discarded due to same distributors and/or manufacturer and/or document characteristics. Brand K which was the only accessible midstream type was also discarded. The 20 selected HPT brands were in Table 3.2

Table 3.2: Types, sources, and brands of HPTs for content analysis and consumer testing

Types / **Sources**	dipping (HPT brand)	card (HPT brand)	**total**
locally manufactured	4 (B, F, U, V)	4 (C, D, R, X)	8
Imported	5 (H, L, S, W, Z)	7 (A, M, N, O, P, Q, Y)	12
total	**9**	**11**	**20**

1.2. The methods used in assessment

Problems on labeling were qualitatively identified by content analysis and quantitatively confirmed by consumer testing.

1.2.1. Indirect method using content analysis

Content analysis was performed by researcher focused on problem analysis of document characteristics. This method served as the general screening of the labeling quality of home pregnancy test (HPT) kits. The criteria used for problem assessment was based upon standards, regulations, and recommendations from several sources e.g. Medical Device Act 1988[38], Guidance for the preparation of 510(k) Submissions: Points to Consider Regarding Labeling and Premarket Submissions for Home-Use In Vitro Diagnostic Devices[65], "Labeling Requirement – In Vitro Diagnostic Devices IVD"[77] and Guidance for OTC Human Chorionic Gonadotropin (hCG) of U.S.F.D.A[78], and suggestions from some reviewed literatures.[10, 30, 67, 75] The 20 selected samples of labeling were screened and analyzed by comparing their weaknesses on 3 aspects of document characteristics including design quality, contents/utility, and comprehensibility. The weakness would include the non-achievable criteria. The details were as following

1.2.1.1. Design quality

It included the print size, print quality, line spacing, information sequencing, and others e.g. line length, information clearness, attractiveness, drawing quality, etc. The examples of some criteria were as following

(1) print size:

The minimum 10 and 12 points of English type font were recommended[10, 30] basing on its type. The 12 points of Thai print is nearly the same size as the English print with 10 points. The 12 points of simple type Thai prints was suggested for Thai contents.[75] The minimum of 12 points[75] with Thai legible print size[38] was used as criteria and as the smallest comparative print size for other languages in this study.

Beside the print size, the print type was also related to its legibility. Therefore, the pattern of the print types and their various print sizes (Appendix B) were listed as the reference for determination of the print types and sizes of the existing HPT products labeling.

(2) print quality, line spacing, information sequencing, and others:

Dark prints on the colorless background; not too small or large line spacing; proper information ordering; and the attractive, beautiful, tender figure[75] were also used to be criteria in consideration of the labeling design quality.

1.2.1.2. Utility/ Content

The quality of content information was assessed against labeling requirements in section 33, 34 of Thai Medical Device Act 1988[38]; and "Labeling Requirement – In Vitro Diagnostic Devices IVD"[77] of U.S.A. including U.S. Guidance for Over-the-Counter (OTC) Human Chorionic Gonadotropin (hCG) 510(k)s.[78] According to such regulations and CRIA of Australia[67]; there were lists of needed contents to be available on the outer label at the point of sale for helping the consumers to identify and select the product, and later at the point of use through out the life of product. Moreover, the details in Thai labeling must correspond with those in the other language in content.[38]

(1) Consumer buying decision information was as product name, product type/category, pack size, intended use, lot number, manufacturing date, expiry date, manufacturer, importer, distributor and address; and claims for performance with services;

(2) Product utilization information was as product storage; precautions; contraindications/ limitations; components supplied; possibility to get false positive and negative results; urine collection and storage; testing method: dipping time length, amount of urine dropping, result reading time (waiting time, least time, and maximum reading time); result interpretation and drawing of positive, negative, and invalid result reading; claims for performance; source of further information; etc.

(3) Consumer education information was as introduction and test principles, revision date, etc.

Quality of contents was considered based on their presence, accuracy and up-to-date, sufficiency, and completeness of information directly and indirectly provided in HPT labels and leaflets as well as inner labels for the novice users.

1.2.1.3. Comprehensibility

The quality of language on labeling was evaluated by the readability or difficulty level needed to read and understand such labeling information using the Gunning's Fog Index.[69] This index is generally used in determining difficulty level of English and several languages in the European countries. However, there was a

research study that had applied this index for Thai language.[26] The difficulty level of the text calculated by such Readability formula could help in considering the language quality of the labeling. The recommended educational level that needed to read and understand by the lay users was no exceeding grade level 6 which was the former required minimum educational level for Thai people.

1.2.2. Direct method using consumer testing

Problems identification of the 20 sampled labels and leaflets (see table 3.2) by consumer testing was performed using Diagnostic Testing.[16, 30, 67] Such testing technique was applied in this phase as monitoring stage to determine the performance of the HPTs' labeling. The purposes of the test were to locate problems on labeling including user comprehensibility, quality as well as opinions on labeling. The comprehensibility was measured by the multiplication of the difficulty in finding the requested information and whether the provided information/ answer were correct. Behavioral observation with video recording, questionnaire, and interview were the techniques used for data collection.

1.2.2.1. Recruitment of participants

Subjects recruited for Diagnostic Testing could be summarized as following

(1) The 90 participants were in several groups of lay persons, 44% were students, 17% were employees, 20% were private officers, 9% were government workers, 2% were owners of small business, 3% were housewives, and the rest 4% were mixed of any other occupations.

(2) All of them had no experiences in using HPT kit to prevent bias from their previous knowledge.

(3) The people most likely to have problems with the design or the people at risk of misusing the product were suggested to be chosen as our samples.[67] There were 90 lay women with 15-49 years old recruited for this study. The participants included in this phase had the characteristics as recommended and represented the target users of HPT kit.[67] The single woman was the preferred group of subjects to avoid the prior experience in using HPT products. The other reason was that the single women were likely to use this product than the married ones, and the likelihood to use was inverse proportion to income.[79] Therefore, the novice lay users of HPT with lower income group and quite low education were most recruited to get the best representation. The details in their age range and background were shown in table 3.3.

Table 3.3: Description in age range of participants (Phase I)

Age range (years old) / **No. of lay users** % (f)	15-24 students & young generations	25-39 working	40-49 presbyopia	Total % (f)
Total (90 lays)	62% (56)	29% (26)	9% (8)	100% (90)

The recruited subjects comprised two-third (56 lays or 62%) as students and young generation with age range of 15-24 years old. There were 29% of lay participants in general working age range (25-39 years old) and 9% were in the group of HPT users with possible farsightedness (40-49 years old). The tendency of more students and young generation using HPT products was consistent with the trend in U.S.A. as users being between 15-17 years old.[79] It was also found from a research study in Thailand of 1,435 women with miscarriage condition that the miscarriage rate in Thailand was 61.3% in women less than 25 years old and 29.3% less than 20 years old. Out of these miscarriage women, 24.7% were students.[80] The Ministry of Public Health also revealed that it has been found that 16% of all pregnant women in Thailand were less than 20 years old.[80]

The age range of participants in this study served the coverage of all users of home-used IVD test kits, not only the people with 15-49 years old. According to Tom Lichty; the people over 40 years old often suffered from presbyopia which causes trouble in the small type reading.[81]

(4) The education level of these participants was not less than Grade Level 4 to ensure the coverage of present users' population of HPT kits. However, the document needing educational grade level higher than 12 was considered as the difficult readability level.[69] The detail in their education was illustrated in table 3.4.

Table 3.4: Description in education level of participants (Phase I)

education level / **no. lay user**	**≤ grade 12**			**> grade 12**			
	< 2nd school	< high school	high school	diploma	during bachelor studying	bachelor	master
Total % (f) (90 lay users)	2% (2)	8% (7)	29% (26)	2% (2)	34% (30)	22% (20)	3% (3)
	39% (35)			61% (55)			
	75% (67)					25% (23)	
	100% (90)						

Table 3.4 illustrated profiles of participants' education. Most of them were taking courses in vocational school and staying in the dormitory near their institutes. Some were students in secondary and high school. For the other young generation, some were employees and some were housewives.

1.2.2.2. Materials/instruments

A set of questionnaires constructed for this testing (Appendix C) was composed of questions adapted from the recommendation by the Diagnostic Testing of Australia and the Consumer Information Rating Form (CIRF) proposed by U.S.F.D.A.[25, 30, 67] The draft of questionnaire was commented by some relevance experts and pre-tested with lay consumers.

The questionnaires consisted of 3 sections

(1) Section 1 contained 29 questions to detect the ability of individual lay user on information finding and right answering, and the labeling quality of HPTs. The evaluated details and their scoring were as following

- **The content tested for users' comprehensibility were:**

- users' buying decision (at the point of sale): product name, pack size, intended use, manufacturing date, expiry date, manufacturer, distributor;

- product utilization (at the point of use): product storage, precautions, contraindications, components supplied, urine collection and storage, testing method (dipping time length, amount of urine dropping, result reading time (waiting time, least and maximum reading time), result reading and drawing (positive, negative, and invalid), false positive and negative results possibility, source of further information, and the test limitations.

- **The scoring**

- The difficulty level in locating information was measured by 3 point Likert's scale with "0" representing "unable to locate", "1" for "hard to locate", and "2" for easily locate". For the consumers' ability in giving the right answer to specific questions related to contents on labels and leaflets, the score of "1' represented "correct answer" and "0' for "incorrect answer". The average percentage of score for each item was rendered in the evaluation of this part of study.

- The concept of passing criterion score from the diagnostic testing was adapted. The multiplication of locating information score and correct answer score was calculated. The cut-off point for passing score was ≥ 81% deriving from multiplying 90% of locating information score and 90% of correct answer score.

The formula in calculating the score of individual consumer competency and information quality was as follow:

Formula: Score = (% of information finding ability) x (% of correct answers)
The passing score must be at least 81% [67]

(2) Section 2 contained 18 questions to view the perceptions of lay users on

- **Overall design quality:** print size, print quality, lines spacing, information organization, line length, attractiveness, information clearness, and benefits of illustrations;
- **Utility:** "how complete and sufficient information were provided for users' buying decision and product utilization", and "how valuable and reliable the information would be for the novice users";
- **Comprehensibility:** how easy or hard of information on labeling is to be located, read, understood, and remembered". The issue of labeling keeping for future reference was not included because HPT was the single use product. The comprehensibility was also detected by the users' ability to use the product correctly and properly.

These perception aspects were measured by 3 point Likert's Scale with "0" for "poor", "1" for "fair, and "2' for "good" quality. The mean score was used in comparison of results in perceptions.

(3) Section 3 contained 6 general questions to determine

- the people's expectations of information they might look for on the label to discover whether any tasks outside our agreed performance (spot missed tasks or consumer priorities),
- the first impression of the package both before and after testing for valuable insight into the labeling performance, and
- opinions about further insights on labeling information, comments on the look and feeling, and final comments on the packaging.

1.2.2.3. Procedure

(1) The Diagnostic Testing and individual interview included

- asking lay users to carry out the tasks they would normally carry out when using the information;
- observing and recording detail of what they do;
- probing to find out whether they could properly interpret and use the information they had read; and

- recording anything they said; either about particular tasks they were undertaking or the information in general, and their perceptions in design quality, contents/utility, and comprehensibility.

(2) The consumers started the Diagnostic Testing by reading the assigned labels and leaflet, followed with using HPT and answering the questionnaire. These processes were under the researcher observation and detail actions were recorded.[16, 19, 67] It was conducted on individual basis in a normal and non-testing environment for 30-35 minutes. In addition, 10-15 minutes of individual interview was followed to probe for interpretation, perception, understanding, and some additional needed information which would be useful inputs for labeling guideline developing in the next phase. The individual interview process was conducted more intensively for those with low quality evaluated by content analysis.

2. International regulations comparison

The **content analysis** was used to review, compare, and analyze the labeling regulations from 5 different countries and 1 international organization. The literature review on the important principles provided the optimal regulatory information to be included in the developed guideline. Not only the regulations from different countries but other literatures e.g. research papers, reports, etc. about home-use in-vitro diagnostic (IVD) test kits labeling were also reviewed.

For regulation comparisons, countries to be studied were purposively selected including Thailand, GHTF, and 4 other countries e.g. Australia, Canada, EU, and USA which were GHTF originators. These 4 countries had their own specific guidelines on IVD labeling. The sources of literatures were from related published documents, several journals and many search engines. However, the information from other Asian countries were not included in this study due to no specific criteria for In-vitro Diagnostic test kit[37] and the difficulty of accessibility on their regulations.

The regulations used in comparison of each country were in following table.

Table 3.5: Laws/ regulations used in labeling comparison of Home-use IVD

No.	country	Laws/regulations
1	Thailand	Medical Device Act 1988 (Section 33, 34)[38]
2	Australia	In vitro Diagnostic Goods for Home-use – Guidelines for Sponsors: June 2003 (Labeling of Home-use IVDs)[32] basing on • Therapeutic Goods Act 1989 • Australian Medical Device Requirements-Version 4, May 1998
3	EU	• EN 376: 2002 (Information supplied by the manufacturer with in vitro diagnostic reagents for self-testing) • EN 592: 2002 (Instructions for use for in vitro diagnostic instruments for self-testing) These regulations issued basing on the Directive 98/79/EC of the European Parliament and of the Council of 27 October 1998 on in vitro diagnostic medical devices[13]
4	U.S.A.	The following regulations and requirements were basing on "The Federal Food, Drug & Cosmetic (FFD&C) Act"; the Safe Medical Devices Act (SMDA) of 1992, the Medical Device Amendments of 1992 and the FDA Modernization of Act of 1997 (FDAMA).[82] • Code of Federal Regulations Title 21, Chapter I, Subchapter H-- Medical Devices, volume 8 [Revised as of April 1, 2005] • 21 CFR Part 801 (Subpart C) (Labeling Requirements for over-the-counter devices) • 21 CFR Part 809 In vitro Diagnostic Products For Human Use (Subpart B, section 809.10) (Labeling for In-vitro Diagnostic Products) • In Vitro Diagnostic Devices: Guidance for the Preparation of 510(k) Submissions (1997) (Appendix C – Points to consider regarding labeling and premarket submissions for Home-use In-vitro Diagnostic devices)[65] • Labeling Requirements – In vitro Diagnostic Devices (2000)[77] • Guidance for Over-the-Counter (OTC) Human Chorionic Gonadotropin (hCG) 510(k)s, July 22, 2002[78] • Guidance on Medical Device Patient Labeling; Final Guidance for Industry and FDA Reviewers (2001)[18]
5	Canada	• Food and Drugs Act: Medical Devices Regulations (1998): Labeling Requirements Section 21, 22 (devices sold to public), 23 (language)[14] • Guidance for the labeling of In vitro Diagnostic Devices[55]
6	GHTF	Labeling for Medical Devices (2005)[62]

<u>Phase II</u>: Development of Labeling Guideline for Home-use In-Vitro Diagnostic Test Kit

The main purpose of this phase is to develop the Guideline for home-use IVD. In order to facilitate the validation study in phase III, the labeling prototype was also developed following the recommendation of this Guideline. The Phase II study was thus composed of 2 parts: guideline development and labeling prototype development.

1. Guideline development

The following steps were taken for IVD Guideline development: the information gathering, analysis, synthesis, arrangement, writing, and review. The results from researcher's analysis, consumers' test of existing HPT labeling, regulation comparisons, and the reviewing of relevance literatures were included to be the informative resources for the development of this guideline and its labeling prototype for Thai consumers. After going through the analysis, labeling Guideline for home-use IVD test kits was then developed and reviewed by experts. This guideline was intended to be implemented by the manufacturers/ importers and authorized regulatory reviewers.

1.1. Information sources

Input for guideline development was from 3 sources:

1.1.1. Domestic problem assessment

1.1.1.1. Problem assessment of existing labeling using content analysis

1.1.1.2. Lay consumers' Diagnostic testing of phase I

1.1.2. International regulations comparison

Review and compare regulations from 1 international institute (GHTF) and 5 countries using content analysis were conducted by the researcher.

1.1.3. Relevance literature review

The related information from literatures review in chapter II was also included to be the sources of the guideline development.

1.2. Aspects of Guideline formulation

The Guideline was formulated based on the recommendation on document factors in the conceptual framework which comprised 3 aspects. The details of each aspect were already clarified in chapter II. They were as follows:

1.2.1. Design quality: e.g. layout/format, legibility/print, illustrations/graphics, etc.

1.2.2. Utility: content of home-use in-vitro diagnostic test kit

1.2.3. Comprehensibility: readability level of labeling and language used in content

However, the idea in 1996 Action Plan of USFDA[30] were drawn to the attention of researcher in rendering the concepts of judgment and consultation for the evaluation of the existing popular home-use IVD labeling in Thailand and for the optimal provision of such product labeling.

1.3. Experts review

Composition of experts' panel for reviewing the formulated Guideline included 5 medical technologists. All experts had a minimum of 15 years experiences. They were 2 academia authorized as external experts and 3 as entrepreneur' representatives (1 experiencing in a large local manufacturer, and 2 experiencing in importing company of home-use IVDs).

2. Labeling prototype development

The labeling prototype was developed as an example following the guideline. It would serve as a validation tool for the developed guideline. According to Health Research System Institution (HSRI), the communicated health material should be clear and sufficient to lay users due to its effects on lay understand and self health care.[83] The labeling should be easy to access and understanding as well as not be too technical.[84] Hence, the content and format of the developed Home-Pregnancy Test kit labeling prototype were designed to be self sufficient and clearly displayed with plain language.

<u>Phase III</u>: Validation of Labeling Guideline for Home-use In-Vitro Diagnostic Test Kit Using HPT Labeling Prototype

The purpose of this phase was to ensure the accuracy and lay understanding as well as broader application of the developed guideline on labeling of home-use IVD test kits. This validation phase was emphasized on the sufficiency and accuracy of the above documents and their congruence to the developed guideline. Appropriateness and application trial in utilization of such developed guideline were assessed through

HPT labeling prototype by relevance stakeholders including authorized regulatory reviewers, entrepreneurs (manufacturer and importer), and consumers.

To effectively validate this guideline and its application, labeling prototype was developed according to the guideline and was then tested with the targeted consumers. The labeling prototype would serve not only as the validation tool for this study, the final corrected version could also present as the good example of HPT leaflet and label.

Phase III comprised 4 parts including expert review, consumer testing, policy maker interview, and final revision.

1. Experts and stakeholders review

The developed labeling prototype of home-use IVD test kits was examined by 3 groups of relevance experts including the technical and regulatory content experts, linguistic or language experts, and design/document presentation characteristics experts. All of them were purposively selected to review the accuracy and appropriateness of the above documents as well as their congruence to the developed guideline. They provided insights and comments with suggestions for improving the documents. The peer reviews and individual interviews of experts in content, language and design of guideline on labeling of home-use IVD test kits were the tools rendered to obtain their comments. Then the researcher modified the developed documents as experts' recommendations for further testing by lay users.

The components of 14 expert panels were as follows:

1.1. Experts in technical and regulatory content

The labeling prototype was reviewed by 9 experts as following:

1.1.1. A physician specialized in Obstetrics and Gynecology from one government hospital

1.1.2. Five Medical Technologists

1.1.2.1. Two instructors from the Medical Faculty belonging to the government academic institutes

1.1.2.2. Three entrepreneurs from both relevant local and international companies who experiencing in IVD products registration and marketing.

1.1.3. Three regulators from Thai FDA

They were the pharmacists working in Medical Device Control Division more than 15 years.

1.2. Linguistic or language experts

Three experts on linguistic or Thai language comprised

1.2.1. Two from academic institutes and

1.2.2. One from the Royal Institute of Thailand.

1.3. Experts in document presentation characteristics

The 2 experts on the design and layout consisted of

1.3.1. one from pharmaceutical company and

1.3.2. one from printing company.

2. Diagnostic testing of HPT labeling prototype by consumers

The samples, sampling selection, method and other conditions were similar to the Diagnostic Testing in Phase I. According to Wilson FL and Williams BN[68], the materials should be tested with potential readers early in the development phase to determine if the information is comprehended. Osborne also suggested that testing materials used focus groups or simple feedback from 10-20 patients before use.[68]

The developed labeling was evaluated by 44 consumers using the Diagnostic Testing. The qualification of participated consumers and details in performing such test were the same as the Diagnostic Testing in phase I. There were 2 rounds of consumer testing in this phase. The Diagnostic Testing was conducted with 22 lay

persons per round. The suitability of the tested document was judged by obtaining the minimum of 80% of consumers who could answer the test questions correctly.[16, 67]

The background information of samples/participants including in lay consumers' testing for the evaluation of HPTs' labels and package leaflets in this validation phase were as follows:

- The 44 participants were in several groups of lay persons. The samples participating in this study were students [27%], daily employee [41%] and employee in the private offices [23%], government workers [4.5%], and owners of small business [4.5%].
- All of them had no experiences in using HPT kit to prevent bias from their previous knowledge.
- Their ages were in the reproductive age range (15-49 years old) which served the coverage of users of home-used IVD test kits. In this phase, there were 28 subjects with age range 15-24 represented young generation, 12 subjects in the age range of working people (25-39 years old), and 4 samples in the group of people with possible farsightedness (40-49 years old).

Table 3.6: Description in age range of participants in both rounds (Phase III)

Age range (year old) / **no. lay users** % (f)	**15-24 students & young generations**	**25-39 working**	**40-49 presbyopia**	**total** % (f)
1st round (22 lays)	72% (16)	14% (3)	14% (3)	50% (22)
2nd round (22 lays)	54% (12)	41% (9)	5% (1)	50% (22)
Total (44 lays)	**28 (64%)**	**12 (27%)**	**4 (9%)**	**100% (44)**

The education level of these participants was not less than Grade Level 4 to ensure the coverage of present users' population of HPT kits. Such education level was the former minimum requirement by Thai Government.

Table 3.7: Description in education level of participants in both rounds (Phase III)

education level / **no. lay user**	**≤ grade 12**			**> grade 12**		
	< 2nd school	< high school	high school	diploma	during bachelor studying	bachelor
1st round % (f) (22 lays)	45% (10)	0	14% (3)	0	41% (9)	0
2nd round % (f) (22 lays)	18% (4)	9% (2)	14% (3)	27% (6)	5% (1)	27% (6)
total % (f) (44 lays)	32% (14)	4% (2)	14% (6)	14% (6)	22% (10)	14% (6)
	50% (22)			50% (22)		
	86% (38)					14% (6)
	100% (44)					

It was noticeable that, the participants or consumers in this test were consistent with those in the 1st phase and the trend of situation in HPT kit utilization in Thailand as specified in the former part. About a half (50%) of their education level were Grade 12 or lower which were considered having a risk to comprehend in HPT labeling. Moreover, the amount of the participants with lower than Bachelor Degree in this phase were 38 (86%) which were more than the % amount in the 1st phase [67 (75%)]. Consequently, the group of participants rendered in this phase coincided with the recommendation of CRIA in Australia.(67)

3. Thai FDA decision makers using interview

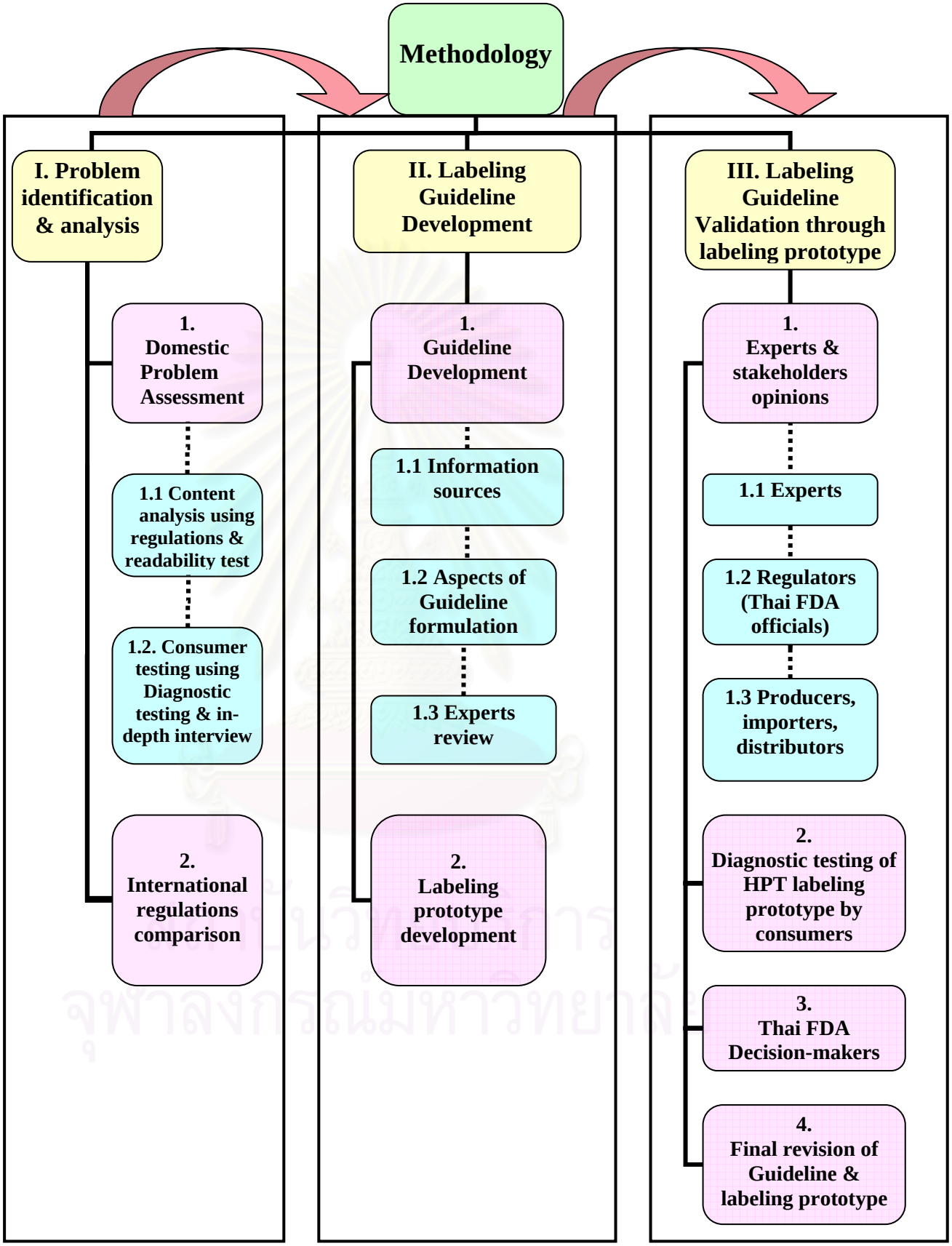
Thai FDA decision makers, the Director of Medical Device Control Division (MDCD), and the Head of responsible sector in MDCD were individual interviewed. Their comments and considerations in implementation of such developed guideline were integrated into the final revision to ensure practical implementation.

4. Final revision of labeling Guideline and HPT labeling prototype

The results from the above assessment were used to finalize the labeling prototype and the guideline in content, language, and document design. This helped to confirm the appropriateness of developed guideline and the labeling prototype of home-use IVD test kits. They could be used as the references and examples for future development by the manufacturers. Developed documents guideline and labeling prototype could then adequately reflect the consumers' expectation.

The final version of the developed guideline and the labeling prototype of home-use IVD test kits would be proposed to Thai FDA for further policy decision to issue the law or notification for regulating the labeling of home-use IVD test kits in Thailand. Such compulsory requirement would hopefully lessen the problem in document factors on the labeling quality. Consequently, this proposed guideline and labeling prototype was expected to facilitate the implementation by both experts and entrepreneurs to enhance more consumer protection in Thailand.

Figure 3.1 Methodology Framework



CHAPTER IV

RESULTS ON DOMESTIC PROBLEM ASSESSMENT AND INTERNATIONAL REGULATIONS COMPARISON

The results of phase I composed of 2 parts. The 1st part was on domestic problem assessment (problem identification and analysis) which were divided into content analysis and consumer testing of existing HPTs labeling using Diagnostic testing. The 2nd part was on international regulations comparison of labeling guideline for home-use in-vitro diagnostic (IVD) test kits. These 2 parts were as follows.

***Part 1*: Results on Domestic Problem Identification and Analysis**

1. Content analysis of existing HPT labeling

The sampling HPTs were composed of 9 dipping type and 11 card type. They were 8 locally produced products; and 12 imported ones. All of the sampled HPTs were studied and analysed based on document characteristics to find out some problematic issues. This part of analysis involved design quality e.g. print size and quality (legible prints), information sequencing, printing and drawing quality, etc.; contents/utility; and comprehensibility e.g. Readability, how easy/hard to read and understand the information, etc.

1.1. Problem analysis on existing HPT labeling quality

1.1.1. Design quality

It composed of print size, drawings, information sequencing, print quality, etc. Some details of noticeable issues were as follows:

1.1.1.1. Print size

(1) Comparing to print size criteria

According to introduction to print media[75], Thai print size is minimum 12 points of dark prints on the colorless background were required. The problems of print size were common to be found in most of existing HPT labeling in this analysis. The

details of print size and font of 20 HPT brands were illustrated in Appendix B. However, the font types found were Angsana New (5), Cordia New (5), Browallia UPC (5), Freesia UPC (3), and Tahoma (2). Most of such print fonts have nearly the same appearance except "Tahoma" that has much bigger than the other font types for the same point. For example, 8 and 9.5 points "Tahoma" respectively had the same size as 12 and 13.5 points "Cordia New, Cordia UPC, Angsana New, Browallia UPC, and Freesia UPC".

(2) Comparing to English contents

Thai labeling contents for the same issue had quite high rate in providing smaller prints than those in the other language[38] as following

- **For product names**, all of Thai names were smaller than the English ones but some HPTs had problematic issues as described in the above table.
- **For the other contents**, smaller print sizes in Thai labeling comparing to English version and too small with pale Thai print size were found.

As observation, some HPT products particularly the imported ones avoided this violation by not providing any English labeling version.

1.1.1.2. Drawing quality

Over half of HPT products labeling got the problems on poor drawings of the test results.

1.1.1.3. Drawing and information sequencing

Drawings were far from texts explaining result reading of some HPTs.

1.1.1.4. Print quality and others (e.g. heading, print font and colour, information sequencing, line spacing, etc.)

The problems found were on the colour choices, such as pale/dark print on light/dark background of label, leaflet or both of them. Some word spacing, printing over bar codes, very fade print on titles, and some alphabet types caused difficulties in reading. About 65% of HPT labeling had the above problems and half of these problematic ones had poor print quality on the label. These labeling problems were found on the important contents e.g. intended use, lot number/manufacturing date and expiry date, etc.

Table 4.1: Conclusion of noticeable issues on design quality of existing HPT labeling

No.	Title	%	noticeable or problematic issues
1	print size		
1.1	compare to print size criteria	70	14/20 HPTs had general contents ≤12 points or 8 points Tahoma (A, B, D, F, M, N, O, P, Q, U, V, W, X, Z)
1.2	compare to English		
(1)	product name	100 65 15 15 10	• All HPTs had smaller Thai prints than English. • 13/20 (A, B, C, D, F, M, N, P, R, S, U, X, Y) had much smaller prints than English. • 3/20 (Q, V, Z) had no Thai name anywhere. • 3/20 (A, M, R) had too small & pale Thai print. • 2/20 (D, M) had design hard to be read
(2)	other contents	65 10	• 13/20 (A, B, C, D, H, M, O, P, U, V, W, X, Z) had smaller prints than English. • 2/20 (M, V) had too small pale Thai print.
2	drawings quality	55	11/20 (B, C, F, H, L, M, O, P, Q, V, Z) had very small & pale drawing of the test results.
3	drawing and information sequencing	10	2/20 (D, X) had drawings of result reading far from texts.
4	print quality and others	65 5 5	• 13/20 (A, B, C, F, H, M, N, P, Q, S, V, Y, Z) had pale, same color of print & background, improper word spacing, printing over bar code, some unfit alphabet types, etc. • M had reflective color of prints. • V had print color of outer label came off with covered plastic during opening the packaging.

1.1.2. Utility/ Content

The contents were classified as the information for consumer buying decision (or at the point of sale) and for the consumer utilization (or at the point of use) as recommended by CRIA of Australia[67] as well as the information for consumer education. The distinct problems were found on no labeling of some necessary details. The other issues were found on information location and sequencing, inconsistency in labeling contents, various claims in same issue, over claimed and some misleading for product sources with performances, etc. The detailed results were as follows:

1.1.2.1. Amount of information comparing to other language

According to Thai regulation, the details in Thai labeling (outer and inner label as well as package leaflet) must correspond with those in the other language in content.[38] The amount of details in labeling would be shown separately as following.

Table 4.2: Amount of information on existing HPT labeling in Thai language

No.	Title	%	noticeable or problematic issues
1	Outer label	25	5/20 < English version (A, M, P, U, Z)
2	Package leaflet	45	9/20 < English version (A, H, M, N, P, Q, U, Y, Z)
3	Inner label/foil	30	6/20 only in English (M, N, Q, S, V, Y)

1.1.2.2. Information for consumer buying decision

The contents at the point of sale in the following table as recommended by Medical Device Act 1988 of Thailand[38] and USFDA Guidelines[77, 78] were selected to be analyzed on existing HPTs as information for consumer buying decision.

Table 4.3: Conclusion of noticeable issues on buying decision information of existing HPT labeling

No.	Title	%	noticeable or problematic issues
1	product name (Thai trade name and generic name)	15 20 55 5 5 5	1. location: • 3/20 HPTs had no Thai name (brand Q, V, Z) • 4/20 HPTs had neither Thai nor English on immediate label (brand A, M, N, Q) • 11/20 HPTs were not in the front/main part of outer label and/or leaflet (brand A, F, H, L, M, O, P, Q, V, W, Z) • generic name following trade name, make conflict to Thai language principle (brand H) 2. different trade names • in 1 leaflet (brand N with discarded brand G) • between label & leaflet of same HPT (brand S)
2	product type and category	90	18/20 HPTs were indirectly specified by their product names and drawings describing testing method with possible results (brand A, B, C, D, F, H, L, M, N, O, P, R, S, V, W, X, Y, Z) [NB] 2 indicated ones were brand Q and U.
3	amount/pack	65 5	1. 13/20 HPTs was non-indicated. • 8 (brand B, F, H, L, S, V, W, Z) were dipping type • 5 (brand O, P, Q, R, Y) were card type [NB] most were imported ones 2. 1/20 HPT (brand M) had too small & pale prints
4	intended use	0	All HPTs labeling indirectly indicated this issue without any heading because their common name (e.g. “Home pregnancy test”) and some parts of trade names (e.g. “..Pregtest”, “Preg..”, etc.) could communicate to it intended use.
5	lot number/ manufacturing date in Thai	50 45 10 5	1. Non-indicated HPTs (10/20) of lot number were brand F, H, O, P, Q, S, U, V, W, and Y. 2. Thai heading was “manufacturing date” but details was in English content or numeric style • 4/20 HPTs had on outer label (brand A, M, N, R) • 4/20 HPTs had on inner label (brand C, L, X, D) • 1/20 HPTs had on outer and inner label (brand B) 3. different lot numbers (brand Q) or different style in specifying lot numbers (brand Z) between outer and inner label (foil) of the same HPT 4.a HPT (brand N) had the same pack insert, lot number, and expiry date with the discarded one (brand G) [NB] higher possibility in Thai labeling for the locally produced HPTs (5/8) than the imported ones (5/12)
6	expiry date in Thai	50 40 10	1. non-indicated anywhere (10/20 HPTs) • 6/9 dipping type (brand F, H, S, U, V, W) • 4/11 card type (brand O, P, Q, Y) 2. 8/10 HPTs indicated with Thai heading but in English details (brand A, B, C, D, L, N, R, X) [NB] 2 HPTs indicated both heading and details in Thai (brand M, Z)
7	Responsible organizations		

No.	Title	%	noticeable or problematic issues
7.1	manufacturer	50 10 5 10 15 5	• 10/20 non-indicated HPTs anywhere (brand F, L, N, O, P, Q, R, S, U, W) • 2/20 non-indicated on outer & inner label (brand D, V) • different between its labels (outer and inner) and leaflet (brand M) • 2/20 HPTs (brand N, Q) had the same totally appearance of immediate containers (foil) and style of lot number but claimed for different country of origin (U.S.A. and Canada) • 3/20 HPTs (brand N, Q, S) labeled for foreign companies without any heading as "manufacturer" • some cited the name of manufacturer (foreign company) of raw material used (brand W)
7.2	address of manufacturer	55 15	• 11/20 HPTs were non-indicated (brand F, L, N, O, P, Q, R, S, U, V, W) • 3/20 HPTs indicated only country (A, M, Z)
7.3	importer	45	9/20 of all HPTs or most of imported HPTs (9/12) (brand P, M, L, O, S, Y, N, Q, Z) except 3 HPTs (brand A, H, W), did not indicate this issue; but some showed the names of foreign companies without any indication of importer.
7.4	distributor	10 15 5	• non-indicated anywhere (2/20 HPTs) (brand U, Z) • non-indicated on outer & inner label (3/20 HPTs) (brand D, Q, V) • different distributors between its label and leaflet (brand X).
8	claimed for performance & source	30 95	• several Quality System standards were labeled in 6/20 HPTs (brand B, D, F, L, W, X) • all HPTs except brand D had several claims for selling points (e.g. fast result, easily use, precise/accurate/sure, etc.) (brand A, B, C, F, H, L, M, N, O, P, Q, R, S, U, V, W, X, Y, Z)

Some details of problematic issues were identified as follows:

(1) Lot number/manufacturing date and expiry dates

• The indication of different lot numbers between label and foil of the same HPT e.g. 1108405 and 11084C5, 1205405 and 12054C5, 03175MM and 03175MN, etc.

• Different styles of lot numbers in each manufacturing of the same HPT product were such as 12294c5 and 2005319, 5050197 and hCG 5050197, etc.

• All HPTs indicated the details of expiry dates in English abbreviations/numeric number and year in A.D. Nearly half cited in Thai title but English contents and most of them were produced by local manufacturer in Thailand. Only 2 HPTs indicated both heading and details in Thai.

• All expiry dates and lot number/manufacturing were found to be indicated together at the same places on the outer label and some in inner label.

(2) Responsible organizations

The noticeable problems were found about half of non-indicated HPTs under the titles of "manufacturer" and "importer", but a small number of distributors.

(3) Claimed for performance & source

Almost locally manufactured HPT products claimed for fast result, easily use, precise/accurate/sure, as respectively. However, the imported ones mostly declared their foreign sources of production (e.g. U.S.A., Canada, Germany, etc.), easily use, and several Quality System standards (Q.S. Standard).

1.1.2.3. Information for product utilization

The details at the point of use in the following table could be presented in package leaflet due to their longer explanation that needed more spacing to labeling and their direct benefits to product utilization after the consumer's buying decisions. The result details were as follows.

Table 4.4: Conclusion of noticeable issues on product utilization information of existing HPT labeling

No.	Title	%	noticeable or problematic issues
1	product storage	25 25 25 5 10	• 5/20 non-indicated HPTs anywhere in Thai (Card type; brand O, P, Q, R; Dipping type: V) • 5/20 HPTs declared storage in varied details in the same HPTs (brand B, N, S, Y, X) • 5/20 HPTs indicated room temperature (2-30°C, 4-30°C, 2-35°C) conflict to real situation or climate in Thailand (brand N, S, U, W, Z) • 1/20 HPT had wrong conversions from degree Celsius to Fahrenheit (brand N) • 2/20 HPTs had too small pale prints on outer label (brand M, S)
2	precautions		
2.1	no specific heading	10	2/20 HPTs (brand C, V)
2.2	read to understand before testing (and/or follow direction strictly)	25	5/20 HPTs were non-indicated (brand H, N, P, V, Y)
2.3	use before expire	75	15/20 HPTs were non-indicated HPTs (brand A, B, D, F, L, M, O, Q, S, U, V, W, X, Y, Z)
2.4	test at once after foil opening	30	6/20 HPTs were non-indicated (brand H, N, P, Q, S, V)
2.5	do not use wet/damp strip	45	9/20 HPTs or all dipping HPTs (9/9) were non-indicated (brand B, F, H, L, S, U, V, W, Z)
2.6	do not drop urine > or < advice	50	10/20 of all HPTs or most of HPTs with card type (10/11) were non-indicated HPTs (brand A, C, M, N, P, Q, X, D, R, Y)
3	contraindications/ limitations	30	non-indicated HPTs (brand H, P, Q, U, W, Y) [NB] 50% dip, 50% card type
4	possible false errors	45	non-indicated HPTs (brand C, H, N, P, Q, R, S, V, U)
5	components	45	nearly half of HPTs (9/20) were non-indicated HPTs (brand A, H, M, Q, S, V, W, Y, Z)
6	urine collection before testing	20	one-fifth of HPTs (4/20) were non-indicated HPTs (brand C, P, U, W)
7	urine storage and/or keeping	80	16/20 of HPTs were non-indicated HPTs (brand A, B, C, D, F, M, O, P, Q, S, U, V, W, X, Y, Z)
8	testing procedure		
8.1	dipping/ card		
	• dipping type	100	all HPTs with dipping type specified this issue
	• card/dropping type	100	all HPTs with card type specified this issue either all places or

No.	Title	%	noticeable or problematic issues
			both outer label and leaflet
8.2	optimum dipping time length (30 to 60 seconds were the suggested)	5 15 5	• one imported HPT (8/9) was non-indicated HPTs (brand S) • too short dipping time e.g. 3 seconds (brand W), 5-10 seconds (brand H), 20 seconds (brand V) • too long dipping time e.g. 3 minutes (brand Z) [NB] various indicated time in each HPT
8.3	amount of urine dropping	5	various claims in the same HPT (brand N) [NB] various indicated drops of urine claimed in each HPT (4, 3, 5 drops as respectively)
8.4	result reading time		
	• drying/waiting time [NB] 1-5 minutes was recommended[81]	15 5 15	• 3/20 HPTs did not mention (brand M, P, Z) • labeling in varieties as 40 seconds to 4 minutes,1, 3, 5, 1-3, 1-5, 3-5 minutes in both the same and different brands - 1 HPT cited as 40 seconds - 4 minutes (brand Y) - three imported HPTs had various claims in the same HPT (brand A, S, Y) [NB] most imported HPTs (6/20) cited in various ranges from minimum 1 minute to maximum 5 minutes (brand A, H, N, Q, S, W); and all locally produced HPTs (8/20) cited in the range of 3-5 minutes (brand B, C, D, F, R, U, V, X)
	• least time	70	14/20 non-indicated HPTs (brand A, C, H, M, N, P, Q, R, S, U, V, W, Y, Z)
	• maximum time	60	12/20 non-indicated HPTs (brand A, C, H, M, N, P, Q, R, S, V, Y, Z) [NB] varied labeling in different brands (5, 10, 15 minutes)
9	result interpretation		
	• positive	100	all indicated
	• negative	100	all indicated
	• inconclusive/ invalid	25	5/20 non-indicated HPTs (brand A, M, P, Q, V)
	• drawings	5 10 5	• no any label for bands on drawing (brand V) • far from texts explaining results (brand B, F) • disproportion of hand during urine dropping (brand M)
10	claims for product performances		
10.1	analytical sensitivity	20 60 15 5	4/20 non-indicated HPTs were all imported (brand A, P, S, Y) [NB] varied claims of hCG from 20 to > 40 m.I.U./1 ml. urine as - 12/20 HPTs cited hCG 25 m.I.U./ 1 ml. urine (brand B, C, D, F, H, L, N, Q, R, U, V, X) - 3/20 HPTs cited hCG 20 m.I.U./ 1 ml. urine (brand O, M, W) - 1/20 HPTs cited hCG 30 m.I.U./ 1 ml. urine (brand Z)
10.2	diagnostic sensitivity [NB] suggested for at least 1 week after expected menstruation for most accurte[81]	10 5 85	• 2/20 HPTs claimed for 1-3 days before missed period (brand M, Z) • 1/20 claimed for 3 days before expected period and 10 days after conception (brand O) [NB] almost HPTs (17/20) declared as early as the 1st day of missed period (brand A, B, C, D, F, H, L, N, P, Q, R, S, U, V, W, X, Y)
10.3	result accuracy	15 30 30	• 3/20 non-indicated HPTs (brand C, Q, V) • 6/20 of HPTs declared different accuracy in same labeling (e.g. 99, > 99, 99.5, 99.9, > 99.9, 99.99, etc.) (brand F, M, N, S, W, Z) • 6/20 be considered as over claimed for all the claimed accuracy of more than >99% (brand A, F, M, N, S, Z) [should never be exceed >99%][75]
11	source of further information	45	9/20 non-indicated HPTs (brand C, F, H, N, P, Q, U, V, W)
12	problematic HPTs		brand V and M were the 2 worst HPTs

Some further results about product utilization information were as follows:

(1) Storage instruction

Only 20% or 4/20 of existing HPTs (brand A, S, Y, and N) indicated this information on inner with outer label and in the package leaflet.

(2) Precautions

All precautions were non-indicated in different degree from 25-75 %. Brand V was the only HPT that did not indicate any detail of precautions anywhere.

(3) Contraindications or limitations

They were about the interfering substances and some health conditions those might involve the testing results was clearly defined by USFDA.[18, 78]

As observation, this information was indicated in nearly 3 quarters of the existing HPT labeling and mostly found in package leaflets with other contents under heading "Q&A" or "precautions" or "recommendations". One of locally produced products (1/8) and nearly half of the imported ones (5/12) did not indicate this information. However, some cited it in English leaflet but none in Thai version.

(4) Possible false errors

They involved the possibility of false errors (false positive and false negative results) which was not indicated in nearly half of the existing labeling.

(5) Urine collection

The urine collection was mostly stated as "the use of dry and clean container in collecting urine sample at any time of day, but best for the 1st morning urine".

(6) Urine storage

The indicated urine storage in their package leaflets was for the case of unable to use the fresh urine sample.

(7) For testing procedure

- **Urine dipping or dropping method**

All of HPTs indicated either of these topics in their labeling based on the HPT type under heading "instructions for use" with somewhat different details.

- **Optimum dipping time length**

Almost existing HPTs cited and emphasized in their leaflets for the users to be sure for this issue and proposed for the additional urine to obtain clearer testing result.

- **Amount of urine dropping**

All of locally manufactured HPT products claimed for 4 drops of urine and they were all fabricated by the same plant in Thailand. The imported ones declared respectively as for 3, 4, and 5 drops and few claimed for different drops of urine in different places of the same leaflet.

- **Optimum time in result reading**

- Drying/waiting time

All locally manufactured and most imported HPTs specified the result reading time in the range of 1-5 minutes as Rosenthal MW and Briggs GC suggestion.[85] However, 1 imported HPT cited wider range especially the lower limit of time. It was only 40 seconds which was quite less than the suggested 1-5 minutes and it could affect the result interpretation by the users.

- Least time for result reading

The majority of non-indicated labeling (10/14 HPTs) were the imported HPTs and 2/6 HPTs indicated as suggested 10 minutes.[85]

- Maximum time for result reading

Only 40% of existing HPT labeling indicated this information as USFDA recommendation.[78] The results showed varied labeling of maximum time in different brands in several degree of existing HPT labeling respectively as 25% for 15 minutes, 10% for 10 minutes as suggested[85], and 5% for 5 minutes. The non-indicated HPT labeling was found as 45% for imported HPTs and as 15% for locally manufactured HPTs. They were 3 HPTs with dipping type and 9 HPT with card type.

(8) Interpretation of inconclusive/ invalid result

It was found that all HPT products indicated this information only in their package leaflets. The unidentification of this information in their labeling and the poor quality of the HPT products was the noticeable issues in labeling quality.

(9) Claims for product performances

- **Analytical Sensitivity**

Most of HPT products cited their analytical sensitivity for 25 m.I.U. hCG/ 1 ml. urine in the package leaflet. All of the locally manufactured ones also specified in such amount, whereas the imported ones possessed in different amounts of urine hCG from 20 to > 40 m.I.U. /1 ml. urine as described in the above table and in the concentration less than the fair-device of HPT (<100 m.I.U. hCG/1 ml. urine).

However, none of existing HPT labeling claimed as the excellent-device that could detect 6.25 mIU/mL urine hCG.[85]

- **Diagnostic Sensitivity**

Most of the sampling HPT products declared their Diagnostic Sensitivity as early as the 1st day of missed period which was consistent with the product labeling for most test kits, according to Rosenthal MW and Briggs GC.[85] Some claimed as 1-3 days or 3 days before expected period, and stated as ability to detect $\leq$ 20 mIU/mL urine hCG. Moreover, there was 1 existing imported HPT labeling declared as 1-3 days before expected period while it claimed the ability to detect $\leq$ 30 mIU/mL urine hCG. Whereas the test with ability to detect hCG levels $\leq$ 25 mIU/mL could claim as 3 days before missed period.[85] However, testing at least 1 week after expected menstruation would give the most accurate testing result.[85]

- **Result Accuracy**

The existing HPTs declared their result accuracy in varied details and most of them indicated over the advice of USFDA which should never exceed >99%.[78] Some stated >99.9% or 99.99% which were misleading statements those USFDA suggested to be avoided.[78]

(10) Source of further information

This issue was required as one of the basic points in labeling review by the health authority in U.S.F.D.A. which the manufacturer were needed to identify a technical assistance number to provide technical support and advice to individuals using a home test kit.[86] For Thailand, the Medical Device Act 1988 did not directly specify as such requirement but required only the name of manufacturer and/or importer with their addresses.[38] Therefore, both manufacturer's and/or importer's name were reasonably to be the sources of further information. Furthermore, the specific heading or distinctly indicated some forward statement to emphasize this issue might be needed especially for the lay users for further trouble shooting. However, nearly half of the existing HPT labeling did not indicate this information.

1.1.2.4. Information for consumer education

It would help the consumers those needed more information or could support their assurance in case of facing with some trouble in product quality. The details of problem analysis of these contents were as following:

Table 4.5: Conclusion of noticeable issues on contents for consumer education of existing HPT labeling

No.	Title	%	noticeable or problematic issues
1	Introduction and test principles	25 45 15 15	1. 5/20 non-indicated HPTs (brand H, P, U, W, Y) 2. 9/20 HPTs usually be found in Q&A part of package insert with smaller print size than its main part (brand B, D, F, M, N, R, V, X, Z) 3. specified near the beginning part of leaflet • 3/20 HPTs had no specific title (brand C, Q, S) [NB] with specific heading (brand A, L, O)
2	contents in Q&A (question, answer)		test principles, the sources of possible error, some limitations, follow-up action, etc.
3	knowledge for pregnancy	5	1 imported HPT with card type (brand N) placed this issue in 1 full page of such leaflet
4	revision date	60 5 10	• none of imported HPTs (12 HPTs) identified (brand A, H, L, M, N, O, P, Q, S, W, Y, Z) • 1 locally non-indicated HPTs (brand V) • 2/20 non-updated versions of locally produced HPT products (brand B, U)
5	problematic HPTs		they were found most in the imported HPTs.

Some further results about consumer education information were as follows:

(1) Introduction and test principles

This part consisted of summary and explanation of the test, as well as principle of the procedure which was required in HPT labeling by the U.S.F.D.A.[77, 78]

(2) Contents in Questions and Answers (Q&A) part

In many countries, Q&A part was one strategy used in motivating the users to read the label and leaflet of the products for their more knowledge and awareness in using such goods e.g. USA, etc. It was 1 of 3 basic requirements of U.S.F.D.A. points in labeling review to provide information in a form of Q&A part.[86] For existing HPT labeling, this part consisted of issues in educating further knowledge about some noticeable matters of the product other than (e.g. test principles, causes of possible error, some limitations, follow-up action, etc.) that directly involving to product usage.

- **Revision date**

Many countries recommended for labeling of this content such as Australia[32, 54], Canada[14, 55], EU[13], USA[18, 65, 77, 78], etc. Nevertheless, Thai Medical Device Act did not call for this information in Thai labeling.[38] It was noticeable that most of the locally manufactured HPTs indicated the revision date in their Thai package leaflets but in numeric of English style such as “Revised 30/09/2004”, etc. Some mentioned in English part as the codes without any heading or title. Comparing the package leaflets obtained from the manufacturer and the drug retailers, many non-updated versions were found. This problem involved the issue of quality system standard.

1.1.3. Comprehensibility

1.1.3.1. Readability level using readability formulae

The former minimum educational level requirement (not exceed grade level 6) was selected to be the suggested readability level for Thai people. According to Fog Index, all sampling HPTs labeling had readability level from 7 to 12 as following:

Table 4.6: Readability level of instructions for use on existing HPT labeling

No.	HPT type	number of HPTs with Readability level					total	remarks
		lower grade level		higher grade level				
		7	8	9	10	12		
1.	dip type	1	2	2	4	0	9	
1.1	local	0	1	0	3	0	4	V;B,F,U
1.2	imported	1	1	2	1	0	5	H;L;S,W;Z
2.	card type	4	5	0	1	1	11	
2.1	local	3	1	0	0	0	4	D,X,R;C
2.2	imported	1	4	0	1	1	7	O;A,P,Q,M;N;Y
	total	5	7	2	5	1	20	

Nearly half (40%) of sampling existing HPTs (66% of dipping type and 18% of the card type) needed the readability level or educational grade level higher than the ideal score (grade level 8)[69] to read and understand their instructions for use.

1.1.3.2. Issues hard to understand

Four HPTs were found to have some issues difficult to comprehend as

(1) Some figures had no label e.g. no text labeling for control and test band of negative result reading, etc.

(2) The test method and the result reading information which should be placed together were set too far apart in the packaging inserts of 2 products.

1.2. Conclusion of labeling quality assessment by content analysis

1.2.1. Labeling quality assessment of existing HPTs with dipping type

Table 4.7: Labeling quality assessment of existing HPTs with dipping type

No.	HPT brand	design quality & content	comprehensibility	print size (points)	remarks
		number of weakness	grade level		
1	L	13	8	11.5 BrowaliaUPC	strengthest
2	B	15	10	9 Angsana new	
3	F	21	10	10.5 Cordia new	
4	U	22	10	10.5 Angsana new	
5	H	23	7	14 FreesiaUPC	
6	W	24	9	9.5 Angsana new	
7	Z	30	10	11 BrowaliaUPC	
8	S	31	9	14.5 BrowaliaUPC	
9	V	36	8	7 Angsana new	weakest

The details of quality assessment in 9 dipping HPTs labeling were as follows:

1.2.1.1. As contents and design quality:

The highest quality HPT was brand L while the lowest one was brand V.

1.2.1.2. As readability/education grade level or comprehensibility:

The lowest one was brand H while the highest ones were brand B, F, U, and Z.

1.2.1.3. As alphabet print size:

The biggest one was brand S whereas the smallest one was brand V.

1.2.2. Labeling quality assessment of HPT with card type

Table 4.8: Labeling quality assessment of existing HPTs with card type

No.	HPT brand	design quality & content number of weakness	comprehensibility grade level	print size (points)	remarks
1	R	14	7	9.5 Tahoma (~13.5)	strengthest
2	X	14	7	10.5 Cordia new	
3	D	14	7	9 Angsana new	
4	O	17	7	11 BrowalliaUPC	
5	C	17	8	8 Tahoma (~12)	
6	Y	23	12	12 Browalia UPC	
7	A	24	8	10 Freesia UPC	
8	N	31	10	10.5 Cordia new	
9	P	32	8	10 Freesia UPC	
10	Q	35	8	11 Cordia new	
11	M	36	8	10 Cordia new	weakest

The details of quality assessment of HPTs with 11 card type were as follows:

1.2.2.1. As contents, and design quality:

The strength HPT was brand R, X, D but the weakest one was brand M.

1.2.2.2. As readability/education grade level or comprehensibility:

Brand D, R, O, X had the lowest grade levels but brand Y was the highest one.

1.2.2.3. As alphabet print size:

The biggest one was brand R even if its print size was 9.5 points Tahoma because its print size actually looked bigger than 10.5 points Cordia new of brand F and X. The HPT with smallest print size was brand D (9 Angsana new).

1.3. Overall quality assessment of existing HPT labeling

Document characteristics for labeling quality of HPTs included contents, design, and comprehensibility. Contents were assessed on their weaknesses, while design quality was focused on the alphabet print size, drawing quality, drawing and information sequencing, print quality and others. The comprehensibility was

evaluated based on Fog Readability formula[69] by determining the difficulty or grade level of language usage.

The number presented in table 4.9 for weaknesses referred to the counting of design quality and content areas as well as the readability level based on Thai Medical Device Act 1988[38], Guidance for the preparation of 510(k) Submissions: Points to Consider Regarding Labeling and Premarket Submissions for Home-Use In Vitro Diagnostic Devices[65], Guidelines in IVD labeling[77], Guidance for the Over-the-Counter (OTC) Human Chorionic Gonadotropin (hCG) 510(k)s[78], and recommendations from some reviewed literatures.[10, 30, 67, 75] The results on weakness, readability level, and print size were as following:

Table 4.9: Overall quality of existing HPT labeling

Type	weakness			readability level			print size (< criteria)		
	mean	range	median	mean	range	median	mean	range	median
Dip (n=9)	23.9	13-36	23	9	7-10	9	0.67 (6/9 HPTs)	7-14.5 points	10.5
Card (n=11)	23.4	14-36	23	8	7-12	8	0.7 (8/11 HPTs)	9-12 points	10.5
total (n=26)	23.7	13-36	23	8.5	7-12	8	0.7 (14/20 HPTs)	7-14.5 points	10.5

The results from the assessment of overall HPT labeling quality showed that the HPT with dipping type and card type had nearly the same degree of weakness. The dipping type required more educational level to read and understand their labeling than the card type. According to the criteria, the number of HPTs labeling with smaller print sizes than the criteria was the same in dipping and card type.

1.4. Labeling selection as the representatives for in-depth interview

The above 20 HPTs (9 HPTs with dipping type and 11 HPTs with card type) were also recruited to be tested by the lay consumers in this phase. The problems found in this phase would be combined with the results from consumers' testing using the Diagnostic Testing technique with questionnaire (adapted from Diagnostic Testing and CIRF of U.S.F.D.A.). The 2 HPTs labeling with worst quality of both dipping and card type (brand V and brand M) would be further strong individual interviewed to obtain more opinions from lay consumers to be the inputs for the phase of labeling Guideline development of home-use in-vitro diagnostic (IVD) test kits in this study.

2. Consumer testing using Diagnostic Testing with questionnaire

Problem analysis through consumer testing was thus conducted with 20 existing HPTs products. The questionnaire suggested by Diagnostic Testing[67] and CIRF of USFDA[30] were integrated, pre-tested, and finalized into the self-administered questionnaire for consumers. Besides self-administered questionnaire, this study used observation and analysis the behaviors of population at risk on reading the HPT labeling and using each HPT product by Diagnostic testing as described in 1.2.2.3(1) of chapter III. Probing on their interpretation and understanding of reading information were also conducted. These activities were aimed to obtain more problems and to acquire some more opinions from the perspectives of lay consumers.

The Communication Research Institute of Australia (CRIA) suggested that the first 5-6 people could identify 80% of the faults in the labeling design and a greater number would locate additional mistakes.[67] The 90 novice users were thus recruited to test 20 HPT products as in the content analysis, 9 dipping type and 11 card type HPTs were respectively tested by 44 and 46 users as in the following table.

Table 4.10: Selection of HPT samples and participants for consumer testing on existing HPT labeling

Issues / HPT type	available HPTs	HPTs selected	no. lay in testing
dipping	10	9	44
card	15	11	46
midstream	1	0	0
Total	26	20	90

The results of consumer testing were shown through 3 aspects, the individual competency of 90 lay consumers on total information finding and answering the questions; quality of information for buying decision and product utilization provided on inner and outer labels as well as in package leaflets; their perception as general and on design quality, utility, as well as comprehensibility of such HPTs labeling. The first two results were judged by the passing score of $\geq 81\%$.[67] The strong individual after Diagnostic Testing was selectively done on the lowest quality of each HPT type (brand V for locally manufactured dipping type and brand M for imported card type).

2.1. Total Competency of lay users on existing HPT labeling

The results from the problem analysis of 90 lay users' competency on information finding and obtaining the correct answer from the existing HPT labeling reflected the quite low competency of individual lay users and the poor quality of the existing HPTs labeling. The scores of both aspects were quite low and the result of their multiplication scores showed that no one could pass the criterion (≥81%) as illustrated in the following table and figure. The average % for information finding and obtaining the correct answer was respectively as 49 and 48%.

Table 4.11: Total competency score of 90 lay users on existing HPT labeling

Case	average finding score (0-2)	% finding score	average answer score (0-1)	% answer score	% average competency (%finding * %answer)	pass or fail (0-1)
1	1.04	52	0.54	54	28	0
2	0.96	48	0.39	39	19	0
3	0.76	38	0.32	32	12	0
4	1.08	54	0.46	46	25	0
5	0.96	48	0.43	43	21	0
6	1.04	52	0.50	50	26	0
7	0.28	14	0.14	14	2	0
8	1.22	61	0.50	50	31	0
9	0.54	27	0.36	36	10	0
10	0.90	45	0.64	64	29	0
11	1.04	52	0.39	39	20	0
12	0.50	25	0.39	39	10	0
13	1.54	77	0.61	61	47	0
14	1.08	54	0.50	50	27	0
15	1.00	50	0.46	46	23	0
16	0.92	46	0.50	50	23	0
17	0.78	39	0.36	36	14	0
18	0.92	46	0.32	32	15	0
19	0.90	45	0.61	61	27	0
20	0.96	48	0.43	43	21	0
21	0.86	43	0.39	39	17	0
22	1.04	52	0.57	57	30	0
23	1.36	68	0.75	75	51	0
24	0.68	34	0.36	36	12	0
25	0.96	48	0.39	39	19	0
26	1.42	71	0.64	64	45	0
27	0.78	39	0.43	43	17	0
28	0.92	46	0.50	50	23	0
29	1.08	54	0.43	43	23	0
30	0.82	41	0	0	0	0
31	1.00	50	0.46	46	23	0
32	0.96	48	0.46	46	22	0
33	0.90	45	0.46	46	21	0
34	0.96	48	0.36	36	17	0
35	1.10	55	0.64	64	35	0
36	0.78	39	0.46	46	18	0
37	0.82	41	0.39	39	16	0
38	1.36	68	0.64	64	44	0
39	0.82	41	0.46	46	19	0

Case	average finding score (0-2)	% finding score	average answer score (0-1)	% answer score	% average competency (%finding * %answer)	pass or fail (0-1)
40	1.18	59	0.54	54	32	0
41	0.72	36	0.46	46	17	0
42	0.90	45	0.50	50	23	0
43	0.86	43	0.50	50	22	0
44	0.86	43	0.39	39	17	0
45	1.32	66	0.71	71	47	0
46	0.96	48	0.68	68	33	0
47	1.50	75	0.75	75	56	0
48	1.14	57	0.71	71	40	0
49	1.10	55	0.54	54	30	0
50	1.14	57	0.64	64	36	0
51	1.08	54	0.75	75	41	0
52	1.28	64	0.54	54	35	0
53	1.00	50	0.32	32	16	0
54	1.26	63	0.46	46	29	0
55	0.72	36	0.32	32	12	0
56	0.82	41	0.43	43	18	0
57	0.72	36	0.39	39	14	0
58	0.72	36	0.39	39	14	0
59	0.92	46	0.61	61	28	0
60	0.86	43	0.57	57	25	0
61	0.58	29	0.36	36	10	0
62	0.96	48	0.46	46	22	0
63	1.00	50	0.57	57	29	0
64	1.14	57	0.61	61	35	0
65	0.82	41	0.46	46	19	0
66	0.50	25	0.21	21	5	0
67	1.00	50	0.68	68	34	0
68	1.18	59	0.43	43	25	0
69	1.26	63	0.46	46	29	0
70	1.18	59	0.46	46	27	0
71	1.10	55	0.68	68	37	0
72	1.04	52	0.64	64	33	0
73	0.82	41	0.50	50	21	0
74	0.78	39	0.46	46	18	0
75	0.92	46	0.46	46	21	0
76	0.78	39	0.29	29	11	0
77	0.76	38	0.32	32	12	0
78	0.90	45	0.39	39	18	0
79	1.28	64	0.57	57	36	0
80	1.28	64	0.46	46	29	0
81	1.22	61	0.75	75	46	0
82	0.86	43	0.39	39	17	0
83	1.36	68	0.57	57	39	0
84	1.22	61	0.43	43	26	0
85	0.64	32	0.29	29	9	0
86	1.08	54	0.50	50	27	0
87	1.10	55	0.46	46	25	0
88	0.72	36	0.46	46	17	0
89	1.14	57	0.54	54	31	0
90	1.00	50	0.57	57	29	0
Mean	0.97	49	0.48	48.08	24	0

N = 90 lay consumers; **Passing criteria** = competency score ≥ 81% [0=fail, 1=pass]
Finding score: 2 = easy, 1 = fair, 0 = can't find; **Answer score:** 1 = right, 0 = wrong
Key message: nobody from 90 lay users get ≥ 81% pass of both scores (finding and answering score)

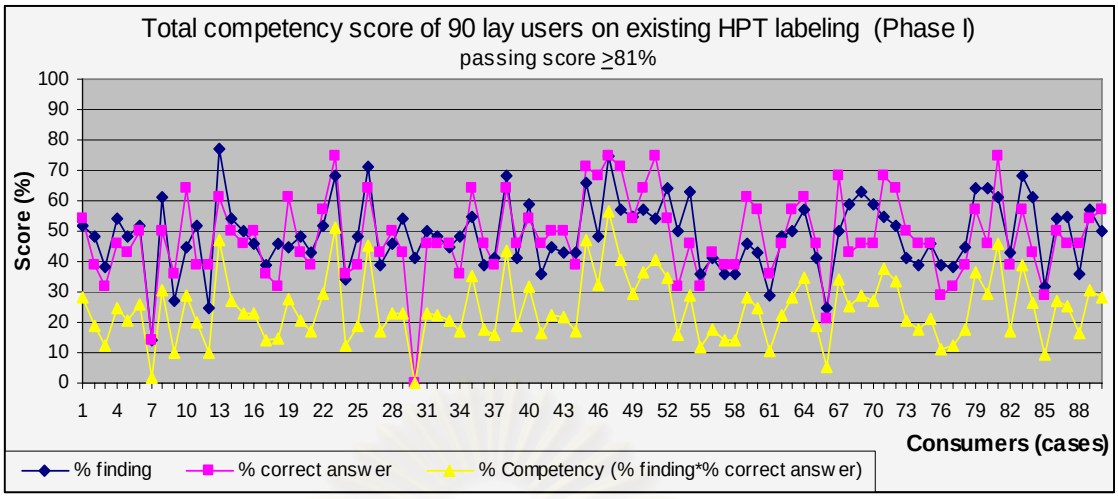


Figure 4.1 Total competency of 90 lay users on existing HPT labeling

2.2. Quality of information on existing HPT labeling

The Diagnostic Testing with questionnaire as well as some individual interviews was rendered to determine quality of information on label and leaflet on document characteristics including design quality, utility, and comprehensibility. Both utility and comprehensibility involved content and detail information on labels and leaflets. The results were combined as quality of content. The consumer testing results were thus divided into 2 sections, quality of content and quality of design.

2.2.1. Testing for competency of each content topic

Contents on label and leaflet contained information for consumer buying decision and consumer utilization. All of them were investigated on difficulty in locating information and ability of individual lay user to give the right answers. The passing criterion score of multiplying result of information finding and right answering by the lay users was ≥ 81%.

2.2.1.1. Consumer buying decision information

The appearance of information for consumer buying decision was usually presented on the outer and/or inner label and sometimes was also in the package leaflet. The information indicating, the ability in information finding and giving the right answer, and the competency of each content topic for consumer buying decision were illustrated in the following tables and figures.

Table 4.12: Indicating rate of buying decision information on existing HPT labeling

Contents % (f) / HPT type	HPT name	amount/ pack	intended use	expiry date	manufacturer	distributor	mean score (%)
dip (9)	35(7)	5(1)	45(9)	5(1)	25(5)	35(7)	25
card (11)	50(10)	30(6)	55(11)	5(1)	25(5)	55(11)	37
Total (20)	85 (17)	35 (7)	100 (20)	10 (2)	50 (10)	90 (18)	62

Note: The presence of information on labels and leaflets was calculated based on 20 HPT products**.**

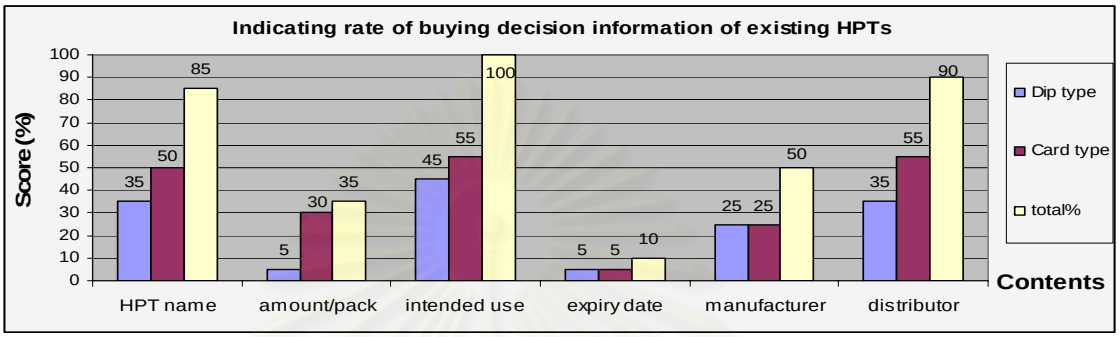


Figure 4.2 Indicating rate of buying decision information on existing HPT labeling

Figure 4.2 showed that the HPTs with dipping type had smaller indicating rate in consumer buying decision information than the card type HPTs in all aspects except the expiry date and the manufacturer. Its average information indicating rate was 62%. The intended use had the highest indicating rate. The rate of expiry date in Thai language was very low and had the lowest score among the consumer buying decision information. However, it was found that about 40% of existing HPTs indicating the expiry date with Thai heading but in English details. For each content labeling quality, the HPT name was the only topic that could pass the criterion score (≥81%). It could be found by 94% of the lay consumers and 87% of all users could obtain the correct answer. The details were shown in the following table and figure.

Table 4.13: Labeling quality of buying decision information on existing HPTs based on average finding score

Contents for buying decision	% **response** (n = 90)				**average finding score** (0-2)	**average finding** (%)	**average answer** (%)	**average competency** (%finding * %answer)	**pass or fail** (0-1)
	finding			answer					
	easy	hard	can't	right					
1.HPT name	90	8	2	87	1.88	94	87	82	1
2.Amount/pack	77	9	14	78	1.62	81	78	63	0
3.Intended use	84	10	6	83	1.79	89.5	83	74	0
4.Expired date	66	20	14	33	1.51	75.5	33	25	0
5.Manufacturer	75	12	13	56	1.61	80.5	56	45	0
6.Distributor	80	7	13	77	1.67	83.5	77	64	0
Mean	79	11	10	**69**	**1.68**	**84**	**69**	**59**	**0**

Note - Calculated based on 20 HPT products by 90 lay users
- Finding score: 2 = easy, 1 = fair, 0 = can't find; Answer score: 1 = right, 0 = wrong
- Passing criteria = competency score ≥ 81% [0 = fail, 1 = pass]

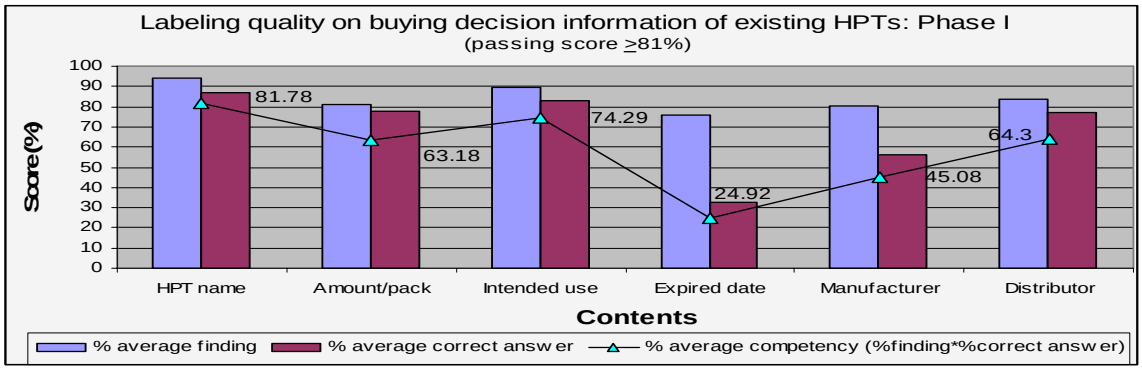


Figure 4.3 Labeling quality on buying decision information of existing HPTs based on average finding score

The results found in each topic of buying decision information were as follows

(1) Product (IVD) name/trade name

There were some HPTs without Thai trade name (3/20) and some with Thai trade name in very small prints. However, most of lay consumers (87%) could give the correct answers and easily found this information (90%). Some lay users revealed that they found this information by noticing the general style in product labeling of trade name. Nevertheless, some lay users indicated for the difficult finding and not capable to locate the HPT name.

According to the average score of difficulty level in finding the information; some HPTs seemed to be correspondingly hard to be located their product names. It was noticeable that brand V was the problematic HPT with difficulty and inability in locating this issue as well as giving the incorrect answer. It was the only brand that its trade name could not be found by some lay users. Moreover, there was 1 HPT (brand H) that almost lay subjects (3 from 4) gave the wrong answers in testing with this HPT labeling even if they expressed as the easy finding of this topic. Its common name with Thai trade name was not on the main part of the outer label. Its English trade name was in the main part of the outer label but in the symbol of trade mark.

For overall result, there was no serious trouble for the lay consumers in locating and comprehending about the labeling of their product names, except few HPTs as above-mentioned. The problems from the individual interview were as

- Some HPTs' name both in English and Thai were presented in improper style of alphabet and hard to be read by the consumers (e.g. P.R.E.G.D.I.P. 2.0.0.7, EAS3, etc.). Nevertheless, one expressed as difficult to pronounce the trade name due to many dots on the product name.

- Some HPTs indicated different names between the outer label and its package leaflet which might confuse the lay consumers.
- Many trade names on outer label burdens the users' visualization.
- Some HPTs had not any trade name in Thai; some indicated only in package leaflet; some specified in very small, pale, and not at the heading of the insert; and some cited in very pale little print on the outer label.

(2) Content/pack or amount/pack

The number of test/pack of this HPT was usually specified on the outer and/or inner label of the products. This study showed that some HPTs cited this detail in Thai or English or both but more than half of HPT products (65%) did not indicate this information anywhere in labeling. Nevertheless, most of lay consumers expressed as easy to find this information (81%) and the less mentioned as hard finding and incapability to locate such information. Moreover, about three quarters of them (78%) could achieve the right answers. However, some lay consumers could not locate the details and some had difficulties in such information finding, but they could obtain the right answers. Besides, a lay consumer proposed that the unit of content in the packaging of the HPT should be as test/pack than piece/pack.

As overall result, some HPTs caused slight troubles to lay users. Most of the problematic HPTs labeling were noticed about the lacking of this information in Thai, their small prints with color nearly the same as the labeling background, and the incapability of the lay users in their implications from the real product.

(3) Intended use

All sampling HPTs were found to have this information in their labeling but many of them did not specify in clear specific heading. Some indicated in either specific or general statements of intended use in the beginning part of their leaflets. However, the common name of this product (pregnancy test) could obvious reflect the intended use. Moreover, the drawing of testing method and its results could communicate to its intended use as the supported statement of a lay user.

As the above result, more than a quarter of HPT products faced with troubles in their labeling but it looked seriously only in 1 HPT (brand V). Nearly all problematic issues (80%) encountered with difficulty and inability of lay consumers in locating this topic in labeling was found in only 1 brand (V). Moreover, almost half of the subjects (47%) testing with this product gave the wrong answers.

It was found in this study that nearly one-fifth of the lay consumers (17%) gave the wrong answers for this information even if almost of them (84%) responded as the easy findings of information. Most of the wrong answers were acquired from the claims on their outer label such as “easy to use; no error; precise, accurate, fast result in 1 minute, accurate 99.99%, and prompt result, etc.”.

As the overall result, some HPTs labeling faced with some difficulties for the lay consumers in finding the content of “intended use” and less comprehended.

(4) Expiry date

This information was one of the most important issues which involved with the consumer decision in product buying especially negative impact from its short duration left. Generally, the expiration date in unopened condition of product had been usually indicated on the label of outer and immediate container.

The existing HPT products were found to cite this detail together with lot number/ manufacturing date on the outer and immediate label in either English or Thai under abbreviated heading (e.g. exp., exp. date, etc.) or its full term (e.g. expiry date, expire, etc.). However, most of them (90%) were found to have no Thai version of expiration date. This information was indicated in the short term of English title with date in English style (month in English or number/ year in A.D.). Some HPTs (40%) specified in Thai heading but content in English style. This situation was considered as non-indicated HPTs. Only few HPT products (10%) mentioned both heading and content of expiration date in Thai. However, the wrong answers were found about two-third of subjects (67%) which was nearly the same as the expression of easy information finding (66%). The examples of incorrect answer were such as no answer of the month and/or year in Thai, giving lot number instead of the expiration date, no answer given due to inability to locate this information. Some expressed inability to find this issue due to unclear content on the outer label.

As researcher’s observation in one HPT product (brand V), the printing color of “expiry date” came off with the plastic covering such product during wrapping off its packaging. As a result, many lay users had some problems in finding (42%) and identifying (77%) the expiration date of such HPT. Furthermore, almost of the rest HPTs confronted with the wrong answers about this detail. However, some problems from the individual interview of the lay users in some HPTs were as follows:

- This information was indicated on the small package side (not on the main part) of outer label so it’s hard for them to find out such information.

• Some lay user did not know English so they could not interpret or translate the abbreviation (e.g. “AUG”) into Thai, and some could not find the expiration date and then interpreted the batch number instead of expiry date (e.g. 05213 = February 13, 2005).

(5) Responsible organizations

Generally, the name and address of the manufacturer, distributors, and/or importer were required by the Medical Device Act 1988 of Thailand and many other countries overall the world for consumer protection.[13, 14, 32, 38, 55, 62] However, only half of HPT products in this study those marketing in Thailand identified the name of manufacturer on either or all of outer label, immediate container, and package leaflet. Moreover, none of them indicated the importer and address in their Thai labeling whereas almost of selected HPT products (17/20) mentioned their distributors and places in such documents. Their details in user testing would be shown as follows.

• Manufacturer name and address

The manufacturer name usually came together with its address. Only if we know the manufacturer name, it was not hard to find it address. However, many of them did not give the place of the manufacturer especially the OEM products.

The overall result showed that half of sampling HPTs indicated this information in their labeling (10/20). Moreover, more than half of selected HPTs were found to cause some problems for the lay users in information finding (12/20) and ability to give the right answer (14/20) about the manufacturer. Furthermore, it was found by the lay consumers that there was 1 HPT product indicated different manufacturer (in U.S.A.) between its outer label and packaged leaflet. Additionally, some lay consumers gave the false answer by providing the name of foreign company that presenting on the outer label without any indication of its status. These situations were found in the cases of non-indicated HPTs and most of them were the HPT products presenting as imported ones. Hence, nearly half of all answers (44%) were the wrong answers which were rather high. However, the difficult finding and inability to locate were expressed by about one-fourth of the respondents (25%).

• Importer and address

There were nearly half (8/20) of sampling HPT products involving in Diagnostic Testing those presenting as imported products and sold in quite high price. However, they were all found without any importers’ name as above mentioned.

• **Distributor and address**

All selected 20 HPT products except 1 HPT indicated the distributor name with address in their labeling (outer/inner label and/or package leaflet). Some of them cited this content completely in Thai and English with specific heading, or only Thai or English in either place of the above labeling with or without distinct title. However, they indicated it in Thai at least one place in their labeling. Furthermore, it was found that one HPT cited its distributor in different names between on the outer label and in the package insert which caused some confusion and hard time in locating the information and giving the right answer by the lay consumers. As the in-depth interview with the manufacturer, there were some errors because such labeling was adapted during the period of changing the distributor of such HPT.

(6) Overall findings of consumer buying decision information

According to the code of practice about the measuring label performance of CRIA in Australia, 81% is the minimum requirement which it means that the lay consumer could find the information at least 90% of what they look for, and can use at least 90% of what they find.[67] Hence, the product name was the only issue of existing HPT labeling that could pass the criteria of CRIA. The matter of consumer buying decision information of HPTs particularly the expiry date and manufacturer were found respectively to be the critical problems in their HPT labeling.

2.2.1.2. Consumer utilization information

The information demonstrating including the information finding ability and competency in right answering as well as the competency of each content topic was shown in the following figures and tables.

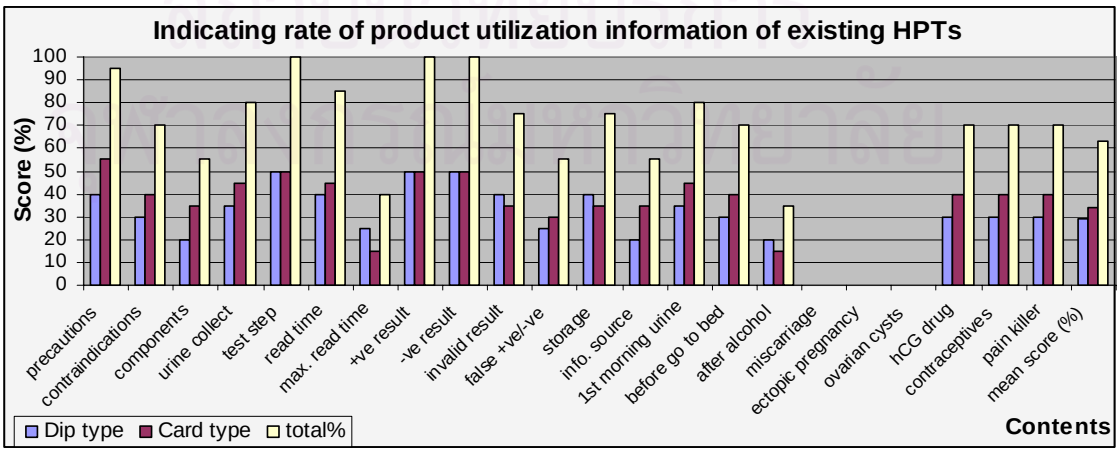


Figure 4.4 Indicating rate of utilization contents on existing HPT labeling

Table 4.14: Indicating rate of product utilization information on existing HPT labeling

Contents % (f) / HPT type	1. precautions	2. contra indications	3. components	4. urine collect	5. test step	6. read time	7. maximum read time
dip (9)	40 (8)	30 (6)	20 (4)	35 (7)	50 (9)	40 (8)	25 (5)
card (11)	55 (11)	40 (8)	35 (7)	45 (9)	50 (11)	45 (9)	15 (3)
total (20)	95 (19)	70 (14)	55 (11)	80 (16)	100 (20)	85 (17)	40 (8)

Contents % (f) / HPT type	8. +ve result	9. -ve result	10. invalid result	11. false +ve/-ve	12. storage	13. info. source	14. 1st morning urine	15. before bed
dip (9)	50 (9)	50 (9)	40 (8)	25 (5)	40 (8)	20 (4)	35 (7)	30 (6)
card (11)	50 (11)	50 (11)	35 (7)	30 (6)	35 (7)	35 (7)	45 (9)	40 (8)
total (20)	100 (20)	100 (20)	75 (15)	55 (11)	75 (15)	55 (11)	80 (16)	70 (14)

Contents % (f) / HPT type	16. after alcohol	17. miscarriage	18. ectopic preg.	19. ovarian cyst	20. hCG drug	21. contra ceptive	22. pain killer	mean score (%)
dip (9)	20 (4)	0 (0)	0 (0)	0 (0)	30 (6)	30 (6)	30 (6)	29
card (11)	15 (3)	0 (0)	0 (0)	0 (0)	40 (8)	40 (8)	40 (8)	34
total (20)	35 (7)	0 (0)	0 (0)	0 (0)	70 (14)	70 (14)	70 (14)	63

Note: - Indicating rate of dipping time = 89% (8/9)
- The presence of information on labels and leaflets was calculated based on 20 HPTs.

The above average indicating rate was found about only two-third of the existing HPT labeling (63%) which was nearly the same average rate of buying decision information (62%). Test method and positive with negative result reading were the only 3 aspects specified in all HPTs labeling and passed the criterion score (≥ 81%). However, the limitations in some health conditions (miscarriage, ectopic pregnancy, ovarian cyst) were not indicated in any HPT and got no score. The labeling quality of each content topic for product utilization information was shown as follow:

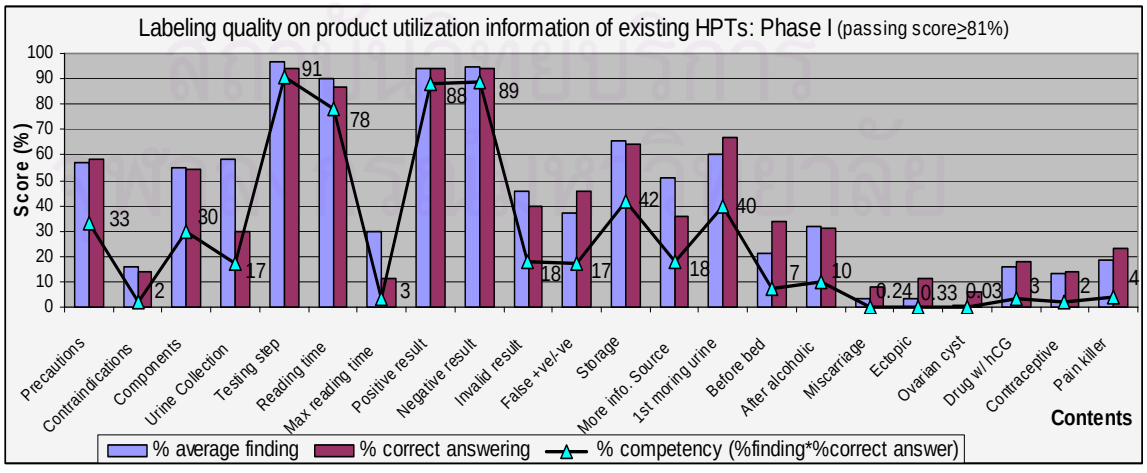


Figure 4.5 Labeling quality of utilization contents on existing HPTs based on average finding score

Table 4.15: Labeling quality of product utilization information on existing HPTs based on average finding score

Contents for product utilization (20HPTs)	**% Response** (n = 90 users)				**average finding score** (0-2)	**average finding** (%)	**average right answer** (%)	**average competency** (%finding * %answer)	**pass or fail** (0-1)
	finding			answer					
	easy (2)	hard (1)	can't (0)	right (1)					
precautions	52	10	38	58	1.14	57	58	33	0
contraindications	11	10	79	14	0.32	16	14	2	0
components	51	8	41	54	1.10	55	54	30	0
urine collect	46	24	30	30	1.16	58	30	17	0
testing step	94	4	1	94	1.93	96.5	94	91	1
reading time	86	7	7	87	1.80	90	87	78	0
max. read time	24	10	66	11	0.59	29.5	11	3	0
+ve result	91	6	3	94	1.88	94	94	88	1
-ve result	92	6	2	94	1.90	95	94	89	1
invalid result	41	9	50	40	0.91	45.5	40	18	0
false +ve/-ve	26	23	51	46	0.74	37	46	17	0
storage	58	16	27	64	1.31	65.5	64	42	0
more info. source	44	13	42	36	1.02	51	36	18	0
1st morning urine	53	13	33	67	1.20	60	67	40	0
before bed	17	9	74	34	0.42	21	34	7	0
after alcoholic	26	12	62	31	0.63	31.5	31	10	0
miscarriage	2	1	97	8	0.06	3	8	0	0
ectopic pregnant	1	3	96	11	0.06	3	11	0	0
ovarian cyst	0	1	99	6	0.01	0.5	6	0	0
hCG drug	10	12	78	18	0.32	16	18	3	0
contraceptive	8	10	82	14	0.26	13	14	2	0
pain killer	13	10	77	23	0.37	18.5	23	4	0
Mean	**38**	**10**	**52**	**42.45**	**0.87**	**43.48**	**42.45**	**27**	**0**

The results in each topic of product utilization information were as follows

(1) Precautions

Precautions were described as the specific hazard alert information that a user needed to know before using the device.[18] It should be provided early in the labeling for users on how to avoid hazard e.g. sources of harm in using device, etc.[18]

In this study, the companies cited this detail in different styles including both with and without particular heading. Some HPTs indicated this issue under the other headings (e.g. "recommendation", "before testing") instead of specific heading "Precautions". However, some products cited only specific heading of "precautions in urine dipping" and it caused the lay users the problems in information finding of other precautions, not capable to locate this topic, and getting the wrong answer. Some expressed as an easy finding but their answers were incorrect. It was noticeable that

almost HPTs with specific heading in Thai packed insert had no problems in difficult finding and inability to locate such information as well as their right answers.

(2) Contraindications of the test

Contraindications were defined as conditions under which product should not be used because the risk of use clearly outweighs any possible benefit, there might be persons in whom the device should not be used due to their health status.[18]

In this study, most of this detail were cited in the part of Q&A of packaged leaflets with no specific heading but some did not indicate anywhere in such documents. However, it has not usually been cited in the outer or inner label due to its limited spacing. Additionally, it was found that almost of lay users (79%) could not locate this information and some (10%) had difficulty in finding this content in the indicated labeling. This result was quite opposed to the indicating rate of this information (70%). However, the other problems found in this topic were also involved with plain, concise, clear and obvious information presentation which were the suggested important characteristics of good labeling.[10]

(3) Components

This information was usually indicated in the packaged leaflet due to its available space for labeling. However, it was found that only about half (55%) of existing HPTs indicated this detail in Thai with or without specific heading in their product leaflets. The rate in easy information locating (51%) and the achievement of correct answers (54%) were nearly the same as the rate of the information indication. Some lay users still misunderstood and replied as content/pack instead of components.

(4) Urine preparation (how & optimum situation to collect urine)

It's obvious that this information is one of the factors those affecting the result quality and accuracy. Therefore, many countries (e.g. EU, U.S.A., Australia, etc.) required this information to be cited in the labeling of home-use IVD particularly in the package leaflet because this information needs quite more spacing in labeling.

It was noticeable that the rate of easy finding (46%) of this information and obtaining the correct answers (30%) were found to be only half of its indication rate (80%). Moreover, it was found in 1 worst case of HPT labeling that this detail was cited in Thai under Q&A part but none of the lay users could locate this information.

(5) Steps in testing method or testing procedure

Almost of lay consumers (94%) could give the right answers and expressed as easy finding of this information. Hence, this issue gave least problems to the lay users

as their same rates in information finding and correct answers obtaining. Moreover, the dipping time was easily found by 89% of lay users and 77% could give the right answers. However, some HPTs were found with very small pale print size and drawings on the outer labels which gave some troubles to the users.

Some lay consumers disclosed their troubles about the urine dipping method during the individual interview. They expressed that they were confused with the direction of urine dipping of one HPT (brand V) due to the different shape of urine container between the real attached one with the product (in horizontal shape) and the drawing presenting on the outer label (in vertical shape). Moreover, they specified that they did not know about how deep for urine dipping due to unclear drawing.

For the other example, a lay user expressed about the drawing of test method as "the drawing accompanied with text can enhance the clear contents". For the example of HPT with card type, a lay consumer revealed as **"**The drawing could ease the understanding in testing method. Otherwise, we might get mistake in performing the test because we don't know which well to be firstly urine dropped. There are 2 wells so we might drop the urine in the well with visible line. Some consumers don't know because they usually don't read the labeling."

(6) Optimum Time/waiting time before result reading

The recommended waiting time before reading results was 1-5 minutes.[85] The optimum time/waiting time before result reading was one of the important factors affecting the achievement in the utilization of HPT product. It was found that this information was indicated in almost HPT products (95%). Moreover, the overall result reflected that many lay users could express the correct answers (87%) with quite easy locating this content in HPT labeling (86%). The other noticeable issue was that some HPTs labeling had inconsistencies of reading time range between label and leaflet, and within the leaflet itself.

(7) Maximum time for result reading

The maximum time for result interpretation should be included in the packaged leaflet of HPT product marketing in U.S.A. to ensure the stability of its result, especially for negative result that might turn into positive over time.[78] However, less than half of existing HPTs (40%) specified this information in the Q&A part of their packaged inserts and many of them (89%) encountered with the problems of wrong answers given by the lay consumers after reading their labeling. Moreover, some of them were also faced with the problems of hardly finding (10%)

and inability to locate this information (66%), as respectively. Some worst cases of HPTs were found due to obtaining all wrong answers (100%) from the lay consumers even though this information was cited in their labeling or expressed as easy finding.

(8) Result reading/interpretation

• For the positive (+ve) and negative (-ve) result

All HPTs cited the interpretation of positive and negative result with drawing in their outer labels and package leaflets in both text and drawing. Some of them also mentioned this information on their inner labels (foil). From researcher observation, almost lay subjects had no difficulties in finding this detail and could obtain the correct answers. However, only small amount of HPTs encountered with the wrong answers and the incapability with the difficulty to find these contents by the lay users.

• For the invalid or inconclusive result

The invalid or inconclusive result of HPTs could be found due to the errors in the product itself or in testing by the lay consumers. The appearances of such results were as indicated in the part of content analysis. Generally, this content would be cited in the part of testing result or result interpretation of their leaflets. However, it was found in this study that about one-fourth of HPTs (25%) did not indicate this information anywhere in their labeling. Additionally, more than half of lay users had the problems with this information locating (59%) and comprehensibility (60%).

From the individual interview, the problematic issues about the result reading expressing by some lay users in using trial of one HPT (brand V) and some observation by the researcher were as the follows.

- There was no colour band showed on both control and test line even if the participant strictly followed the use instruction as well as waiting for a period of time as recommendation. Therefore, she criticized that “I could not find any information about the suggestion of further action for this case and I thought that these contents in the labeling are insufficiency. There was no detail how to notice the invalid result and possible result errors e.g. false positive and negative result, etc.”

- A lay user found the fade band on the strip of one HPT (brand V) due to her urine dipping 20 seconds sharply before bringing it out of the urine container as recommendations in labeling. Therefore, she expressed that she got some difficulty and felt unconfident in such result reading.

As the overall result, the problems in finding and comprehension in positive and negative result interpretation were very low whereas such problematic issues in the valid result reading were respectively quite high.

(9) Possible errors or false results of this test (false positive or false negative)

The possible errors or false result of the testing were composed of the false positive result (negative when pregnancy exists) or false negative result (negative when no pregnancy exists). These results might be due to some limitations such as false negative result might occur if the urine was too dilute or with a very early stage of pregnancy, etc.[78] Moreover, the guidelines of many countries (e.g. U.S.A., Canada, and E.U. etc.) except Australia specified only general heading of this content. According to TGA of Australia, the guidelines of home-use IVDs required the package insert to include the interpretation of results that explains the meaning of false positive and false negative results as well as the implications of false results in plain English.[32]

As the result, nearly half of existing HPTs in this study (45%) were found no specifying of this information in their labeling. More than half of lay participants (51%) could not find any information of this topic, and about one-fourth (23%) expressed their finding as the difficult ones. These were nearly 3 quarters of lay users that confronted with the problems in this information locating. As overall result, the correct answers of this information were found less than half of all answers (46%) and were consistent with both easy and hard information locating rate (49%).

(10) Storage and maintenance instructions of product

The product storage condition was one of the important information for lay consumers in their product keeping after buying and before using as recommended by many countries.[13, 14, 18, 32, 38, 55, 62, 65] It affected highly to product quality and performance. The clearly describe proper preparation for storage and storage conditions including the results of improper storage conditions, should be considered to be under this topic.[18]

From table 4.15, the result of the users' inability and difficulty in locating this detail were quite high (43%) and the right answers (64%) were rather low comparing to the indication rate (75%). These results reflected that many lay participants had hard time in locating and giving the right answers.

(11) Sources of further information

This information was actually useful to the lay users, particularly if they had any problematic issues about their product utilization or any other related suspicious matters. Some might further consult about their troubles especially for the unwanted pregnancy. Therefore, it must be clearly indicated in their labeling. Moreover, any styles of the highlight of this information heading were recommended to be the navigate tool in such information finding.[87] However, it was found that many HPTs cited this issue without any specific heading. Hence, the right answer could be the company name or any possible contact channels those specified in their labeling (e.g. address, telephone number, facsimile, email address, etc.).

As a result, more than one-half of the sampling HPT labeling indicated the sources of further information (55%) and could be easily and hardly found by the lay consumers (57%). However, only one-third of them (36%) could give the right answers. The lay respondents gave many answers about this issue such as print materials, consult with physician, clinic and health centre, community pharmacy, name and telephone number of distributor. Many lay consumers could not achieve the correct responses even if nearly half of them expressed as easy finding of such information. Moreover, it was observed that almost HPTs faced with this problem except the HPTs with clear specific heading.

(12) Limitations and interferences of the test

This part intended to detect how difficulties for lay consumers in finding the information of whether the urine of women in different situations or in certain health conditions could or could not be used with this test kit. Most of the manufacturers were found to indicate this content in the part of Q&A (Questions & Answers), and some in the main part of package insert. The two highlighted questions as "Is it necessary to use the 1st morning urine?" and "Can alcohol and any medications affect the test?" were usually found in some existing HPTs marketing in Thailand. However, the responses from lay users would be described as follows.

- **Directly indicated information in package leaflet**

- First morning urine

The 1st morning urine was recommended to be used in HPT testing unless kits indicated otherwise.[85] It was found that nearly half of lay users faced with the problems in finding or inability to locate this information, and about one-third gave the wrong answers.

- After taking the alcoholic

It was found that nearly 3 quarters of lay users (74%) had problems in hard finding and incapability to locate this information which were consistent with the rate of incapable to give the right answers (69%).

- Oral contraceptives, drug incorporated with hormone hCG, and pain relievers with other commonly used medications

According to U.S.F.D.A., the studies of these medications should be conducted by the responsible companies to validate the claim of "no interfering with the test" and they should include this information in their labeling especially in their package leaflets.[78] Moreover, general medicines (e.g. pain relievers, oral contraceptives, antibiotics, and other commonly used medications) were found usually do not interfere with the test.[78] However, certain medications containing the pregnancy hormone hCG (e.g. Profasi, Pergonal, etc.) could affect the result of HPT utilization and lead to the false-positives result.[85]

As the result of this study, the degree of problematic issues in finding (87%, 90%, 92%) and right answering (77%, 82%, 86%) by the lay users of these 3 kinds of information (oral contraceptives, hCG drug, pain relievers) were found respectively very high and consistent with each other.

- **Indirectly indicated information in package leaflet**

- "Before going to bed"

The content about the condition of urine "before going to bed" was not indicated directly in the document and it needed to be implied by the lay users before being capable to get the answers. This information was asked to see whether the lay users could imply the knowledge from the general statement given in the labeling that this test kit could be used anytime. The results in consumer testing of this content showed that many lay users expressed their problems in finding as 83% and nearly 3 quarters of their answers (66%) were incorrect. It's noticeable that even if about a quarter (26%) of the lay users expressed that they could easily or hardly find such contents, the right answers were more than such rate (34%).

- **Non-indicated details in package leaflet (Certain health conditions e.g. miscarriage, ectopic pregnancy, ovarian cysts, etc.)**

There were some circumstances those might interfere this testing and cause some false or irregular results.[78] However, these situations were usually not indicated

in the document of any sampling HPTs in this study. This information was about the status of urine in some different situations such as “miscarriage or given birth in past 8 weeks”, “patients with ovarian cysts or ectopic pregnancy (pregnancy outside the uterus)”, etc.[85] The first condition could give the false-positives result whereas the second situation might bring to unreliable results.[85] The results showed the small amount of rate in locating (0.5-3%) and giving the correct answers (6-11%) which were already described in the above Table 4.15.

As individual interview, the lay users were found not to be usually read the contents in the Q&A part of almost of the existing HPT labeling or might not read it carefully. Many lay users expressed that they usually read only the details on the outer label and in the main part of package leaflet. They did not read the contents in Q&A part because they thought that it might not be important as in the main part.

There was an example of a lay user expression in this study as “I only need to know the result of testing whether I am pregnant or not. I am not interesting to know about the other information especially the contents in the Q&A part”. Moreover, it was found that these 3 kinds of information developed some boring and confusing with feeling of unreliable to the product utilization by the lay users as the following expressions of some lay users as “I felt confusing after reading the limitations and interferences of the test because the contents were too long. It should be as short as they could, and must cover all the needed information. Some details (e.g. the false negative result) caused me worried whether the result is correct or not. Hence, I felt unsure with the result obtained”.

In conclusion, the above results showed that the direct indications of limitations and interferences of the test with simple contents such as “1st morning urine”, “after taking the alcoholic”, and “before going to bed”; were answered more correctly by the lay consumers than the difficult issues such as painkillers, contraceptive medication, medicaments containing the pregnancy hormone hCG, ectopic pregnancy, ovarian cyst, etc..

(13) Optimum time length in HPT strip dipping

This information would be found only in HPT products with dipping type. Hence, it was not included in the above table and figures. However, it was also observed and analyzed in the ability to find and give the right answer by the 90 lay users. About 89% of HPTs with dipping type (8/9) indicated this content in their

labeling. Therefore, the rate of easy finding was quite high (89%) while the rate of right answer obtaining was somewhat lesser (77%).

As the individual interview in some lay users, the result revealed that they preferred the time to be indicated in minutes than in seconds (e.g. “1 minute” is better than “60 seconds”) due to the feeling of faster as the smaller number. As observation in 1 HPT, the lay users were confused with the direction of urine dipping of one HPT (brand V) due to different shape of urine container attached with the product (horizontal) from the drawing presented on outer label (vertical). They specified that they did not know about how deep for urine dipping due to unclear drawing.

(14) Overall findings of all contents for consumer utilization

As the overall findings of all contents for lay consumers’ utilization information of this HPT labeling, the degree of problems found in this study were varied as indicated by the proportion of correct and wrong answers as shown in the above Table 4.15. About one-half of the lay users (52%) could not locate at least one issue of content and another 10% had difficulty in finding some contents. More than half of lay users (57%) made mistakes in answering questions related to contents.

The information that was totally absent from HPTs labeling included ovarian cysts and miscarriage as well as ectopic pregnancy. Other information on HPTs’ labeling with lower rate of presence (<60%) included the limitations of the test in specific situations like “after alcohol drinking”, maximum time for result reading, components, possible false positive and negative result, and source of further information. The product storage, invalid or inconclusive result, contraindication, urine before going to bed, hCG drug, oral contraceptives, and pain relievers had the indicated rate as 70-75%. More than 80% of labeling indicated information related to utilization method as testing procedure, positive and negative result reading, precautions, dipping time, waiting time before result reading, urine collection, and the first morning urine.

On the average, the product buying decision information presented fewer problems in information finding and comprehensibility of users than product utilization information. It was noticeable that almost all of such higher degree of problematic topics was found most in case of unavailability of information on HPTs labeling. However, the contents indicated on the labels with clear specific heading got only little amount of problematic answers or obtained high number of correct answers from the lay users.

2.2.1.3. Overall results of testing on each content topic

In comparison between 6 items of product buying decision information and 22 items of product utilization information except dipping time, the average total score of incorrect answering was more than half of all existing HPTs in this study (52%).

As overall result in 20 selected HPTs labeling quality from the diagnostic testing in 90 lay consumers, the information that could pass the minimum 81% (finding rate x rate of the right answer) as criteria of the Diagnostic testing were product trade name (82%), testing method (91%), and positive (88%) with negative (89%) result reading. The other contents were below the above criterion and had the score 0 % to 78 %. The group of lower score was found most in the information of test limitations particularly the certain health conditions, some medications, contraindications, maximum time in result reading, etc. which were consistent with the above mentioned analysis.

2.2.2. Testing for lay user perceptions on existing HPT labeling

The lay consumer perceptions about the document characteristics of labeling were evaluated on 3 aspects (perceived design quality e.g. print size, print quality, lines spacing, organization of information, attractiveness, clearness of contents, and the benefits of drawings; perceived utility e.g. how personally relevant or useful the information was, and perceived comprehensibility e.g. language, how easy or hard to read and understand the information, etc.)[30] and part of overall opinions of this section. The perception on all aspects was measured by 3 Likert's Scale with "0" for "poor", "1" for "fair, and "2' for "good" quality. The testing for perceptions of lay participants was performed in the following aspects.

2.2.2.1. Perceived design quality

The average % reading was compared to average overall perception of the lay users in design quality and it was found that their average means were quite consistent with each other but % average design quality between fair and good perception were opposite. There were lower average score in good perception than the fair one for reading. The results of consumers' perception in design quality were as follows.

Table 4.16: Lay user perceptions on design quality of existing HPT labeling

design quality (0-2)	perceived design quality (0-2)								average % (f)	read % (f)
	print size % (f)	print quality % (f)	lines spacing % (f)	info. org. % (f)	line length % (f)	attract ive % (f)	info. clear % (f)	drawing benefits % (f)		
poor	32 (29)	7 (6)	22 (20)	5 (4)	22 (20)	29 (26)	4 (4)	1 (1)	15 (14)	6 (5)
fair	9 (8)	53 (48)	15 (13)	54 (49)	16 (14)	23 (21)	59 (53)	38 (34)	33 (30)	68 (61)
good	59 (53)	40 (36)	63 (57)	41 (37)	62 (56)	48 (43)	37 (33)	61 (55)	52 (46)	27 (24)
Mean score	1.27	1.33	1.41	1.37	1.40	1.19	1.32	1.60	1.36	1.21

The average score of each design quality factor was quite nearly the same which ranged from 1.19 to 1.60. The attractiveness of labeling got the lowest score at 1.19 then print size, information clearness, print quality, information organization, line length, line spacing; and the drawing benefits obtained the highest score at 1.60.

As the lay consumers' perceptions, all aspects of design quality in HPTs labeling had encountered the poor quality responses with very high poor quality feedback on print size (32%) and attractiveness (29%). These 2 aspects also received the 2 lowest average score (1.27, 1.19). Moreover, the quality of lines spacing (22%) and line length (22%) also got high poor quality responses, but they also received the top 2 highest good quality feedback (63%, 62%). The other characteristics of design quality (print quality, information organization, information clearness) got very high rate in fair quality.

In-depth evaluation revealed that brand V was the only existing HPT labeling that lay users expressed their negative perceptions in all 8 aspects of design quality. It was the locally manufactured product that about half of complaints from the lay consumers were too small print size of the contents in Thai labeling. However, some HPTs (7/20) were the examples those correspondingly found to have good quality and no poor design quality in the lay users' perceptions. The results would be as follows.

(1) Print size (Poor/fair/good = 32%: 9%: 59%; mean score = 1.27)

Almost all dipping HPTs (8/9) except brand S, and about half of the card type (5/11); were perceived by the lay users as too small print size. The total mean score of this aspect was near the border line (1.27) and lower than the average mean score.

Comments from some lay users in this study were as follows

- "The print size and spacing of the information on the main and side labeling of the outer package were too small and hard to read. Hence, they should be

enlarged. There was no need to emphasize in labeling the trade name on several places of the outer label. Moreover, the print size of such trade name could be smaller on the main part of the outer label because it was also cited in the package leaflet. Why do they have to specify it again on the box side?"

- "The print size was very small and pale on the outer label. The larger print size could ease the labeling reading for customers especially the adult and the ones with poor eye-sighted."

- "The important information had to be in proper print size and easy to read."

- "The test method, result reading, and precautions of this HPT kit are the key contents for users to know. Hence, they are in proper print size. For the details in Q&A part, the users might choose to read only the significant because such information might or might not be interesting to the users."

(2) Print quality (Poor/fair/good = 7%: 53%: 40%; mean score = 1.33)

A qurter of selected HPTs' labeling (5/20) were found to have problems and the mean score of the print quality of selected HPTs labeling (1.33) was nearly the average mean score (1.36). Only 7% of lay users perceived poor quality on this aspect whereas about half of lay users (53%) expressed as the fair quality. As investigations during consumers' testing, the printing colour on the outer label of brand V was several times come off with the plastic covering during the packaging unwrapping of its packaging. However, some comments with the expressions of the lay users about the print quality of HPT labeling were as follows:

- Too much design and indication in labeling product trade name

"Its printing quality was not good and the HPT trade name should be written in their normal style of alphabets. The presentation style was hard to read. The HPT trade name was labeled in too several parts on the outer label."

- the highlight or bolding

Heading should be highlighted and bolded, otherwise it might not be interesting. However, it had to be careful not to overdo highlight. A lay user expressed that "This labeling has the good print quality because only the titles were emphasized and the other contents were in normal prints. The bold prints of all details might compromise information interesting. Each section should be numbered because

the user will not read all the details at the same time. Sometimes we might firstly read only the heading and selective read details of interested section only."

The other lay user commented "The precautions of this product are easy to locate due to its clear visible titles".

- the print colour or printing clearness

Some lay users perceived as the good print quality due to their preferences in the eye-catching colour for HPT product. However, some lay participants perceived in many HPTs labeling as very pale print colour. Many lay users expressed as

"I perceived that this labeling was the good print quality due to the clearness of the print face."

"The print colour (blue) was too pale and reflecting so it was hard to read. It should be the black or dark blue print on the white background."

"Besides the pale, crowded, and very small print size on the outer label, the small and pale print face in the Q&A part of package leaflet could lessen the lay users interesting to read such document."

"The printing of reflective blue colour caused difficulty in reading. It should be the black prints on the white background."

(3) Lines spacing (Poor/fair/good = 22%: 15%: 63%; mean score = 1.41)

A lay user evaluated a label as fair for line spacing, somewhere was too wide and some places were too narrow. She also told that "the large line spacing led to easy reading and the narrow one caused the difficulty in reading".

The mean score of this aspect was 1.41 which was slightly higher than the average mean score of design quality of the lay users' perception (1.36). However, consumers revealed that line spacing of labeling were narrow in somewhere and not narrow in someplace. She pointed to the side of the package and said "here is narrow". Then she pointed to the title "Instructions for result interpretation" in the package insert and stated "here is not narrow". Moreover, she disclosed the effect of the narrow line spacing as "I don't feel like reading the labeling because it's too narrow line spacing and too much information. I'm lazy to read and will not read. I feel that there is no need to read and it's better to read only the test instructions and results from the testing. It will be easier to read if it's not undersized. The fewer number of lines make it faster to read. However, it depends on individual opinion."

Some lay participants revealed that the narrow line spacing (e.g. in Q&A part) affected negatively the users' intention to read. The comments were, thus,

discouraged to read all but selected the contents necessary for product use, i.e. test method and result reading. However, some of them expressed that the proper line spacing could ease their reading and comprehension due to its small amount of contents and their time saving in labeling investigation. A few lay users told that the HPT labeling was fitting because of their appropriate line spacing and format.

(4) Information organization (Poor/fair/good = 5%: 54%: 41%; mean score = 1.37)

The mean score of this aspect was the same as average mean score. As lay consumers' perception, the examples of sequencing in the information organization of HPT labeling were expressed as following details.

- The labeling information was in order as the degree of their importance (e.g. the test method following by the test result, etc.).
- The lay users regularly do not give any attention to other details except the test instruction, result reading, precautions, expiry date, and its lot number.
- They could understand and recognize information related to the test method after reading.
- Some lay users suggested for the easy of reading by beginning with test method, and respectively followed by the result interpretation with the precautions which was consistent with a lay user expression as "The information is organized in proper ordering started with testing method, the result reading, and precautions.".
- Lay consumers had proposed some examples about the precautions to be emphasized on the outer label as "Carefully read the instruction manual before using this test kit", and "Improperly reading could lead to information misunderstandings", etc.
- Some lay users recommended that the precautions should come before the test method to inform about the conditions under which the test kit should and should not be used, the causes of false result (e.g. negative or undetectable result due to deteriorate strip, etc.) and further action (e.g. retest, etc.).
- The information about the manufacturer should be in the last part of package leaflet due to its irrelevancy to utilization.

The sequences of information suggested by some lay users were as test instruction, result reading, and precautions. However, some had suggested that the

precautions should be placed before the test method and result interpretation. Their reasons were that the precautions might not be read if they were placed last. She further explained that the lay users usually only want to know about the test procedure and the test result.

(5) Line length (Poor/fair/good = 22%: 16%: 62%; mean score = 1.40)

The overall result about the line length showed higher mean score (1.40) with about one-third of lay users (38%) scoring poor and fair answers. Some expressed that the appropriateness of labeling was due to its conciseness. Some suggestions from users were as follows:

- Few words with better information explanation (in the main part of leaflet) was preferred to the longer sentence with greater burden by the difficulty to comprehend such contents (e.g. details in the Q&A part, etc.).
- Some lay participants proposed that the short clarification of contents was easy to comprehend and the long one might be appropriate for the complexity details that were hard to understand.

Another consistent comment of the lay user to confirm the proper line length was "The line length is proper and not too long. It could be understood directly after reading. If it is short but complete meaning, it will be better than the long ones but hard to comprehend". However, a lay user gave an interesting opinion as "The proper line length of this HPT labeling was due to its easy to understand after reading. The contents about what to be done are cited in details with short and easy to comprehend. Nevertheless, the knowledge information should be in longer sentence and it could be the benefits for the students in making their report about this health product".

(6) Attractiveness (Poor/fair/good = 29%: 23%: 48%; mean score = 1.19)

This aspect was perceived by the lay users as the most problematic issue in design quality. More than half of their perceptions were poor and fair attractiveness. There were both negative and positive comments. The example of negative one was "I couldn't imagine the kind and the benefits of the product from the front side of its outer label. We will not know that it is HPT until we turn to see at its back part". However, the optimistic expression was **"**This product labeling is interesting. It seems to help the teenagers who intended to diagnose their pregnancy but be ashamed. This type of product makes them dare to buy for their individual utilization. It's better than go to see the physicians."

The lay users perceived with the essential of labeling information so they suggested that it must be developed to be more attractive to motivate their reading. A lay user suggested for the more attractiveness of the labeling by improving the colour and the picture on its outer label to be more sparkle looking. The other recommendations were that the colourful result drawings could be interesting due to their effects on the ease of the reading. A lay consumer expressed that it's attractive because she could learn much from this labeling and expected her ability to recommend to the others. The product benefits, the importance of each kind of content were also the attractive points expressed by the lay consumers.

The other noticeable issue was that many lay users didn't give any attention to the contents in the Q&A part. One reason was that some of them thought that it's not important information so it was not cited in the main part of the leaflet. This result could be supported by another comment of a lay user expression about her interested issues in the labeling. She specified as "I was interested in testing method and result reading, precautions, and benefits of this product. I do not concern to the details in the Q&A part." Moreover, some of the lay users said that they were interested only the test method and its test result as well as precautions, not the other details (e.g. contents in the Q&A part, etc.).

(7) Information clearness (Poor/fair/good = 4%: 59%: 37%; mean score = 1.32)

Information clearness involved the support factors, kinds, and places of information labeling to promote the lay users understanding. It got the highest fair rating among all aspects and the second lowest poor quality. Its average mean score was close to the average of total mean score. However, the comments of some lay users were quite positive than negative. A positive comment from a lay user was "The information in this labeling is clear due to additional knowledge obtained from it; the complete details in each topic were well comprehended after reading this labeling".

Other comments from this rating fair quality on this aspect involved the kinds and places of information labeling as follows.

- "The information in the test method with its results and the precautions was clear, whereas the Q&A part provided ambiguous information. An example is that the labeling talks about the hormone hCG which some lay users don't have any knowledge of it. Hence, some might guess without any reference while a few could identify that it's about the pregnancy."

- "The information on this labeling is clear because they specify the testing method and its result interpretation."
- "Some parts of information on this HPT labeling are clear and some are unclear. The unclear detail is whether the dark blue colour result as stated in the labeling is actually the dark blue colour or the blue colour. The clear one is if pregnant, there will be 2 bands (blue and red colour); but if not, the single band will be seen. This clear description makes it easier to understand. Therefore, the testing procedure and the result reading should be emphasized and made clear."

It's noticeable that a lay consumer judged for the clearness of one HPT labeling by their numbering for each step to ease her reading. However, many lay participants criticized the ambiguousness of the contents as follows:

- some details except test method had to be read several times to comprehend (e.g. product characteristics, etc.)
- confusion in the part of result reading, including using the inconsistent colour bands between texts and drawing, unclear explanation for invalid or inconclusive result reading
- too much scientific or technical terms especially in the Q&A part (e.g. what is hCG?, etc.),

Some suggestions by lay users to improve content clearly included:

- the information clearness should be specially paid attention to test method and result interpretation
- use lay language particularly for test method and result reading
- the best time for urine collection should be directly indicated

(8) Drawings or table benefits (no/some/much = 1%: 38%: 61%; mean score = 1.60)

The result showed only 1% of lay users rated poor measuring as no useful of the drawings in existing HPTs labeling of this study. They were perceived as containing some benefits by one-third and much benefit by two-third of lay consumers. While the overall mean score of drawing was the highest comparing to other attributes, the low scoring could be explained by its poor quality of figures. The reasons of its benefits and supported expressions of lay users were as the follows:

- Users explained during the individual interview that drawings or tables in HPT labeling were important and useful because of the following reasons:

- They could better explain in more details and lead to more understanding than text only.

- They could better communicate to product type and the lay users expressed that their ability to recognize HPT product after seeing its drawing.

- They could improve the user comprehension to ease and ensure their HPT product utilization. Otherwise, they might get error in dropping into the wrong well of card type HPT and could not obtain the correct result. Therefore, carefully reading the labeling should be performed before testing.

- They could encourage the lay consumers to utilize the HPT as the recommendation in labeling before consulting any physician.

- The above advantages gained from such figures could be confirmed by some notes of the lay user as follows.

- "They could fairly help in HPT utilization because the texts with the drawing illustrating 3 drops of urine in the test instructions would provide her better knowledge in product utilization. Otherwise, she might drop the urine in rectangular hole and got the mistake in test result due to dropping in wrong place."

- "They ease the understanding of the directions to use. Otherwise, we might perform the test incorrectly because we have no knowledge which well to drop the urine. There are 2 wells and we might drop in the wrong well. Most of lay consumers do not read the labeling so they will not obtain the correct result. We must carefully read its use direction before doing the test."

2.2.2.2. Perceived utility/ contents (no/fair/much = 17%: 25%: 58%; mean score = 1.41)

Table 4.17: Lay user perceptions on utility/content of existing HPT labeling

Utility (0-2)	perceived utility (0-2)				average utility % (f)	overall utility % (f)
	complete % (f)	sufficient % (f)	valuable % (f)	reassure % (f)		
no	43(39)	23(21)	2(2)	1(1)	17(16)	4(4)
fair	25(22)	7(6)	38(34)	31(28)	25(22)	52(47)
much	32(29)	70(63)	60(54)	68(61)	58(52)	43(39)
average mean	0.89	1.47	1.58	1.67	1.41	1.39

Owing to the Diagnostic Testing, this part was taken to evaluate how complete, usefulness, sufficient, and reassure of information provided in HPT labels and leaflets for the 1st time of HPT utilization. According to Krass Ines and colleagues, the quantity (completeness) and usefulness (valuable) scores were

summed to create a summary utility score for each topic.[30] The adequacy and the reassuring of the information in HPTs labeling was also reflected by the lay consumers to confirm their usefulness. Hence, they were also included in calculation to obtain the average utility.

The average percentage of problematic issues in HPT information utility was expressed by nearly one-fifth of the lay users (17%). Almost of selected HPTs labeling (17/20) were perceived by nearly half of lay users (43%) to be incomplete in HPT supplied information, but only about half of HPTs (11/20) were found by a quarter of lay people (23%) as insufficient information. Nonetheless, their no reassurance and no usefulness were respectively expressed by the lay users as 1 and 2%. Moreover, the mean score of information completeness (0.89) was only somewhat more than half of the perception on adequacy (1.47), information value (1.58), and reassuring (1.67). The details in their quantity with adequacy, and valuable with reassuring were as follows:

(1) Information quantity and adequacy

It was found that both % and mean score of the perception on incomplete information was about half of its insufficiency, invaluable, and unreassuringly.

The example of a lay consumer expression about the information sufficiency was “It is enough because I think that the purchaser might not be much interested in any other details except the test method and its result of whether she is pregnant or not. Only these 2 kinds of contents might be already enough. Nevertheless, it must contain all information for the completeness of good packaging.” In addition, she also gave an opinion in the issue of information quantity as “The contents are complete in my perception because there are lot number, expiry date, test method, and result interpretation. I think that it’s already complete and enough for the consumer.”

In regard to information sufficiency of HPT labeling, many lay participants expressed their intention to read only the test instruction and result reading, and some of them revealed their needs in reading some more contents (e.g. the test instruction, result reading, precautions, expiry date, and its lot number) as the follows:

- They only needed to know the result of testing whether they were pregnant or not. They were not interested to know about the other information especially the contents in the Q&A part.

● They could read and test as well as directly get the result. If they had any inquiry or additional information, they could contact to the phone number as indicated in the labeling of such HPTs.

● The supplied information was clear enough for them to conduct the test, and the test result was actually correct.

In-depth analysis across HPT products illustrated that contraindications, possible error, precautions, invalid or inconclusive result, storage, components, urine sample preparation, HPT type, manufacturing date with expiration date were among information choice found to be insufficiency in more than half of HPTs as following:

- **contraindications**

The contraindications which focus on the risk assessment was considered by the lay users to be most hard finding and lacking in labeling information supplied.

- **possible error or false results or its sources**

This information was expressed by most of lay participants that it's hard or unable to locate. A lay user specified that she couldn't locate this information and further suggested for additional details in the labeling as "If the result obtained is not the same as recommended in the labeling, it might be that this test is already expired or kept in improper storage condition. Hence, the new one of test kit should be taken." The other one also asked for supplementary information as "If the false result obtained in case of red band occurred only at "T" and none at "C", it might be due to the decomposed quality of the test kit."

- **precautions** e.g. user conditions before using HPT
- interpretation **of invalid or inconclusive result** e.g. the case in lighter intensity test line than the control line, only test line or no band, etc.
- **storage**
- **components**
- **clear instruction of urine sample preparation, manufacturing date with expiration date in Thai**

The manufacturing and expiration date were expressed by a lay user as "The expiration date let us know about its inappropriateness to be used whereas the manufacturing date help us in assuring its effectiveness to be used."

- **HPT type** e.g. dipping or card type

The other evidence supported their adequacy was the quoted answer of a lay user as “The information in HPT labeling was sufficient because the customers were generally not interesting to read the label and package insert. They expected only the test method and its test result. Their intention in buying the HPTs was only to know whether they were pregnant or not. Most of the consumers would not read in many details as asking in this questionnaire. In case of the product packaging producer, the complete specifying of this information should be labeled in the HPT labeling.”

(2) Information valuable and reassuring

The valuable and reassuring of the information were perceived by the lay users at high as much and fair answers. Their average mean scores were respectively as 1.58 and 1.67 which could confirm their good information quality and usefulness. Moreover, the mean score of information helpfulness (1.58) of the existing HPTs’ labeling was quite consistent with the mean score of overall rate in their usefulness (1.41). It’s noticeable that their expression rates in no helpfulness (2%), no reassuring (1%), and no usefulness (4%) were respectively compatible with each other. The examples of lay users’ expressions in such answers were as the follows.

- **For the information usefulness or its helpfulness**; some cited for only some valuable whereas some specified as much helpful. When asked about the helpfulness of the labeling or how valuable the labeling information is; the same contents, test method, result reading, precautions, and illustrations were consistently brought up by consumers as valuable contents. Besides, some commented the value of the labeling in general as “They help much by first indicating as reading carefully before testing and the test method. They give us more knowledge about the product before using such test and lead to the convenience as well as fast testing.” However, the reason of the lay users expressing with somewhat valuable information was due to the unclear information in some contents. In addition, a lay participant with answer as some helpfulness specified as “The result about possible error as the inconclusive result such as no band appearing or only single pink band at “T” position, etc.” These statements could also confirm the lay consumers’ attentions to the test method and its result reading as their examples.

- For the information reassuring, a lay user expressed as “I feel reassuring in this HPT labeling due to its accuracy claimed as more than 99.9% which is nearly 100%. Moreover, I got the proper result after my trial in testing. For

example, the pregnant women should know their circumstances of pregnancy. If they obtained the results of red band at the position of T, such result is reliable." However, the other lay participant gave both reliable and unreliable details as "Its test result and precautions seems valuable. However, I feel reluctant because the product type could not be identified from the outer label. Its front part should be also labeled in Thai along with English content because someone might not understand English details."

2.2.2.3. Perceived comprehensibility (Hard/fair/easy/others = 3%: 63%: 34%) (mean score = 1.31)

The labeling comprehensibility was reflected by the consumers ability to be consulted about how easy or hard the label and leaflet of this HPT was to: read, understand, locate (to find important information), and remember such information and keep for future reference.[30] Nevertheless, the evaluation about keeping such document was not measured due to HPT was a single use product. The average mean % of perceived comprehensibility and % perceived comprehended items (amount of uncomprehending items) were compared to see whether there was any difference.

Table 4.18: Lay user perceptions on comprehensibility of existing HPT labeling

Comprehensibility	perceived comprehensibility (0-2)				average mean %	% perceived comprehended items
	find % (f)	read % (f)	understand % (f)	remember % (f)		
hard	3 (3)	6 (5)	1(1)	1(1)	3	2 (many)
fair	61 (55)	68 (61)	69 (62)	56 (50)	63	43 (some)
easy	36 (32)	27(24)	30 (27)	43 (39)	34	55 (no)
average mean	1.32	1.21	1.29	1.42	1.31	1.53

(1) Comprehensibility issue

From the above table, the mean percent of problematic comprehensibility of lay user in HPT labeling was rarely found in this study (3%) which was consistent with the rate of many items of uncomprehending information (2%) expressed by the lay users. Almost of the lay consumers (>95%) expressed as the easy and fair finding, reading, understanding as well as memorizing all the contents in these HPTs labeling. However, the rate of fair answers was a half to twice higher than the easy ones which reflected for the average fair quality of the existing HPTs labeling (1.31).

The following examples were the quoted statements of lay users' perceptions

- **Finding**

"The information finding is fair. The ones with hard to find are such as the small prints on the outer label and the contents in Q&A part. The easy finding one is

the heading of the test method with some emphasizing. However, the blue highlight of such title should be changed to be more attractive. It should be altered to the other colour. The using of black colour is also not appropriate."

"It's hard for me to locate some information because I couldn't understand after reading it. Hence, I have to reread and try to understand in such content before finding. For the easy finding, they have clear visible headings and prominent prints."

- **Reading**

"This labeling is fair to read. Small print size on the outer label and its trade name originate some difficulty to read such labeling. The alphabets in such trade name are written in incomplete style. It should be in full English prints e.g. "P" and "R" must be in ordinary alphabet and shouldn't have space between them."

"Some contents on the outer label are hard and some are easy to be read. Small prints and pictures' colour with their background cause them hard to be read. Therefore, the colour of such pictures should be changed and the alphabets should be clear written."

- **Understanding**

"The contents in Q&A part are hard to realize and test method is easy."

- **Memorizing**

A lay user expressed as "This information is easy to remember because its wordings are comprehensible. The examples of such information are as 3 drops of urine; observation of colour change (blue and red colour if pregnant, and single band of red colour for non-pregnant). These terms are easy to understand due to its lack of complexity for the purchasers."

A lay user cited as easy to remember this information and she revealed her technique in memorizing as "It's easy to remember the test results. Two colour bands refer to the result as pregnant because it means that I have someone to stay with. The single band can represent to staying alone so the result is non-pregnant. The factors affecting my easy memorizing are the colours and the amount of bands."

A lay user expressed her perception as fair memorizing "The contents in Q&A part are hard to comprehend. The test method and the result reading as well as the precautions are the easy ones."

(2) Incomprehensibility issue

The problematic incomprehensibility issues were expressed by about nearly half of the lay users (45%). The examples of incomprehensible issues were as follows

- hard to locate necessary contents and some incomplete explanation
- simple words should be used
- details on outer label were mostly in English which couldn't be understood e.g. control region, patient test region, etc.
- many words or contents confused reader e.g.
  - knowledge about hormone e.g. hCG, A.P.L., Pregnyl, etc.
  - Alcohol drinking, medication affect the test
  - some information were not necessary e.g. CICA technique
  - "principle of immunology" should be clarified, otherwise no need to be specified
  - "manufactured under technology of San Diego Biotech" was communicated in style hard to recognize and some might unable to understand the contents about "unable to interpret" or "inconclusive result" (no highlight as positive and negative result)
- Thai translation of "Is it necessary to use the first morning urine" or "the necessary to use urine at anytime"
- product storage e.g. "keep at temperature 2-30 °C" was presumed as "storage in refrigerator"
- urine collecting: too small amount of details, different figure shape of urine container on outer label & actual one
- contents in test method:
  - "wait for 5 minutes before result reading" refer whether "to remain the strip in urine for 5 minutes before result reading" or "get the dipping strip out of urine and leave it for 5 minutes before result reading"
  - dipping time must be cited due to vague figure of dipping method
- result interpretation: the absorption of blue line as specifying in the package leaflet should actually be pink line as observing
- "contraindications"
  - unclear indicating for contradict conditions
  - "Would it be possible for this HPT to give the wrong result?"

- don’t know about specified drug name contradict to the test
- medicinal name incorporate hCG should be cited in Thai

● Further actions for negative result (single band) and false positive result e.g. “what to do if the result show single colour band (negative)?”

● Question and Answer (Q&A) part

- content about the meaning of pink band on control line, hard finding in test method, error result, precision
- some contents needed several times in reading to understand e.g. this test can detect the result 1-3 days before missed period, negative result (should clearly indicate about the case of only one blue line appears)
- false error and waiting time as well as maximum time in result reading should be in the main part of package leaflet

2.2.2.4. Overall opinions

The overall opinions of HPTs labeling in reading, understanding, and utility between dipping and card type were illustrated in the following table.

Table 4.19: Perceptions and problems in overall opinions of existing HPT labeling quality

HPT type	no. lay users with problems in overall opinions (poor/fair/good) (mean score) (0-2)			total lay users (poor/fair/good) (mean score)
	reading	understanding	utility	
1. dip type				
44 lay users	11/24/9 (0.96)	6/24/14 (1.18)	2/24/18 (1.36)	19/72/41 (1.17)
9 HPTs	5/9 HPTs	4/9 HPTs	2/9 HPTs	
problems	hard for one without English knowledge & due to small print	some contents confuse lay user	rarely in storage, contraindications, precautions, possible errors	
2. card type				
46 lays	6/25/15 (1.2)	6/27/13 (1.15)	2/23/21 (1.41)	14/75/49 (1.25)
11 HPTs	4/11 HPTs	4/11 HPTs	2/11 HPTs	
problems	• some hard e.g. technical term that no need to know • easy due to standard print size and proper line spacing	some content confuse lay user	• need simple details (some contents no need to know) • doubtful details (e.g. result reading, Q&A, etc.) lessen its utility • much due to convenience in using, easy access for ones who dare not see doctor, etc.	
3. total				
20 HPTs	17/49/24 (1.08)	12/51/27 (1.17)	4/47/39 (1.39)	33/147/90 (1.21)
90 lays	9/20 HPTs	8/20 HPTs	4/20 HPTs	

The result of lay users' perceptions or consumer raters in the overall opinions of HPTs labeling were found more positive about the leaflets comprehensibility (1.17) and usefulness (1.39) than the ease in reading (1.08).

It was noticeable that the numbers of "fair" answers in this part of lay consumers' overall opinions were quite high comparing to the "poor" and "good" answers in all aspects. This could be interpreted that the quality of selected HPTs labeling in overall perceptions of the lay users had mostly fair in reading, understanding and somewhat utility; whereas somewhat difficulty and usefulness.

According to the average total mean scores (1.21), the problematic degree of selected HPT labeling was at risk in the lay consumers' perceptions. The dipping (1.17) and the card type HPT labeling (1.25) were found to have somewhat the same problematic level. The utility (1.39) was expressed by the lay users as quite superior comparing to the aspects of reading (1.08) and understanding (1.17). It's noticeable that the perceptions about information reading of lay users in dipping type (0.96) was quite lower than the card type (1.2) while the other 2 aspects were almost the same.

As overall opinion, a lay user noted about the reading as "Some information is difficult and some are easy to comprehend. The example of the hard one is the small alphabets on the outer label and its trade name is difficult to read. It's written in unstable style, the alphabet should be in full prints. For instance, there should not have any space between the letter P and R. Moreover, the picture's colours of couple of man and woman on the outer package should be changed." For the example of a lay consumer's note comprehensibility issue, it was "Some information is difficult and some are easy to comprehend. The hard one is such as the contents in Q&A part and the easy one is such as the directions for use." However, an example of a lay person's statement about her overall attitude of the HPT labeling was "It has much utility due to its necessity. Totally, the teenager should use this kind of product if they are not sure whether they are pregnant or not. The HPT kit could help them in more facilitating than seeing the physicians or going to the hospital. If they have strong willing to test, they could know the result only in 1 minute."

2.2.2.5. Conclusion on user perception evaluation

(1) Problematic issues

As the overall quality of HPTs labeling, the lay users' perception of poor quality found from this study in all aspects for the existing HPT were varied as

• **Design quality** (14%) e.g. attractiveness, too small and pale print size, poor line length and lines spacing, etc.

• **Labeling utility** (17%) e.g. incomplete and insufficient details in some contents such as contraindications, expiration date, false errors, etc.

• **Comprehensibility** e.g. hard to find (3%) and remember (1%), etc.

(2) Consumers' recommendations

The examples of lay consumers' suggestions for further improvements were as

• **Design quality** e.g. need larger print face with some highlight and clearer information presentation, Thai translation due to their poor English, etc.;

• **Utility** e.g. more details in contraindications, precautions, possible error or false results, result interpretation, expiration date in Thai, etc.; and

• **Comprehensibility** e.g. Thai labeling of all contents was needed to facilitate their information finding and understanding.

2.2.3. General perceptions on labeling

2.2.3.1. Information necessary for using HPT

Table 4.20: Needed labeling information expressed by the lay users (Phase I)

No.	needed contents	% no. (f)	remarks
1	test method	88.9 (80)	
2	precautions	75.6 (68)	
3	possible error	70 (63)	
4	storage	58.9 (53)	
5	manufacturer & address	58.9 (53)	
6	others	20 (18)	e.g. expiry date, manufacturing date, lot number, content/pack, intended use, compositions, adverse reaction, price, etc.

These requested details were perceived as necessary by users. Before reading the labels and package leaflets, the subjects thought that the details of testing procedure, precautions, possible errors, storage instruction, manufacturer, and address as well as telephone number; were the necessary information required to facilitate the utilization of home-use medical devices. The possible errors were such as false positive, false negative, invalid result, etc. It was obvious that all of these contents were directly necessary for the HPT product consumption. Fewer subjects concerned about information related to purchasing decision. The examples of such details were expiry date, manufacturing date, lot number, content/pack, intended use, compositions, adverse reaction, price, certificate approval, result reading, clear Thai contents, more details, test kit characteristics, etc.

When asked about general searching on labels and leaflets of these necessary information, most of lay consumers (87%) expressed as easy locating whereas nearly one-third of them (31%) could not find some information and almost a quarter (22%) specified as hard to find some details.

It was noticeable that most lay users suggested the testing method to be the most necessary contents for using all 20 HPTs. This information was easiest found by the lay consumers and none of HPT products was perceived as difficult finding on the test method. Moreover, possible errors, precautions, storage and other contents, were information perceived as hard and not capable to be found by lay persons.

2.2.3.2. Comparison and explanations of lay consumers' most attractiveness before and after testing

Table 4.21: Comparison of lay user most attractiveness on existing HPT labeling before and after testing

Aspects of information	most attractiveness before & after testing				remarks
	before		after		
	no.	%	no.	%	
contents/details	22/90	24.4	35/90	39	after e.g. test method, result reading, Q&A part, result, suggestions, intended use, precautions, all details, etc.
result figures	22/90	24.4	18/90	20	of test method and/or result reading
labeling format	15/90	16.7	6/90	7	outer label
label advertising	7/90	7.8	7/90	8	on outer labeling
easy language	6/90	6.7	3/90	3	after: test method & recommendations
package colour	7/90	7.8	2/90	2	
print size	4/90	4.4	2/90	2	
HPT trade name	3/90	3.3	2/90	2	brand B, brand P, brand Q, brand W
none/no reaction	0/90	0	2/90	2	
others	4/90	4.4	13/90	15	after: e.g. product characteristics, result efficiency, satisfaction, Certification mark, advertising picture, etc.
total	90/90	100	90/90	100	

There were varieties of most attractive information expressed by the lay consumers. The test method was the most impression expressed by the lay users before and after testing. The drawings of test method and/or the result reading were expressed as the 2nd impression. However, some of the lay consumers expressed as no any impression but one of them gave different reason from the others as all important information. The other impressions had already illustrated in the above table.

The contents those the lay users mostly specified were as the test method and its results reading. They cited about the benefits of such contents and its easy

language that make them clear and easy to understand. According to the drawing of test method and the result interpretation; the lay users specified that such drawing could reflect its use, and increase understanding as well as result convincing. It was noticeable that the attracted trade name involved the women e.g. “Sofia”, “pretty”, etc. In addition, design quality of label and leaflet was among most attractive aspects perceived by lay users.

2.2.3.3. Additional needed information, product image, and proposed opinion of lay users about HPTs labeling

There were respectively about 31%, 12%, and 39% of 90 lay consumers proposed for further details, product image, and proposed opinions to manufacturer. The product image was emphasized most on design quality while the proposed opinions and the additional details were highlighted most on contents. Their suggestions about HPTs labeling quality were as follows.

(1) Additional information: clearer result reading, test limitations, and HPT type

(2) Product image:

- interesting to use
- suggestions for
  - clearer presented as HPT or better symbolic by picture on label
  - smaller pack size to easy handling & make less shy to buyer
  - brighter, nicer package
  - enhancing better image by more details

(3) Proposed opinions to manufacturer

- **Design quality** (38 items) e.g.
  - print face and print size (14)
    - need bigger print face with darker colour and easier legible Thai print face e.g. expiry date, producer name, storage, etc., especially for adult and poor eye vision lay users
    - more attractive and clearer prints
  - heading or emphasizing (3) e.g.
    - hard finding due to no specific heading with reflecting text colour, no stress heading

- specific heading better than in Q&A for easier information locating (e.g. possible error)

- drawings and table (8) e.g.

- need interesting drawings and distinct colour of drawing to separate from text

- helping in more understanding than only texts

- labeling design (8) e.g. factors to improve the uninteresting

- more attractive of picture on outer label should reflect HPT product e.g. picture of pregnant woman for better symbolism

- shouldn't have the format of Q&A part

- brighter colour of packaging

- clearer colour of drawing and print face in leaflet to separate from other texts e.g. brighter colour of result reading, clear colour bands of positive and negative result

- too small line spacing (2) burden the reading

- information organization (1): test method should be before "recommendation"

- **Contents/utility** (94 items)

- indicating all relevant issues and more details needed in using HPTs to add its utility (4)

- some boring contents (1)

- need more emphasizing for the contents in labeling (1)

- HPT name (1) e.g. correct English alphabet with Thai version to ease the Thai reader

- HPT type (1)

- components (3)

- amount/pack (2)

- product storage (9) e.g. clearer temperature

- urine collection (4) e.g.

- need more details

- too small urine container

- directly or precise specifying the best time duration for testing

- "precautions" (15) e.g. clearer indicating of proper using conditions

- result reading (12) e.g.
  - inconsistent indicating of result reading time
  - maximum time in result reading
  - emphasize drawing > text
  - result reading for single band on test line & no any band
  - need clearer and colour result reading
  - need more details
- "contraindications" (12) e.g.
  - incomplete explanation and unclear should be improved
  - affected medications and health conditions
  - clear examples of medications with hCG hormone affecting the test result
  - clearer citing of optimal health conditions for testing e.g. after alcohol drinking, etc.
- more details about possible error/false result (13)
- the manufacturing date should be specified for user to notice the product quality (4)
- clearer indications about the expiry date (3)
- name of producer/importer in Thai for lay users with poor in English (6)
- test performance e.g. expecting of 100% accurate result (1)
- emphasize further action after obtaining the negative result to ensure correct outcome (1)
- clarifying the meaning of "glycoprotein hormone" (1)
- indicate names of all countries sold this HPT (1)
- maximum age of user (1)
- risk information e.g. adverse reaction, etc. (2)

• **Comprehensibility** (11 items)

- need Thai translation of all details, more Thai contents on outer label, and English with Thai translation/ writing as English accent for easier understanding by lay users, Thai text accompany with English on the outer label could lower confusing and timing for lay users (7)
- more concise and comprehended contents (2)
- simple language (1)

- need easier to locate (1)

There were many issues recommended by the lay users in the field of contents (94 items) supplied with the 17 labels and package leaflets of the existing HPTs and their design quality (38 items). However, their suggestions were quite less in such document comprehensibility (11 items). The test method was the only information aspect without any complaints about their document quality. In addition, almost of them (94%) could give the right answers and expressed as the easy finding of this information (94%) in such labeling.

It's noticeable that the first 5 aspects of additional information suggested by the lay consumers were precautions, contraindications, possible error or false results, result interpretation, and product storage. The other acquired information were respectively as manufacturing date, more relevance details, manufacturer, urine preparation, components, contents/pack, expiry date, importer, examples of drug with hCG affecting the test, Q&A part, and the age of user.

Most of the proposed issues in design quality were about the print face. They suggested for the print face with darker colour and larger size, more legible print face for the adults and lay users with difficulty in reading. The drawing was the further factor demanded by the lay consumers as better symbolism by picture on the outer label, distinct or colour drawing to its separation from the texts, and drawing as well as table highlighted more than texts for their better understanding. In addition to the above mentioned symbolism, the brighter with beautifier packaging and more attractive labeling design were asked to motivate their buying decision in HPT product. The other propositions were respectively as specific/emphasized heading, details with more concise and easy to understand (proper line length), information organization, proper line spacing, and smaller pack size for easy handling with less embarrassment to the customers due to the nature of HPT product.

The advices of lay consumers in HPT labeling comprehensibility were found most in requesting for Thai translation of all contents in such labeling.

2.2.3.4. Overall results to be emphasized

(1) Design quality: print face with proper colour (not reflective) and larger print size as well as more legible prints; drawing with better symbolism, distinct or colour, and highlighted; brighter with beautifier packaging; more attractive labeling design; emphasized heading information; proper organization and line

spacing as well as line length; and smaller pack size for easier handling with less embarrassment;

(2) Contents: precautions, contraindications, possible error or false results, result interpretation, and product storage;

(3) Comprehensibility: Thai translation of all contents with simple language and the information should be easier to locate.

2.2.4. Noticeable matter from individual interview and observation

Some noticeable matters from the individual interview and observations in lay consumers about the comprehensibility in some HPT labeling were as follows.

(4) The sign of "♦ x 3" in leaflet could probably not be understood by lay users.

(5) Some respondents could not understand the content in label and leaflet of one HPT so they just guessed for the answers (e.g. 2 bands for the positive result, distributors, recommendations for using this HPT after alcohol drinking, etc.).

(6) Many lay users took quite long time to locate their needed information.

(7) The lay consumers seem to be puzzle during using the HPT test kit (especially in urine dropping) even if they tried their best to follow strictly the recommendations in the labeling.

(8) The above noticeable matters obtained from the individual interview and observations in lay consumers, illustrated that they concerned most in the contents and design quality of the HPT labeling.

<u>Part 2</u>: Results on International Regulations Comparison

The results would be on international regulations comparison and on extracted labeling contents from different countries as follows.

1. International regulations comparison

The comparing on guidelines of different organizations (U.S.F.D.A., Health of Canada, European Union, TGA of Australia, GHTF, and Thai FDA) was performed to obtain some inputs for the guideline formulation. However, only Australia[32, 54], E.U.[13], and U.S.A.[77, 78] were the 3 countries those have specific guidelines for

Home-use IVD. Canada[55] and GHTF[62] had IVD Guidelines but not definite for Home-use IVD. Thailand has general requirements for medical device labeling[38] as some Asian countries (e.g. Korean, etc.). Furthermore, the Consumer Protection Law of Thailand also requires the control of contents in all general consumer products labeling both manufactured in Thailand and imported for consumers in Thai market.[88]

The comparison of labeling requirements and regulations among different countries/organizations from 1 international institute (GHTF) and 5 countries including current Medical Device Act (1988) was illustrated in the following aspects.

1.1. Purposes of laws/ regulations

Table 4.22: Comparison on purposes of laws/regulations on IVD labeling

No.	Purposes	TH	AU	EU	US	CA	GHTF
1	Emphasize on public and users interests						
	• For the sake of public welfare; control of quality, standard, safety in the use of medical devices[38]	/					
	• To provide patients/ users/3rd party with a high level of health protection & attain the performance levels originally attributed to them by the producer[13, 89, 90]			/			
2	Emphasize on performance of the entrepreneurs						
	• Outline the approach to regulate home-use IVDs[32]		/				
	• Identify key issues to be considered by producers & sponsors of home-use IVDs, including the data requirements of TGA[32]		/				
	• To assist manufacturers in IVD labeling to meet Canadian regulations[14, 55]					/	
3	Emphasize on both performance of the entrepreneurs, public and users interests				/		
	• To assist prospective manufacturers, producers, and marketers of home-use IVDs in complying with existing labeling regulations[65, 77] and				/		
	• To better serve the general public health by the availability of meaningful and reliable as well as adequate labeled home-use IVDs[78]				/		
	• To communicate safety and performance related information to users and to identify individual devices[62]						/
	• To offer significant benefits to the manufacturer, patient /consumer, and to Regulatory Authorities[62]						/

From table 3.5 in chapter III, Thailand is the only country that has no specific regulation for labeling control of Home-use medical devices or IVD. While Australia,

EU, and USA have specific manuscript and Canada as well as GHTF cited as the additional contents in general labeling requirement.

All 6 different organizations in this study required the labeling of IVD name, intended use, contents/pack, batch/control number or manufacturing date, expiry date, storage and handling conditions, direction for use, warnings and precautions, and name with address of manufacturer. However, except Thailand the other 5 organizations imposed specific obligations on description and limitations of the test procedure (e.g. kit identification, test summary and explanation, interferences, factors considered in result reading, etc.), specimen collection and preparation, test result, analytical performance characteristics, and date of issue or latest revision of labeling.

Instruments and reagents (e.g. reagent names, composition, relevance statements, reagent preparation, etc.) were required differently across countries. Canada and U.S.A. indicated the details to be labeled in 2 separated parts of the same guidance, but EU specified these 2 parts into separated guidelines.

1.2. Some key definitions

The key definitions of following terms would be compared in table 4.23.

1.2.1. "In-vitro Diagnostic reagent/test kit/medical devices/ products" [IVD]

1.2.2. "Home use in-vitro diagnostic devices" or "device for self-testing" or "near patient in vitro diagnostic device"

The definitions of "In-vitro diagnostic devices" (IVDs) in all countries and GHTF except Thailand are nearly the same. The similar key terms in their meaning were illustrated in Table 4.23. Furthermore, the definition of "Device for self-testing" in EU covered some concept of "Home-use IVDs" in Australia (IVDs capable to be used by lay persons) and Canada (IVDs for testing at home). Without specific IVDs definition in Thailand, "In-vitro diagnostic devices" were general medical devices as definition in section 3 (1) or would be stringent control medical devices if they were prescribed by the Minister of Public Health as medical device by publication in the Government Gazzette.[38]

Classified under "Home-use in-vitro diagnostic devices", Australia defined IVDs as those supplied to lay persons while EU claimed IVDs as "Device for self-testing" that could be used by lay persons in a home environment. The IVDs for testing at home in Canada was included in one part of the definitions of "Near patient in vitro diagnostic

device" other than IVDs intended to "be used outside a laboratory" and "at the point of care", whereas the definition "point of care (POC) IVDs" in Australia has its own separate meaning. However, the results from comparable details on definitions about IVD of the above different countries would be used to set up the definition of "Home-use in-vitro diagnostic devices" for Thailand.

Table 4.23: Comparable details on definitions about IVD

No.	Key words	TH	AU	EU	US	CA	GHTF	Remarks
1	Specific definition for "IVD"		/	/	/	/	/	TH: none but included in "medical device" definition
2	Specific definition for "Home use IVD"		/	/		/		• EU: "device for self-testing" that differed from point of care (POC) IVDs • CA: included in "Near patient IVD device"
3	Products details							
3.1	a medical device	/		/	/	/	/	with other details for more clarification
3.2	reagent, reagent product, calibrator, control material, kit, instrument, apparatus, equipment, or system, whether used alone or in combination			/	/	/		• US: "reagents, instruments, and systems"(91) • CA: reagents or articles or any combination…
4	Intended to be used in vitro		/	/		/	/	• AU: indirectly mentioned as "IVD" • GHTF: intended for the in vitro
5	in a home or similar environment by lay persons		/	/		/		• CA: for testing at home • AU: supplied to lay persons
6	Benefits							
6.1	Collect, prepare, examine specimens from human body		/	/	/	/	/	• AU: collect a sample for analysis • CA, GHTF: examine specimen from human body • US: examine specimen, blood and tissue donations derived from human body
6.2	Interprete to diagnose, monitor/ identify risk factors		/	/	/			EU: monitor therapeutic measures; US: diagnose disease or conditions
6.3	Determine presence, absence or quantity of specific chemical or substance			/	/	/		• EU: determine safety and compatibility • US: determine state of health
6.4	Providing information			/				

1.3. Readability requirements for labeling documents

Table 4.24: Readability requirements for the labeling of home-use devices

No.	Country	Readability requirements
1	Thailand	none
2	Australia	none but require clinical study of the device performance in lay users assisted by provided labeling[32]
3	EU	e.g. for British public, advocate for the 9th grade reading level for the medication labeling[2]
4	U.S.A.	recommended no higher than the 8th grade reading level for the labeling of home-use devices[18, 77]
5	Canada	suggested the commonly accepted standard of no higher than the 6th grade reading level for the medication labeling to reach the maximum audience[16]
6	GHTF	none

Even there was readability requirement in some countries like Australia, Canada, EU, U.S.A., etc., their requirement was by recommendations. Only some countries in this study (U.S.F.D.A., Canada, EU) required directly the readability grade level computed from appropriate readability formulas for the labeling of home-use devices. Other countries indirectly specified for the general obligations e.g. the labeling with simple, concise, and easy to understand and applied by the lay users, etc.

Some countries (e.g. Australia, Canada, EU, U.S.A., etc.) asked the entrepreneurs for the consumer testing in developing and improving their labeling of the health products. U.S.F.D.A. suggested the entrepreneurs to predict the reading level of their consumer labeling by using readability formulas. Moreover, they recommended not higher than the 8th reading grade level for the labeling of home-use devices, the average reading level among adults.[18, 77] Canada and British suggested the 6th and 9th grade reading level for the labeling of medication sold in their countries.[16] For Thailand, there was no requirement for readability.

1.4. Document characteristics

The comparison of labeling requirements among countries was described in the following 3 aspects: design quality, comprehensibility, and content utility as details shown in 3 tables of Appendix D.

1.4.1. Design quality

All countries and GHTF concern for the design quality of IVD labeling but in somewhat different points as illustrated in Table 1 of Appendix D. Canada was the

only one that paid the attention to all 4 aspects of the design quality including labeling format, print size, focus, and graphic whereas Thailand concerned only the aspect of print face (legible & size). Australia put more emphasis on the proper format to IVD type & intended use, highlighting the warnings and precautions, and the use of different graphic types with explanations to help lay consumers in their product utilization. The others (EU, U.S.A., and GHTF) need only 2 aspects in their labeling design quality. EU emphasized on prints and graphic, U.S.A. stressed on highlighting and graphic, and GHTF underlined on format and graphic utilization but asked each nation to keep the minimum country-specific requirements for labeling text.

For the symbols and other graphics (e.g. drawings, illustrations, diagram, charts, etc.), EU required that such graphics should be explained in the leaflet of Home-use IVDs. GHTF also needed the explanation of the symbols but for only newly introduced symbol or the symbols with unobvious meaning to the device user.

1.4.2. Utility/ Content

1.4.2.1. General characteristics of required contents in labeling

Each country specified only some details about the general characteristics of required contents on the device labeling. The countries in EU concerned about the availability of IVD package leaflet by calling the entrepreneurs for the obligation in accompanying each device with its package insert[13] whereas GHTF allowed such document to be supplied for the users in various media and several means.[62] In addition, an adequate amount of labeling information in EU and U.S.A. were asked to be helpful for the consumers in product utilization and in understanding the result interpretation. Australia and GHTF required that the contents should be proper to IVD type and its intended use. Canada did not indicate any details about the general characteristics of contents on labeling instead concerned about the places for the contents to be labeled.

Canada asked for labeling on the outer package and required that it should be visible under the normal sale conditions. In case that the outer package is too small, the statement referring to the contents in its package leaflet should be cited on the outer label. The purposes of this obligation in Canada were to make an informed choice to lay users and to easily permit device identification for the post-market activities (e.g. recall, etc.).[55]

For Australia[32] and GHTF[62], they required that the contents should be on IVD itself, otherwise it should be on the outer label or its package leaflet or both. It

was noticeable that GHTF specified that the instructions of low/moderate risk medical devices might not be needed or could be abbreviated if it was safe to use and as intended by producer without any such instruction.[62] Moreover, Australia called for the control of home-use IVDs to be regulated in accordance with the risk class particularly the instructions for use.[32]

Other than Medical Device Act 1988 of Thailand, Thai Constitutional Law[92] called for the right of a person as a consumer shall be protected as provided by law. The Consumer Protection Act 1979 also sheltered the consumer right to receive correct and sufficient information and description as to the quality of goods or services, and required the entrepreneurs to prepare the label of such goods before the sale in accordance with the rules.[88]

1.4.2.2. From Table 2 in Appendix D, GHTF and all 5 countries in this study required the labeling of home-use IVDs to include 3 main information functions as

(1) Consumers' buying decision information

The product name, intended use, batch/lot number, expiration date, content/pack, name and address of manufacturer; were recommended to be indicated on the outer label to inform choice to the consumers.

(2) Consumers' utilization benefits information

The storage conditions, warnings and precautions, name & place (address) of entrepreneurs (manufacturer, packer, importer, exporter, arranger or distributor), and directions for use were needed to be indicated on the outer label and/or package leaflet and/or on IVD itself. However, most of the countries recommended to specify on outer label and inner label in some short and concise details as well as some statements linking to more details of the explanation in package insert. This was due to the limitation spaces on the inner and outer label.

It was noticeable that all of the above contents for consumers' buying decision and consumers' utilization were the general requirements that could be applied to all medical devices and the rest of contents illustrating in Table 2 in Appendix D are more specific to each product type (IVD). These particular details were suggested by GHTF[62] and compulsory by the law in all countries except Thailand. All of them have their own Act or regulations with particular guidelines involving IVDs, whereas Medical Device Act (1988) of Thailand[38] had only general labeling requirements for all medical devices. Moreover, home-use IVDs in Thailand were classified as general

medical devices without stringent control. Therefore, general labeling requirements of such Act was presently implemented to IVDs without any legal penalty.

It was found that all labeling requirements of the other 4 countries were indicated either in the Act or the Ministerial Regulations/the Directive of all countries which were the higher order of law comparing to the Notifications, Guidelines, and other requirements. All of them specified the scope of basic information in titles with broad explanations to assure the benefits of the lay consumers in health product buying decision and utilization, and necessary relevant knowledge. They also described in the guidelines about the contents in each topic to facilitate the entrepreneurs in product labeling, help in reviewing by the regulatory authorities, and assist the lay consumers understanding to ensure their safety uses with less risks.

For the information about the product identification or catalogue number, GHTF and all countries except Thailand and U.S.A. needed it to bear on the labeling. EU called for it if the product name does not uniquely identify the product.[13] The indication of situation in performance evaluation (AUS L number, Thai FDA number) was required only in Australia and Thailand. However, home-use IVDs are not presently required to declare such number due to its classification as the general medical device with least stringent control. The other issues of product utilization (e.g. limitations of procedure, the result interpretation, the last revision date, etc.) and other details were the examples of specific contents for each medical device product. This information was usually specified in the document with lower degree of enforcement (e.g. Ministerial Regulations, Notifications, Guidelines, etc.) to declare in details for more practical application.

(3) Consumer' education information

The date of issuance or the last revision date of the leaflet and the test principles were the information that GHTF and all countries in this study except Thailand required to be cited in their leaflet whereas only 2 countries (Canada and U.S.) asked for the bibliography. The principles of the procedure were about the test chemical, physical, physiological, biological, microbiology, immunochemical reaction or principles, etc. Summary and explanation of the test were needed by some nations (Australia, Canada, and U.S.A) to inform the lay users about short history of the test (benefits, methodology, and test limitations). However, Canada suggested combining these 2 concepts together under the same heading. Thailand did not have any particular regulation about IVD products. Therefore, the information of

consumer' education as illustrated in Table 2 of Appendix D was not required. Nonetheless, Medical Device Act (1988) let Thai FDA to issue the specific requirements for each medical device by the information bearing in such Act as "the other information prescribed by the Minister".

1.4.3. Comprehensibility

The comprehensibility in labeling of Home-use IVDs was the other important factor that affected the potential of lay users and safety in product utilization. All countries concern for all aspects of the comprehensibility but in different emphasis. It was reasonable that U.S.A. needed not to specify about the issue of language and translation because English is the only official language in U.S.A. However, the use of official language and/or translation into the official language in countries selling product were needed in Australia, EU, Canada, and Thailand.[13, 38, 54, 55]

It was noticeable that GHTF suggested that one or more languages other than its national language may be authorized in labeling to ensure safe and correct use of the device whereas the country-specific requirements for labeling should be kept to the minimum.[62] The reasons of GHTF were to strike a balance between the responsibilities of Regulatory Authorities to safeguard the health of their citizens and their obligations, and to avoid placing unnecessary burdens upon the industry.[62] However, the country-specific requirements of GHTF were not clearly defined.

The other matter concerned by GHTF and all nations were the jargon and language use in the labeling with the terms easily understood by lay users. Australia was the country that concerned quite much about the simple and concise contents as well as the factors to facilitate the understanding and application of the lay users. Some other nations (EU, U.S.A., Canada) and GHTF, were also gave the attention to some of such factors. However, EU and GHTF were the only 2 organizations stating that the placement of information should be proper to IVD type and its intended use.

2. Extracted information for labeling development

The information for labeling design quality, contents, and comprehensibility were mostly extracted from the international regulation comparison. The conclusion from the content analysis and consumer testing on the existing HPTs labeling were also concerned to suit the existing Thai regulations and lay consumers in Thailand.

2.1. Conclusion from international regulations comparison

As overall consideration, the specific guideline for Home-use IVD was necessary for Thailand to more public and users' interests, better performance of the entrepreneurs, and to be the evaluation tool of regulators. The extracted details derived from the 5 countries and GHTF were as follows:

2.1.1. The key definition as "Home-use IVDs"

It was derived from international comparison illustrating in Table 4.23 to be as

"Any medical device (reagent, reagent product, calibrator, control material, kit, instrument, apparatus, equipment, or system, whether used alone or in combination, whether used alone or in combination) intended by the manufacturer

- To be used in vitro by lay persons in a home or similar environment
- For the collection, preparation, and examination of specimens including blood and tissue donations derived from the human body

To diagnose disease or conditions, to monitor therapeutic measures, to identify risk factors or to determine safety and compatibility, state of health, and the presence as well as absence or quantity of specific chemical or substance".

The definition of "medical device" of Thailand was already clearly explained in the Medical Device Act 1988 and some related details about IVD and home-use IVD from different countries were added to complete the "Home-use IVD" definition.

2.1.2. Proposed design quality, utility/content, comprehensibility

The details of design quality, contents, and comprehensibility extracted from some countries to be labeled for home-use IVDs in Thailand would be as follows.

2.1.2.1. Design quality

The 4 aspects of design quality were proposed to be concerned in labeling as

(1) Format

The format of labeling should be proper to IVD type. Its intended use should be clearly written and directions for use should be detected step by step.

(2) Prints

The legibility was revealed by Meade and Smith (1991) as one of the most important factors to consider when developing or evaluating written health education

material.[10] Hence, the labeling prints should be legible characters or proper print sizes for all ages of the lay users. The 12-point font size of prints was suggested.[10]

(3) Emphasis

The emphasis of labeling should be permanent and prominent manner by using the bold prints or other ways to highlight the headings or important information (e.g. instructions for use, warnings & precautions, test interpretation, etc.). The various techniques to enhance the legibility were dark prints on light contrast background, Arabic numerals, bold prints, proper use of lower and upper case letters, etc. were recommended.[10]

(4) Graphics

The labeling should be made by the liberal use of different types of graphics such as drawings, illustrations, diagram, charts, colour identification, internationally recognized symbols. The symbols should be explained in their leaflets particularly the "directions for use", test results, result interpretation, etc. This could promote the lay users' understanding and effective use of devices.

2.1.2.2. Utility/Content

(1) General characteristics of contents

The characters of information on Home-use IVDs labeling, and the useful content (e.g. up-to-date, relevant, reliable, and accurate, etc.) must accompany each device and it should be proper to IVD type with its intended use. Moreover, the information should be consistent with each other in each place of labeling (outer and inner label, package leaflet) and be enough for the lay user to use the device with proper and safety method as well as capable to understand the result reading.

(2) Specific contents

- **Consumer buying decision information**

The information of this part should be illustrated on the outer label and foil (if possible). Generally, some of these details would be also specified in the package leaflet for more emphasis on their importance to the lay consumers. However, the manufacturers usually indicate the contents on batch/lot number, manufacturing and expiration date, content/pack, name and address of manufacturer and distributor, and license number on the outer label and inner label (foil). This might be due to their consumptions of smaller space than the other information, and their necessities for consumers' decisions in product purchasing. The batch/lot number was also useful to the stakeholders in the traceability for safety issues of the product.

The proposed details needed to be labeled would be as follows

- product name (proprietary and established name) and/or product identification (e.g. catalogue number)
- intended use (purpose of the device)
- batch/lot number
- manufacturing and expiration date
- content/pack
- name and address of manufacturer, importer, and distributor
- license number (if required)
- others e.g. reasonable price, etc.

[NB] Batch/lot number, and manufacturing with expiration date which were found to be usually presented together should be declared in Thai both heading and their details for better consumer protection especially to the lay persons.

- **Consumer utilization information**

The necessary contents for the lay consumers to effective product utilization were generally indicated in the package leaflet because of much detail to be labeled for users' clear understanding. However, most of countries asked the manufacturer or responsible companies to label this information on both outer and inner labels as well as in product insertion, if possible. The directions for use could be exempted from the outer label but needed a statement linking to its indication in the package leaflet.

As the result from consumers' testing conducted with the Thai lay users, usually they first read the information on the outer label rather than from the package leaflet. Therefore, the test method and the result reading of the home-use IVD should also be indicated on the outer HPT label. However, the details needed to be on outer and inner label, would be the short contents or concise statements linking to more details in the package leaflet of the following aspects.

- Components (description of device, its parts, and accessories)
- Storage and maintenance conditions
- Warnings and precautions
- Specimen collections and preparation
- Instructions/directions for use
- Assay procedure (result interpretation and follow-up action)
- Limitations and Contraindications
- Expected values

- Performance characteristics

• Consumer education information

This kind of information was required by most countries to be specified in the product insertion for more education to the users about the product. They were not directly involved with the product utilization but some of them would be useful for their further information and in the process of product information traceability. The examples of such content were as follows:

- Summary and explanation of the test
- Principles of the procedure
- Bibliography
- Revision date of the leaflet
- Other information as prescribed by the minister

Finally, the above extracted information was composed to be included in the 1st draft guideline (see Appendix E) of Home-use in–vitro Diagnostic Test Kit (IVD) in this study for further assessment by the group of variety experts. After revising the 1st draft guideline as the experts' opinions, its 2nd draft version (see Appendix F) was used as the reference in developing the 1st draft HPT labeling prototype (see Appendix G) for further validated by the lay consumers.

2.1.2.3. Comprehensibility

The 3 aspects of comprehensibility in Home-use IVDs labeling would be as

(1) Readability level

The labeling with no higher than the 6th reading grade level should be proper for the lay users as stated in chapter III. It was the same level of the former education minimum requirement for Thai people to cover the middle age group of lay users.

(2) Language and translation

The information must be in the simple and clear official language of country selling the product and the translation was needed in case of imported products.

(3) Ease factors for lay users

The information in labeling should be simple, concise, in easy language and terms easily to understand and applied by the lay users at all stages to reduce risks in specimen and IVD handling, result interpretation, etc.

(4) Location

The location of labeling should be proper to IVD type and its intended use.

2.2. Conclusion of problems from content analysis of existing HPT labeling

Table 4.25: Conclusion of problems from content analysis of existing HPT labelling

No.	Problematic issues from content analysis	
1	Design quality	
1.1	Print size	• pale & too small Thai prints (< 8 points Tahoma or <12 points for other print types)
		• much smaller prints < English
		• design hard to be read
1.2	Print quality	• pale, same colour of print & background
		• improper word spacing
		• printing over bar code
		• reflective colour of prints
		• some unfit alphabet types, etc.
		• print colour of outer label came off with covered plastic
1.3	Emphasis	no specific heading
1.4	Drawing	• too small & pale drawing
		• drawings of result reading far from texts explaining
		• no any label for bands on drawing
		• disproportion of hand during urine dropping
1.5	Others e.g.	• location: not in the front/main part of outer label and/or in Q&A part of package leaflet
		• information sequencing: generic name following trade name, make conflict to Thai language principle
2	Contents	
2.1	Amount of information	• non-indicated/ no Thai version /only in English/ < English version e.g. contraindications, interfering substances, exp. date, manufacturer, importer, storage, max. reading time
		• No Thai nor English on immediate label
2.2	Information details	
(1)	General	• indirectly specified
		• varied details in same/different brand for the same topic
(2)	Trade name	• different in 1 leaflet or between label & leaflet
(3)	Lot number/ manufacturing date/expiry date	• heading in Thai as “manufacturing date” or “Lot no.” or “Expiry date” but details was in English content/numeric style
		• different details or different presentation style between outer & inner label (foil) of the same HPT
(4)	Manufacturer	• different manufacturer between its labels (outer & inner), leaflet
		• labeled for foreign companies without any title as “manufacturer”
		• cited manufacturer (foreign company) of raw material
(5)	Address of manufacturer/ country of origin	• same total appearance of immediate containers (foil) and style of lot number but claimed for different country of origin (U.S.A., Canada)
		• indicated only country
(6)	Importer	• only name of foreign company without any importer
(7)	Storage	• declared in varied details in the same HPTs
		• indicated room temperature (2-30°C, 4-30°C, 2-35°C) conflicting to real situation or climate in Thailand
		• wrong conversions from degree Celsius to Fahrenheit
(8)	Test method	• too short or long dipping time
(9)	Test performance	• several claims for selling points (e.g. fast result, easily use, precise/ accurate/sure, etc.)
		• declared different accuracy in same HPT labeling
		• be considered as over claimed for accuracy > 99%

2.3. Conclusion of problems from consumer testing on existing HPT labeling

Table 4.26: Conclusion of problems from consumer testing on existing HPT labeling

No.	Problematic issues from consumer testing	Remarks
1	Perceived design quality (0-2): mean score = 1.36 (Perceived reading = 1.21)	overall reading = 1.08
	• Attractiveness (1.19), print size (1.27), information clearness (1.32), print quality (1.33)	< 1.36
	• Poor (15%), fair (33%), good quality (52%)	
	• Suggestions for respectively improving in print face & size, labeling design (e.g. attractiveness, no Q&A part, etc.), drawing, emphasis, line spacing, information sequencing	38 items
2	Perceived utility/contents (0-2): mean score = 1.41	overall utility = 1.39
	• Quite low mean score in the information completeness (0.89)	< 1.41
	• Less (17%), fair (25%), much (58%)	
	• Suggestions for respectively improving in precautions, possible errors/false results, contraindications, result reading, storage, name of manufacturer, more relevant details, manufacturing date, urine collection, clearer expiry date, components, adverse reaction, etc.	94 items
3	Perceived comprehensibility (0-2): mean score = 1.31; (Perceived comprehended items = 1.53)	Overall understanding = 1.17
	• Quite low mean score in reading (1.21), understanding (1.29)	< 1.31
	• Hard (3%), fair (63%), easy (44%)	
	• Suggestions for respectively improving for more Thai translation, more concise and comprehended contents, easier language, and easier to locate	11 items
Total	Average mean score in 3 aspects = 1.36	Overall = 1.21

CHAPTER V

RESULTS ON GUIDELINE DEVELOPMENT AND VALIDATION

The details of labeling guideline development for Home-use In-vitro Diagnostic (IVD) test kit and its validation through HPT labeling prototype using the peer reviewed with consumer testing and readability level calculation were as follows.

1. Guideline development

The results of Phase I (Chapter IV) and some information from literatures review of this study were used to develop the guideline and its labeling prototype (HPT). The 1st draft guideline (see Appendix E) was prepared as the following:

1.1. Information sources

The inputs to formulate the guideline were gained from 3 sources:

1.1.1. Concluding details from domestic problem assessment

Problem identification studies including content analysis of existing HPT labeling and lay consumers' Diagnostic testing (tables 4.25 and 4.26 in chapter IV) as well as some information from literatures review reflected that the development of labeling guideline and HPT labeling prototype should be emphasized as following:

1.1.1.1. Design quality

(1) Proper Thai legible print sizes on the contrast background;

(2) Proper print quality of text and drawings, proper lines spacing with attractiveness;

(3) More attractive and highlighted for clearer information, and

(4) Unnecessary for the format of Q&A part in the package leaflet

1.1.1.2. Contents/utility

(1) Complete and consistent labeling information without over claimed matters of performance and promotional contents;

(2) Clearer and more contents on the following topics e.g. precautions, contraindications, maximum reading time, possible false errors and limitations in some certain health conditions as well as affected medications, invalid/inconclusive result interpretations, manufacturing and expiry date, HPT type, etc.

(3) Simple explanation of the contents especially all limitations, contraindications, scientific knowledge and less technical terms as possible; and

(4) Preferably directly indicated information for easy to read, find, and understand, and remember.

1.1.1.3. Comprehensibility

(1) Thai translation for all information of labeling, and

(2) Simple and concise information particularly the instructions for use with the educational grade level not higher than grade level 6.

1.1.2. International regulations comparison

The extracted information from the comparison of labeling regulations and requirements among 1 international institute (GHTF) and 5 different countries including current Medical Device Act (1988) was already illustrated in chapter IV.

1.1.3. Information from literature review

1.1.3.1. Requirements from Section 33, 34 of Medical Device Act 1988[38];

1.1.3.2. Legible Thai print sizes must not smaller than other languages[38];

1.1.3.3. The introduction to print media part[75];

1.1.3.4. The proposed principles for designing effective written education materials from the study of Janelle Griffin and colleagues[10];

1.1.3.5. The optimal provision from the study of Krass I. and colleagues[30], Morris L.A and colleagues[53];

1.1.3.6. The report on Medical Device Labeling prepared for CDRH by Patricia A. Kingsley[51]; and

1.1.3.7. The study about HPT by Cole L.A. and colleagues.[74]

1.2. Guideline formulation

1.2.1. The 1st draft Guideline development and its reviewing by experts

1.2.1.1. Write up the 1st draft Guideline (Appendix E) using the above 3 sources. Its format consisted of 6 parts as introduction; purposes; key definitions; requirements on inner and outer label, leaflet; and specifications for self-testing.

1.2.1.2. Guideline reviewing by the experts

The results revealed that the experts commented for too many details in some topics of such 1st draft guideline so they asked to revise in some aspects such as to

(1) remove some details e.g. some specific hazard statements or impractical warnings for situation in Thailand which might cause some confusion to the lay users, some contents in test method and test result;

(2) change in some heading sequences e.g. "components of kits" should be before "specimen collection and preparation", 'disposal" and "test performance";

(3) wrap up some headings e.g. put "some additives addition for urine preparation" in the same title of specimen description;

(4) separate some information e.g. grouping the information necessary on outer and inner label and in the package leaflet, separate "follow-up action' from "limitations", etc..

1.2.2. The 2nd draft Guideline and HPT labeling prototype development

The 2nd draft Guideline (see Appendix F) was obtained from revising the 1st draft after experts reviewing. The 1st draft HPT labeling prototype with dipping type was then developed corresponding to such 2nd draft Guideline for better understanding and practical implementation. Moreover, the details from the above documents in 1.1.3 were also rendered to be references in developing this HPT labeling prototype.

The 1st draft of HPT labeling prototype (see Appendix G) was composed of

- the package insert: single A4 paper size with twice folding and dark print on 80 grain white plain paper with high density;
- the outer label: 8x13x1.5 cm. of the card art paper and dark print on pale pink background; and
- white inner foil label as recommended by the above reference.[75]

The contents obtaining from the above-mentioned sources were composed in such draft labeling prototype as the follows.

1.2.2.1. The outer label consisted of product name (proprietary and established name), intended use of the device, batch/lot number, manufacturing and expiration date, amount/pack, name and address of manufacturer and distributor, license number, test accuracy, test method and result reading with drawings, product storage, and statement "carefully read the labeling before product utilization".

1.2.2.2. The inner label consisted of product name (proprietary and established name), intended use (purpose of the device), batch/lot number, manufacturing and expiration date, and amount/pack.

1.2.2.3. the package leaflet consisted of needed contents in sequencing as

(1) product name, intended use (purpose of the device),

(2) product description (knowledge about test strip and test principle), compositions of test strip (description of device, its parts and accessories)

(3) amount/pack e.g. test/pack

(4) storage and maintenance conditions

(5) warnings and precautions

(6) limitations and interferences (and/or contraindications) e.g. false positive, false negative, unreliable results, etc.

(7) components provided in 1 pack

(8) specimen collections and preparation

(9) test procedure with drawing

(10) factors facilitating accurate result reading

(11) results interpretation (with drawing) e.g. positive and negative as well as inconclusive/invalid result, etc.

(12) possible sources of result errors

(13) follow-up action

(14) means or notice to assure the proper quality of test kit

(15) expected values and performance characteristics

(16) disposal of used product

(17) "Sources of further information or consultation" e.g. telephone number (under such title), etc.

(18) manufacturer and distributor with their address

(19) revision date

2. Guideline validation through HPT Labeling prototype

Following the guidelines, the HPT labeling prototype with dipping type was developed and then reviewed with commented by groups of 5 experts and stakeholders. They were the experts in technical knowledge from several sectors in both private and governmental organizations, and some of them were also the

stakeholders. After the 1st revising, the 2nd draft labeling prototype (see Appendix H) was reviewed by the 2nd group of experts and adapted to be the 3rd draft of labeling prototype (see Appendix I) for further consumer testing by the methodology adapted from the Diagnostic Testing of Australia[67] with the same questionnaire as in Phase I. The 4th draft labeling prototype (see Appendix J) after revising the 3rd draft was further tested by the lay users in the 2nd round testing. The guideline was thus again reviewed following such final draft labeling prototype to obtain the final version.

2.1. Validation by the experts and stakeholders

The 1st and 2nd draft of developed HPT labeling prototype was reviewed and revised as recommended by a group of 14 purposively selected various experts and stakeholders comprising an obstetrician and gynecologist**,** 5 medical technologists (2 academia and 3 entrepreneurs), 3 regulators from Thai FDA, 3 linguistic or language experts, and 2 design/document presentation experts. The detailed results of their assessments were shown in Appendix K. However, the validation through HPT labeling prototype by the assessment of varied experts for 2 rounds on their perceptions and suggestions were as the follows.

2.1.1. Design quality

Almost experts in the 1st round suggested for larger and more interesting prints to be read, be highlighted only on main titles, larger lines spacing, and some revises in information sequencing for less confusion and easier to be read. In the 2nd round, 2 experts asked for larger line spacing, revising some sequences of contents in leaflet.

2.1.2. Utility

As the 1st round, the expert in Thai language gave suggestions for concise, not too length and depth, or shorter explanation to avoid unconfident in product using. An expert suggested in the 2nd round for some additional content e.g. test principle, its performance, and “1 piece” of cup for urine collection in the HPT leaflet.

2.1.3. Comprehensibility

As the 1st round, more than half of experts specified for hard to find the information. An expert proposed a phrase as “retest with other test kit” to be added in the inconclusive result for clearer understanding. The language used for some contents should be somewhat revised.

As the 2nd round, some incomprehensibility details were about the rationale of retesting within 48 hours after obtaining the inconclusive result, the coating with hCG antibody to goat at the control line of test strip, knowledge about hCG hormone, false-positive result, internal quality control, "For single use only" in the lay term, and the details under title "Disposal of used materials".

2.2. Validation by consumer testing using Diagnostic Testing with questionnaire

The consumer testing of HPT labeling prototype was performed for 2 rounds after which the labeling was reviewed by the above experts. The 22 lay participants were recruited for each round, accounting for the total of 44 consumers. The participants' characteristics were summarized in Table 3.6 and 3.7 in chapter III. The details and results of consumer testing for the 3rd and 4th (final) draft of HPT labeling prototype were as follows.

2.2.1. Total competency of lay users on HPT labeling prototype

The following tables and figures presented total competency score across subjects. The results showed that the first 22 lay users' competency on information finding and obtaining the correct answer from the HPT labeling prototype (3rd draft) could pass the criterion score (multiplication of finding and right answering ability score ≥81%) less than the last 22 lay users' (4th draft).

There were respectively 11 and 18 out of 22 lay users those could pass such criterion. After the first consumer testing, some adjustment was made and resulted in the improvement of competency from 50% to more than 80% of subjects (≥ 16 out of 20 cases or lay users or the result of 90% each ability[67]) achieved the passing score of 81% in the 2nd round. It reflected the quality improvement of the HPTs labeling prototype in the 2nd round testing.

Table 5.1: Total competency score of 22 lay users on HPT labeling prototype (1st round)

Case	**average finding score** (0-2)	**% average finding score**	**average answer score** (0-1)	**% average answer score**	**% average competency** (%finding* %answer)	**pass** (1) or **fail** (0) (>80%)
1	1.72	86	0.76	76	65	0
2	2	100	0.97	97	97	1
3	1.94	97	0.97	97	94	1
4	1.94	97	1	100	97	1
5	1.9	95	0.79	79	75	0
6	1.8	90	0.93	93	84	1
7	1.94	97	0.83	83	81	1
8	1.48	74	0.93	93	69	0
9	1.68	84	0.97	97	81	1
10	1.34	67	0.86	86	58	0
11	1.56	78	0.69	69	54	0
12	1.58	79	0.9	90	71	0
13	1.68	84	1	100	84	1
14	1.8	90	0.9	90	81	1
15	1.66	83	0.79	79	66	0
16	1.62	81	0.86	86	70	0
17	1.68	84	0.86	86	72	0
18	1.58	79	0.72	72	57	0
19	1.48	74	0.72	72	53	0
20	1.94	97	0.97	97	94	1
21	1.82	91	0.93	93	85	1
22	1.8	90	0.9	90	81	1

Finding score: 2 = easy, 1 = fair, 0 = can't find; answer: 1 = right, 0 = wrong
Key message: 11 participants get > 80% pass of both scores (finding and answer score)
[NB] No. 1, 5, 8 were 2nd year students of vocational school; while no. 10-12, 15-19 were graduated ≤ grade 6.

Table 5.2: Total competency score of 22 lay users on HPT labeling prototype (2nd round)

Case	**average finding score** (0-2)	**%average finding score**	**average answer score** (0-1)	**%average answer score**	**% average competency** (%finding* %answer)	**pass** (1) or **fail** (0) (>80%)
1	1.66	83	0.76	76	63	0
2	2	100	0.86	86	86	1
3	2	100	1.00	100	100	1
4	1.76	88	0.86	86	76	0
5	1.82	91	0.86	86	78	0
6	1.72	86	0.90	90	77	0
7	1.82	91	1.00	100	91	1
8	1.94	97	0.97	97	94	1
9	1.94	97	0.97	97	94	1
10	2	100	1.00	100	100	1
11	2	100	1.00	100	100	1
12	1.96	98	1.00	100	98	1
13	1.8	90	1.00	100	90	1
14	1.86	93	1.00	100	93	1
15	2	100	1.00	100	100	1
16	1.9	95	1.00	100	95	1
17	2	100	1.00	100	100	1
18	2	100	1.00	100	100	1
19	1.8	90	1.00	100	90	1
20	2	100	1.00	100	100	1
21	1.94	97	1.00	100	97	1
22	1.96	98	1.00	100	98	1

Key message: 18 out of 22 participants get > 80% pass of both scores (finding and answer score)

[NB] No. 1 was graduated as grade 6, no. 4-5 was graduated as diploma in marketing, and no. 6 was graduated as Bachelor in business management.

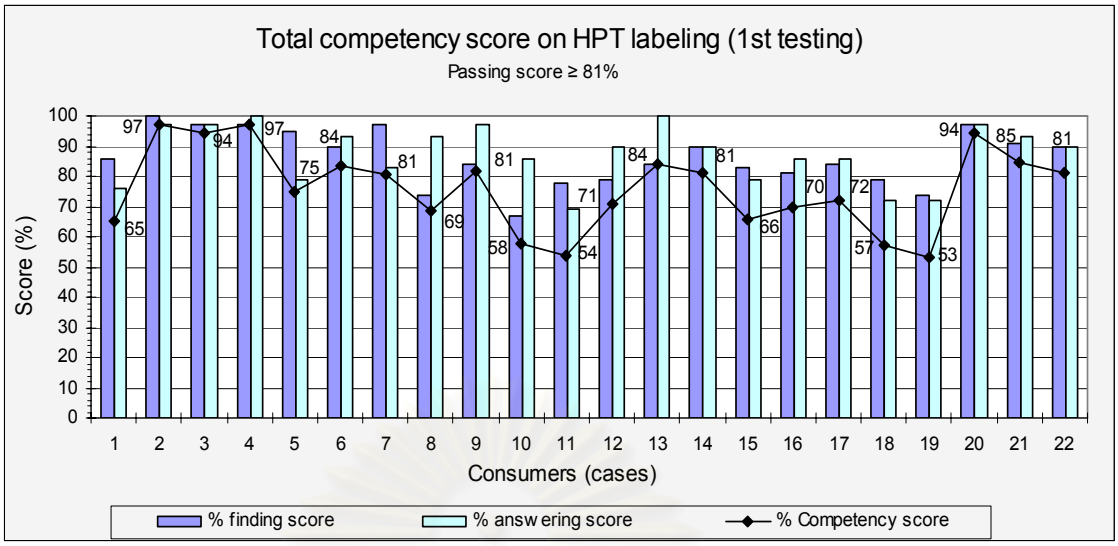


Figure 5.1: Total competency score on HPT labeling prototype of 22 lay users (1st round)

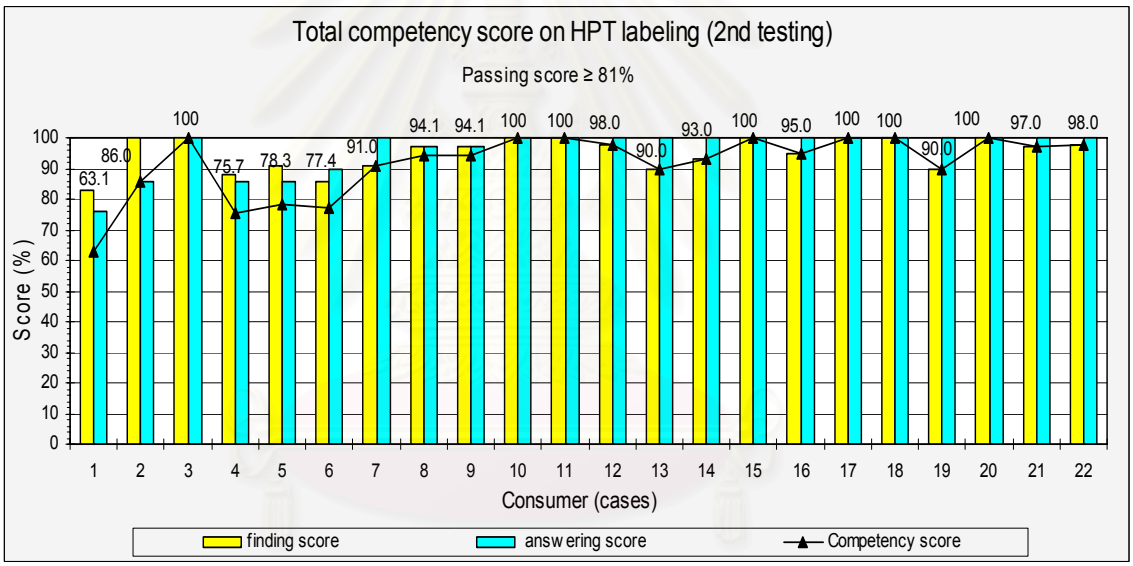


Figure 5.2: Total competency score on HPT labeling prototype of 22 lay users (2nd round)

2.2.2. Quality of information on HPT labeling prototype

2.2.2.1. Testing for competency of each content topic

The concept of passing criterion of the diagnostic testing as Phase I was also applied to diagnose each topic so the researcher could specify the problem area and make an appropriate improvement. Under each content topic, it was required at least 81% passing score of which 90% of subjects were able to locate the requested information and 90% could answer it correctly. The decision whether each topic achieved the satisfactory level of competency was based on the product competency

not on each ability dimension. The results on both average and easy finding rate were somewhat different in the 1st testing but all passed in the 2nd testing as the follows.

(1) Based on average information finding score

- **Consumer buying decision information**

This kind of information had been usually indicated on the outer and inner label due to the nature of short contents. Some of them were also cited in the package leaflet to emphasize their importance. However, it depended on the available spacing and its practicality. The testing of ability in this information finding and giving right answer from the 3rd and 4th draft HPT labeling prototype in both rounds of consumer tests were shown in the following tables and graphs.

Table 5.3: Labeling prototype quality of buying decision information based on average finding score (1st round)

Contents for buying decision	**mean finding**		**mean answer**		**% mean competency** (% finding*%answer)	**pass** (1) or **fail** (0) (≥81%)
	score (0-2)	**%**	**score** (0-1)	**%**		
1. HPT name	2.00	100	1	100	100	1
2. Amount/pack	1.77	88.64	1	100	89	1
3. Intended use	2.00	100	1	100	100	1
4. Expiry Date	1.86	93.18	1	100	93	1
5. Manufacturer	1.86	93.18	1	100	93	1
6. Distributor	1.77	88.64	0.95	95.45	85	1
Mean	**1.88**	**93.94**	**0.99**	**99.24**	**93**	**1**

Note: Finding score**:** 2 = easy, 1 = fair, 0 = can't find; Answer score: 1 = right, 0 = wrong

Table 5.4: Labeling prototype quality of buying decision information based on average finding score (2nd round)

Contents for buying decision	**mean finding**		**mean answer**		**% mean competency** (% finding*%answer)	**pass** (1) or **fail** (0) (≥81%)
	score (0-2)	**%**	**score** (0-1)	**%**		
1. HPT name	1.95	97.5	1	100	98	1
2. Amount/pack	2.00	100	0.95	95	95	1
3. Intended use	1.95	97.5	1	100	98	1
4. Expiry Date	1.91	95.5	1	100	96	1
5. Manufacturer	1.91	95.5	1	100	96	1
6. Distributor	1.95	97.5	1	100	98	1
Mean	**1.95**	**97.25**	**0.99**	**99.17**	**96**	**1**

Note: Finding score**:** 2 = easy, 1 = fair, 0 = can't find; Answer score: 1 = right, 0 = wrong

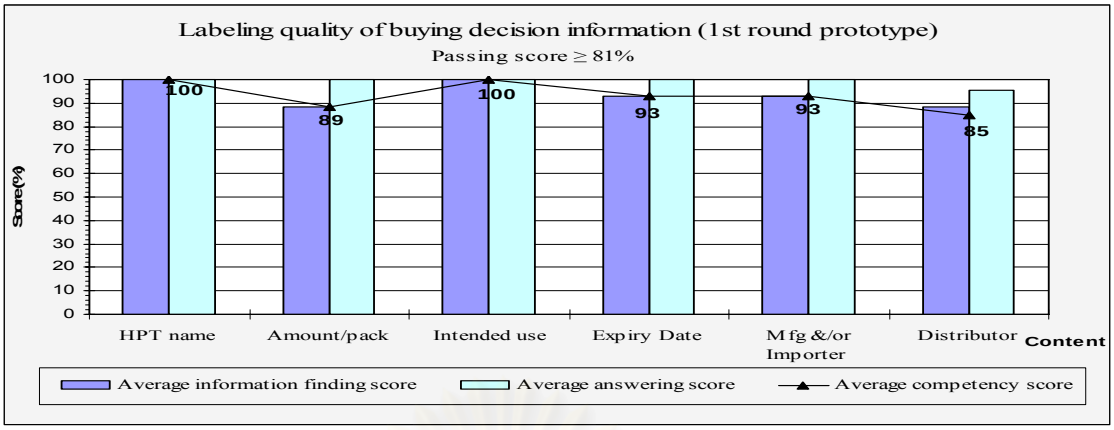


Figure 5.3: Labeling prototype quality of buying decision information based on average finding score (1st round)

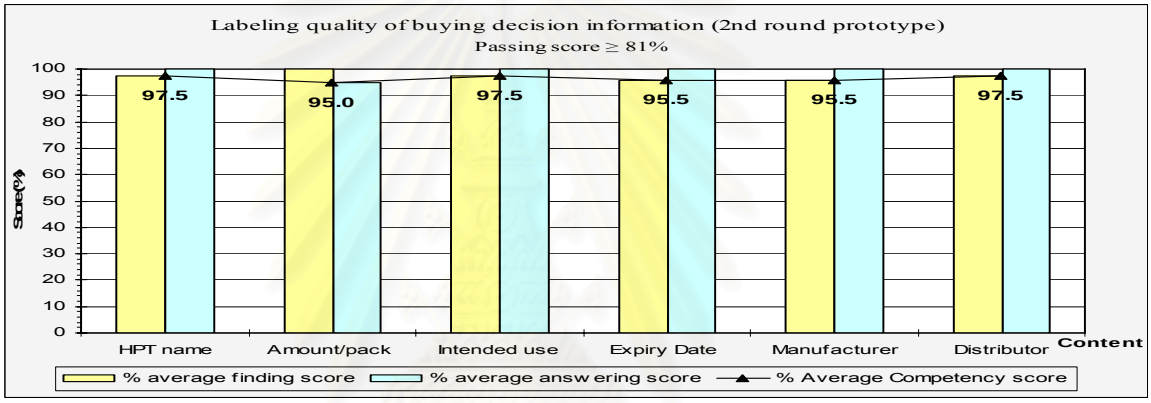


Figure 5.4: Labeling prototype quality of buying decision information based on average finding score (2nd round)

As the results in both rounds of testing basing on the average finding score, all buying decision information passed the required criteria (minimum 81%). Its average scores were respectively quite high (93%, 96%). Only small numbers of lay users still had difficulty in finding some information on "amount/pack and distributor". The user with wrong answer about content/pack in the 2nd round answer was as "3 pieces/pack" instead of "1 test/pack". For the information about "distributor", it was found to be quite hard to locate comparing to the other information. However, a lay consumer gave the incorrect answer due to her inability to find such detail.

- **Consumer utilization information**

The results of both rounds testing basing on average finding of this kind of information were shown as following**:**

Table 5.5: Labeling prototype quality of utilization contents based on average finding score (1st round)

Contents for product utilization	mean finding		mean answer		% mean competency (%finding * %answer)	pass (1) or fail (0) (≥81%)
	score (0-2)	%	score (0-1)	%		
1. precautions	1.95	97.73	0.91	90.91	88.84	1
2. contraindications	1.73	86.36	0.73	72.73	62.81	0
3. components	1.82	90.91	0.82	81.82	74.38	0
4. urine collection	2.00	100.00	1.00	100.00	100.00	1
5. testing step	1.91	95.45	1.00	100.00	95.45	1
6. dipping time	1.91	95.45	0.95	95.45	91.12	1
7. reading time	1.91	95.45	0.91	90.91	86.78	1
8. max reading time	1.95	97.73	1.00	100.00	97.73	1
9. positive result	1.95	97.73	0.95	95.45	93.29	1
10. negative result	1.95	97.73	1.00	100.00	97.73	1
11. invalid result	1.77	88.64	0.95	95.45	84.61	1
12. false +ve/-ve	1.64	81.82	0.82	81.82	66.94	0
13. storage	1.91	95.45	1.00	100.00	95.45	1
14. more info. source	1.77	88.64	0.55	54.55	48.35	0
15. 1st moring urine	1.27	63.64	0.68	68.18	43.39	0
16. before bed	0.55	27.27	0.32	31.82	8.68	0
17. after alcoholic	1.59	79.55	0.73	72.73	57.85	0
18. miscarriage	1.50	75.00	0.73	72.73	54.55	0
19. ectopic pregnancy	1.64	81.82	0.77	77.27	63.22	0
20. ovarian cyst	1.68	84.09	0.77	77.27	64.98	0
21. hCG drug	1.50	75.00	0.68	68.18	51.14	0
22. contraceptive	1.36	68.18	0.59	59.09	40.29	0
23. pain killer	1.45	72.73	0.59	59.09	42.98	0
Mean	1.68	84.19	0.80	80.24	70.02	0

Note: Finding score**:** 2 = easy, 1 = fair, 0 = can't find; Answer score: 1 = right, 0 = wrong

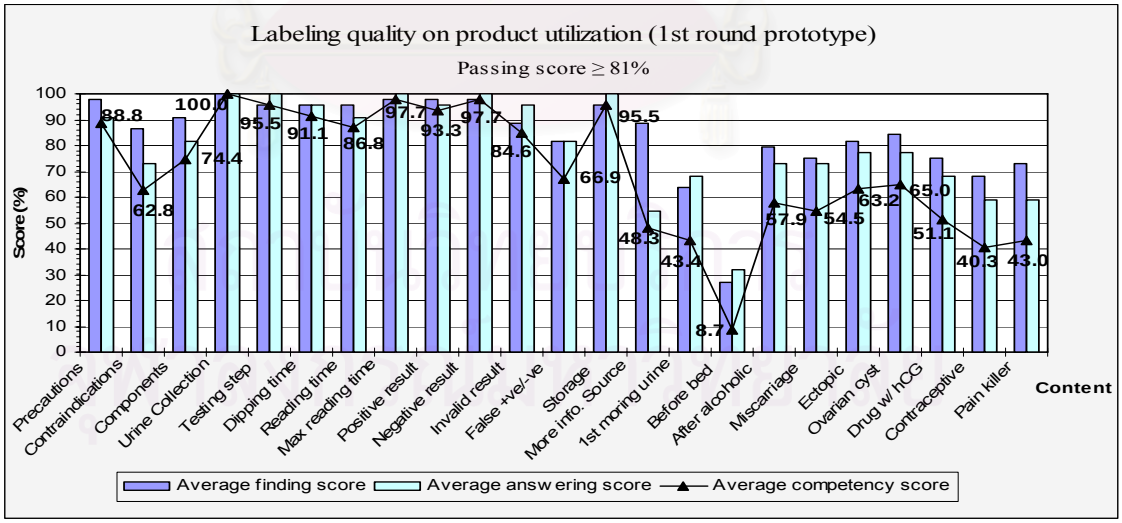


Figure 5.5: Labeling prototype quality of utilization contents based on average finding score (1st round)

The above results of the 3rd draft showed that only 10 out of 23 aspects of contents for product utilization passed the criterion (≥81%). The unqualified items were as contraindications, components, source of further information, possibility to

get false errors, and all limitations e.g. some health conditions, interfering substances, etc. Hence, it was adapted to the 4th draft and was tested by the other 22 lay users.

Table 5.6: Labeling prototype quality of utilization contents based on average finding score (2nd round)

Contents for product utilization	mean finding		mean answer		% mean competency (% finding*% answer)	pass (1) or fail (0) (≥81%)
	score (0-2)	%	score (0-1)	%		
1. precautions	2.00	100	1.00	100	100.00	1
2. contraindications	1.91	95.5	1.00	100	95.50	1
3. components	1.95	97.5	1.00	100	97.50	1
4. urine Collection	1.95	97.5	1.00	100	97.50	1
5. testing step	2.00	100	1.00	100	100.00	1
6. dipping time	2.00	100	1.00	100	100.00	1
7. reading time	1.95	97.5	1.00	100	97.50	1
8. max reading time	2.00	100	1.00	100	100.00	1
9. positive result	2.00	100	1.00	100	100.00	1
10. negative result	1.95	97.5	1.00	100	97.50	1
11. invalid result	1.95	97.5	1.00	100	97.50	1
12. false +ve/-ve	1.64	82	0.82	82	67.24	0
13. storage	1.95	97.5	1.00	100	97.50	1
14. more info. source	1.86	93	0.95	95	88.35	1
15. 1st moring urine	1.95	97.5	1.00	100	97.50	1
16. before bed	1.32	66	0.77	77	50.82	0
17. after alcoholic	1.77	88.5	0.82	82	72.57	0
18. miscarriage	2.00	100	1.00	100	100.00	1
19. ectopic pregnancy	1.91	95.5	0.95	95	90.73	1
20. ovarian cyst	2.00	100	1.00	100	100.00	1
21. drug wt hCG	2.00	100	0.91	91	91.00	1
22. contraceptive	1.64	82	0.86	86	70.52	0
23. pain killer	1.77	88.5	0.86	86	76.11	0
Mean	**1.89**	**94.50**	**0.95**	**95.39**	**90.67**	**1**

Note: Finding score**:** 2 = easy, 1 = fair, 0 = can't find; Answer score: 1 = right, 0 = wrong

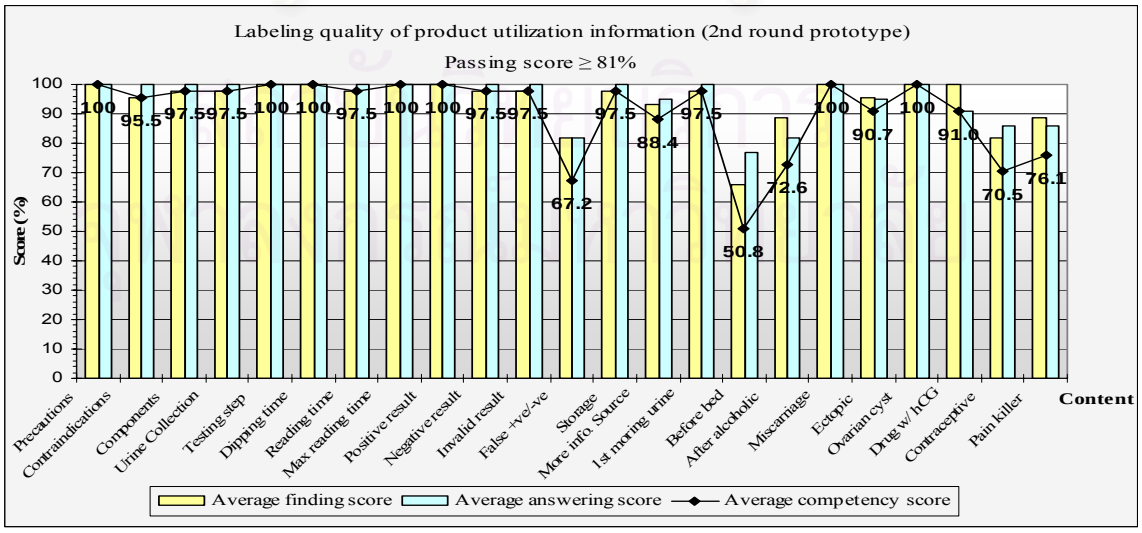


Figure 5.6: Labeling prototype quality of utilization contents based on average finding score (2nd round)

The result from the 2nd round testing or on the 4th draft of HPT labeling prototype illustrated that all aspects of product utilization information were improved and 18 out of 23 contents passed the required criteria (≥81%) except the part of details in "possibility to get the errors or false positive/negative results" and some contents on "limitations & interferences" as the urine collection before going to bed, after alcoholic taking, contraceptive, and pain killer. All of these contents were also failed in the 1st round testing but their scores in the 2nd round were higher. As the overall problem findings, contents for product utilization of this HPT labeling were more serious than the information for consumer's buying.

(2) Based on the easy information finding score

To ensure the labeling quality and avoid over estimation, only those who could easily locate or find the information were counted. Subjects who could find the requested contents but using longer time or with more difficulty were not counted in % finding. Table 5.7 compared competency scores of both rounds on each content topic related to buying decision and Table 5.8 compared the product utilization contents. In the 1st round, some participants had difficulty in finding some contents causing the low average percentage of finding information than those shown on Table 5.1 to 5.6.

For buying decision contents in Table 5.7; 2 topics could not pass ≥81% in the 1st round (Figure 5.7) but all contents had achieved in the 2nd testing (Figure 5.8).

Table 5.7: Labeling prototype quality of buying decision information based on easy finding score

Contents on buying decision	1st round			2nd round		
	% finding	% correct answer	% competency	% finding	% correct answer	% competency
1. HPT name	100.00	100	100.00	95.50	100.00	95.50
2. Amount/pack	77.30	100	77.30	100.00	95.00	95.00
3. Intended use	100.00	100	100.00	95.50	100.00	95.50
4. Expiry Date	86.40	100	86.40	90.90	100.00	90.90
5. Manufacturer	86.40	100	86.40	90.90	100.00	90.90
6. Distributor	81.80	95.45	78.08	95.50	100.00	95.50
Mean	**88.65**	**99.24**	**88.03**	**94.72**	**99.17**	**93.88**

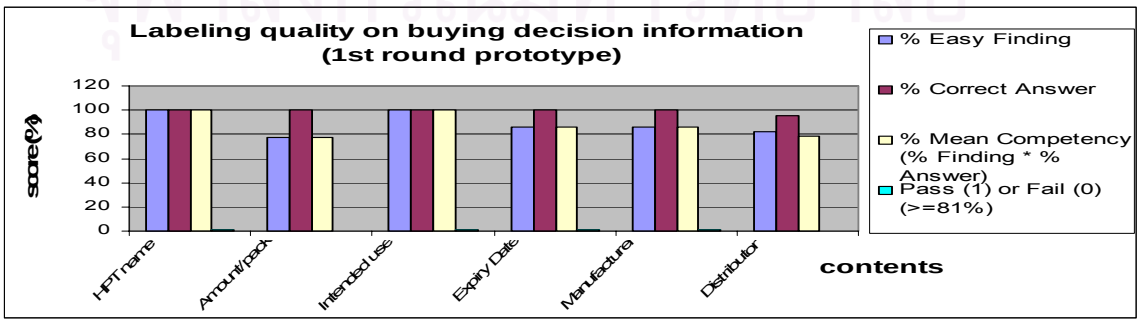


Figure 5.7: Labeling prototype quality of buying decision information based on easy finding score (1st round)

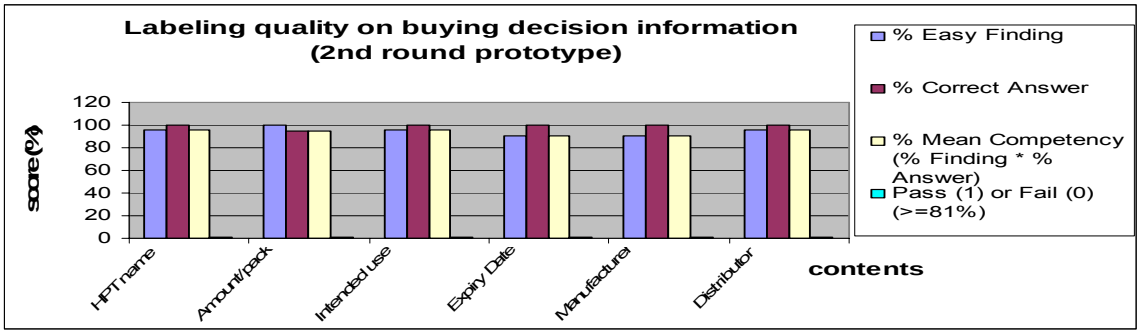


Figure 5.8: Labeling prototype quality of buying decision information based on easy finding score (2nd round)

For the product utilization topics basing on easy finding rate in the following Table 5.8, only 9 out of 23 aspects of the 1st round testing (Figure 5.9) could pass the above competency criterion score. After modification, all contents except 5 items in the 2nd round (Figure 5.10) had passed the criterion as in 2.2.2.1(1) but lower scoring. Such 5 existing problematic contents included topics on "possibility to obtain false results" and some limitations of urine conditions, e.g. before going to bed, contraceptive, after alcoholic taking, and pain killer.

Table 5.8: Labeling prototype quality of utilization contents based on easy finding score

Contents on product utilization	1st round			2nd round		
	% finding	% correct answer	% competency	% finding	% correct answer	% competency
1. Max reading time	95.50	100.00	95.50	100.00	100.00	100.00
2. Positive result	95.50	95.45	91.16	100.00	100.00	100.00
3. Testing step	90.90	100.00	90.90	100.00	100.00	100.00
4. Precautions	95.50	90.91	86.82	100.00	100.00	100.00
5. Dipping time	90.90	95.45	86.77	100.00	100.00	100.00
6. Components	77.30	81.82	63.25	100.00	100.00	100.00
7. Ovarian cyst	72.70	77.27	56.18	100.00	100.00	100.00
8. Miscarriage	63.60	72.73	46.25	100.00	100.00	100.00
9. Urine Collection	100.00	100.00	100.00	95.50	100.00	95.50
10. Negative result	95.50	100.00	95.50	95.50	100.00	95.50
11. Storage	90.90	100.00	90.90	95.50	100.00	95.50
12. Reading time	90.90	90.91	82.64	95.50	100.00	95.50
13. Invalid result	81.80	95.45	78.08	95.50	100.00	95.50
14. 1st morning urine	59.10	68.18	40.30	95.50	100.00	95.50
15. Drug w/ hCG	63.60	68.18	43.36	100.00	91.00	91.00
16. Contraindications	81.80	72.73	59.49	90.90	100.00	90.90
17. Ectopic pregnancy	72.70	77.27	56.18	95.50	95.00	90.73
18. More info. Source	81.80	54.55	44.62	90.90	95.00	86.36
19. Pain killer	68.20	59.09	40.30	81.80	86.00	70.35
20. After alcoholic	68.20	72.73	49.60	81.80	82.00	67.08
21. Contraceptive	63.60	59.09	37.58	72.70	86.00	62.52
22. False +ve/-ve	72.70	81.82	59.48	72.70	82.00	59.61
23. Before bed	22.70	31.82	7.22	63.60	77.00	48.97
Mean	**78.06**	**80.24**	**65.31**	**92.30**	**95.39**	**88.72**

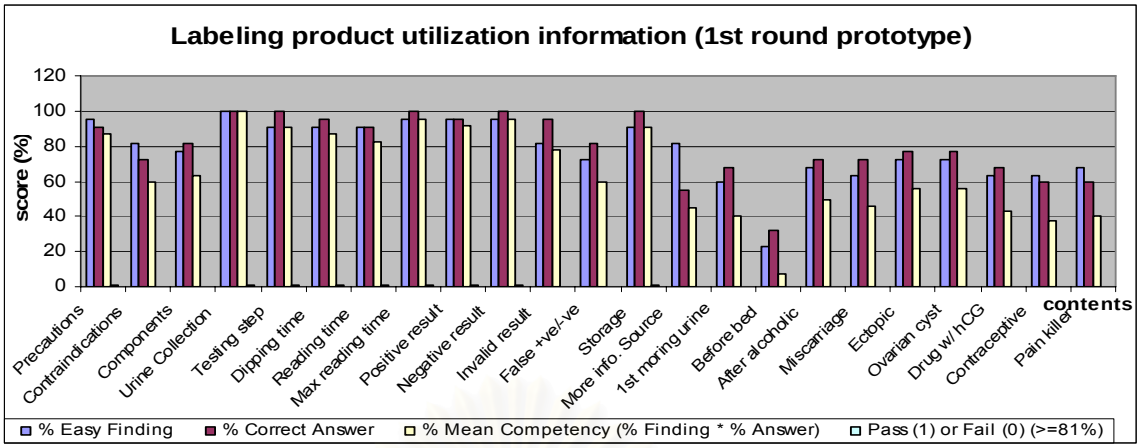


Figure 5.9: Labeling prototype quality of utilization contents based on easy finding score (1st round)

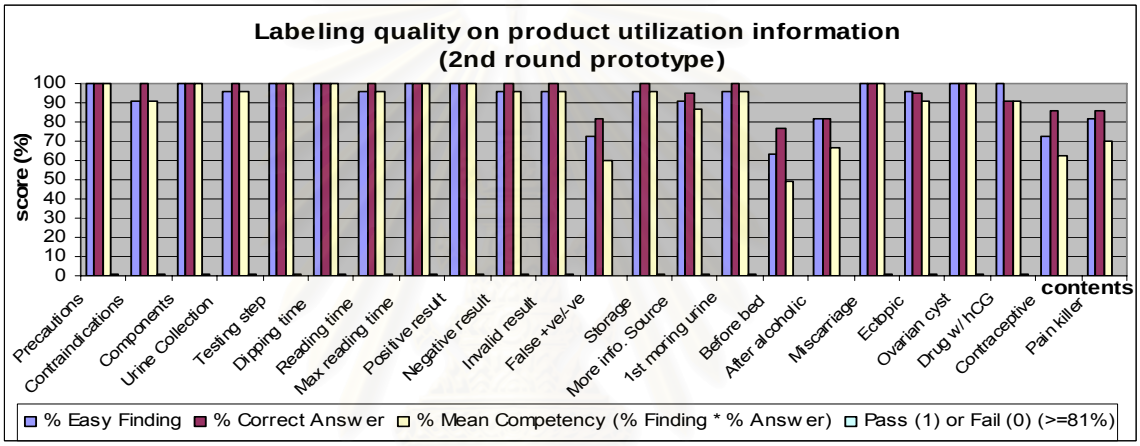


Figure 5.10: Labeling prototype quality of utilization contents based on easy finding score (2nd round)

As opening question, some lay users proposed not to use the terms of “false positive results and false negative result” because “the positive result” caused them misunderstanding as “the positive blood”. The other lay user asked that whether it was the formal definition and suggested that these terms should be simpler explained. For the content about “miscarriage”, a lay user expressed that she didn’t pay attention to this information and thought that it’s nonsense to cite in the labeling because she didn’t have knowledge about the pregnancy of women in the post partum period (past 8 weeks after the birth delivery or miscarriage).

For the use of this test kit after alcohol drinking, the labeling indicated as “the alcoholic drinking had no effect to the test result”**.** Many lay consumers gave the wrong answers due to their own considerations that alcoholic might interfere the test result. In the individual interview, some could locate this information but they misinterpreted “no effect to the test result” to be as “did not give any result” as evidence by expressing “The one who take alcoholic drinking could use this test kit

but the result would not show whether she was pregnant or not due to such alcoholic drinking." Moreover, most of the lay users were found to prefer direct indicating of information that needed no interpretation or much time to think about before questionnaire answering e.g. the preferring of content as "the one who take painkiller can use this test kit" than "the painkiller doesn't affect the test result".

As conclusion, the problems were found most on the above 5 fail contents with indirect indicating with wordings as "..any time of day" and "..no effect to ..".

2.2.2.2. Testing for lay consumer perceptions on HPT labeling prototype

This testing was a part of consumer test with questionnaire as in Phase I. The result details on perceptions were as follows.

(1) Perceived design quality

Table 5.9: Lay user perception on design quality of HPT labeling prototype

design quality (n=44)	**perceived design quality (0-2)**								**average design quality**	**read**
	print size	print quality	lines space	info. org.	line length	attracti veness	info. clear	drawing benefits		
1.poor	% (f)	% (f)	% (f)	% (f)	% (f)	% (f)	% (f)	% (f)	**%**	**%**
1st test (n=22)	0 (0)	0 (0)	9 (2)	0 (0)	5 (1)	0 (0)	0 (0)	0 (0)	**2**	**0**
2nd test (n=22)	5 (1)	5 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**1**	**0**
2.fair										
1st test	41 (9)	41 (9)	14 (3)	36 (8)	32 (7)	18 (4)	23 (5)	23 (5)	**28**	**32**
2nd test	32 (7)	32 (7)	18 (4)	9 (2)	14 (3)	14 (3)	14 (3)	5 (1)	**17**	**5**
3.good										
1st test	59 (13)	59 (13)	77 (17)	64 (14)	64 (14)	82 (18)	77 (17)	77 (17)	**70**	**68**
2nd test	64 (14)	64 (14)	82 (18)	91 (20)	86 (19)	86 (19)	86 (19)	96 (21)	**82**	**95**
4.mean	score	score	score	score	score	score	score	score	**score**	**score**
1st test	1.59	1.59	1.68	1.64	1.59	1.82	1.77	1.77	**1.68**	**1.68**
2nd test	**1.59**	**1.59**	**1.82**	**1.91**	**1.86**	**1.86**	**1.86**	**1.95**	**1.81**	**1.95**

In the 2nd round, the average % of good design quality and their mean scores were improved to be satisfying (more than 80% and 1.81) in all aspects except print size and print quality. Such scoring was consistent with the mean score of improved reading quality from 1.68 to 1.95. The detailed problems were as follows:

- **Print size**

For the 1st round, some lay users criticized for the small print size on the outer label (e.g. test method, result reading, texts at the drawing of result reading, etc.) and in the package leaflet for all headings. After revising for bigger print size in outer

label and leaflet as well as move some contents from the side part of outer label to its main part, few lay users still argued for some small prints in the 2nd round. The 2 out of 22 lay users still talked about somewhat small print size of "contraindications".

- **Print quality**

After the suggestions in the 1st round testing were adapted in clearer drawing and printing on outer label and leaflet, better attractive design and paper quality; a lay user still complained on print quality and 2 users asked for clearer printing of the outer label. The researcher did not change for brighter colour of outer label background due to few complaints so this issue was still suggested by few users in the 2nd round. This request was all from the participants with low education level. Even there was no improvement in average mean score of this aspect, its % good design quality was somewhat progressed in the 2nd round testing.

- **Lines spacing**

It was found that few lay users complained for confusion due to too small line spacing and somewhat small on the outer label as well as in the package leaflet that lead to hard in reading. After revising, some suggested for the larger line spacing for the test method and all prints on the outer label as well as about "further knowledge" in the package leaflet, and asked for the underlining of each title in the insertion.

- **Information organization**

There were some lay users' opinions of somewhat proper information organization in the 1st round as following examples:

- Contraindications and limitations should come before test method so the user might not use this test if they are in improper conditions.

- The order should be benefits, contraindications, warning and precautions, urine collection, test method, etc.

- The precautions and contraindications should be after "further actions" and "test method" because they might discourage the reader in product utilization and the lay users usually might not read it.

- The principle and the storage should be in further knowledge. It should be in respectively as benefits, test method, warning, precautions, limitation, and contraindications.

For the 2nd round, the average mean score was quite high but some lay users suggested that the precautions should be together with contraindications but before test method and the knowledge of HPT should be at the beginning of the leaflet.

- **Line length**

Most of problems were found in the 1st round than 2nd one. The recommended issues in the 1st round were as follows:

- The line length was poor because the sentence about false positive and false negative results was too long and cause confusion in reading.
- The line length was somewhat proper due to
  - o too long test method e.g. no need to cite about the foil tearing, etc.
  - o too long sentence of contraindications so it should be improved e.g. the false negative result due testing before the missed period, etc.
  - o too many titles of contents about further knowledge e.g. test performance, hCG knowledge that no need to concern, etc.

After revising following the above suggestions, the lengthy sentence of test method and further knowledge were still criticized by 2 lay users. However, the average line length in the 2nd round was quite improved comparing to the 1st round.

- **Attractiveness**

The attractiveness of HPT labeling prototype was more expressed as somewhat proper in the 1st round while most of good attractiveness was found in the 2nd testing due to no interesting of some lay users in the 1st round in following issues:

- contraindications according to the difficulty to understand,
- further knowledge e.g. "test efficiency", "hCG" explanation, too much details and no need for the hCG knowledge, no chance to use HPT, etc.

However, a lay user still expressed as no interesting in further knowledge and suggested improving for more attractive packaging in the 2nd round.

- **Information clearness**

The lay users gave the reasons for their somewhat proper quality of information clearness in the 1st round as unclear result reading (e.g. only know where the upper & lower bands but unfamiliar with the meaning of control region), unclear drawing and its texts in leaflet. However, a lay still criticized for unclear result reading and too much detail in some titles of the package leaflet e.g. test method, etc.

- **Drawing benefits**

The somewhat useful of drawing benefits was expressed in the 1st round as the reason of the necessary to read details in texts together with such drawing and the unclear drawing**.** However, the lay user suggested in the 2nd round for indicating "C" & "T" of result reading on the test strip.

(2) Perceived utility/ content

Table 5.10: Lay user perceptions on utility/content of HPT labeling prototype

Utility n = 44 (22/test)	**perceived utility (0-2)**				**average utility**	**overall utility**
	complete	valuable	sufficient	reliable		
1. no	% (f)	% (f)	% (f)	% (f)	%	%
1st test	0 (0)	0 (0)	5 (1)	0 (0)	**1**	**0**
2nd test	0 (0)	0 (0)	0 (0)	0 (0)	**0**	**0**
2. fair						
1st test	23 (5)	23 (5)	27 (6)	18 (4)	**23**	**14**
2nd test	0 (0)	0 (0)	14 (3)	9 (2)	**6**	**5**
3. much						
1st test	77 (17)	77 (17)	68 (15)	82 (18)	**76**	**86**
2nd test	100 (22)	100 (22)	86 (19)	91 (20)	**94**	**95**
4. mean	score	score	score	score	score	score
1st test	1.77	1.77	1.64	1.82	**1.73**	**1.86**
2nd test	2	2	1.86	1.91	**1.89**	**1.95**

The result revealed quite high rate of lay users' perception of much utility in the 1st round for all aspects except the information sufficiency, but all aspects showed the improvement to be very high rate in the 2nd round. The very rarely and none of no utility were respectively found in the 1st and 2nd round. The result on average utility score was consistent with the average score perception of lay users as overall utility.

The possible false errors (false positive and negative results) were found to be the problematic issues for all components of information utility (completeness, valuable, sufficiency, reliability) in the 1st round. Some lay users were confused and felt somewhat unreliable after reading about such information. Furthermore, few lay users expressed their needs of more diseases to be labeled in the precautions as "whether other diseases affected the test? A lay user asked for the test reliability while the other one requested for clearer drawing as well as the other drawing of invalid result. The presentation for the test band of the other condition of inconclusive results on the test strip should be added to be consistent with the texts explained in such labeling prototype.

The 2nd round result after labeling prototype revising showed much improvement but a lay user who gave the somewhat utility expressed that she could

not understand some information after labeling reading. For the issue of somewhat sufficiency, a lay user articulated that she had no knowledge to judge for the optimum information due to no experience in using this test. The other 2 lay users with fair answer felt unreliable in test result due to their no experiences in using this test kit. Therefore, they expressed that it might be better to consult the physician after self-testing for the ones with suspected pregnancy.

(3) Perceived Comprehensibility

The comprehensibility of this HPT labeling prototype was tested in lay consumer for several questions those representing to their composite characteristics in the information finding, reading, understanding, remember. The keeping such labeling for reference was not tested due to the single use nature of this product. Furthermore, the degree and details about the information that was hard for lay consumers in using this HPT labeling was also tested by the other question. Therefore, this part of testing was composed of the comprehensibility and the incomprehensibility issues (amount of uncomprehending items). The average % and average mean score of these 2 perceived issues in both rounds of testing were compared to each other as illustrated in the following table.

Table 5.11: Lay user perceptions and problems on comprehensibility of HPT labeling prototype

comprehensibility (n=44)	**perceived comprehensibility (0-2)**				**average**	**comprehended items**
	find	**read**	**understand**	**remember**		
1. hard	% (f)	% (f)	% (f)	% (f)	%	%
1st test (n=22)	0(0)	0(0)	0	5(1)	1	4
2nd test (n=22)	0(0)	0(0)	0	0(0)	0	0
2. fair						
1st test	50(11)	32(7)	54(12)	59(13)	49	73
2nd test	23(5)	5(1)	32(7)	41(9)	25	50
3. easy						
1st test	50(11)	68(15)	46(10)	36(8)	50	23
2nd test	77(17)	95(21)	68(15)	59(13)	75	50
4. mean (0-2)	score	score	score	score	score	score
1st test	1.50	1.68	1.45	1.32	1.49	1.18
2nd test	1.77	1.95	1.68	1.59	1.75	1.50

- **Comprehensibility issue**

As Table 5.11, the average % of perceived comprehensibility issue (including the mean score of each characteristic composition) and the average mean score of perceived comprehensibility in the 2nd round were found to be much improved comparing to the 1st round testing. However, such scores in both rounds for fair and easy to comprehend were quite different with each other and were less than the issues

of design quality and utility. The % of perceived less comprehended items was lower than the fair and many comprehended items. The detailed problems were as follows.

- **Information finding**

Some information (contraindications and further knowledge e.g. hCG hormone; limitation in using after alcohol, general medicine, food, etc.) was found as somewhat hard to locate in both rounds. The incapability to understand texts explaining drawings and arrows, and the need in more eye catching or attractive title were expressed by 2 lay users in the 1st round. After revising such labeling prototype, few lay users stated that the indirectly indicating about the best time to test ("can test anytime") and no continuous ordering of precautions and contraindications were the causes of hard finding in the 2nd round. However, most of lay users agreed for this information organization.

- **Information reading**

It was expressed in the 1st round as somewhat hard in result reading from the drawing. The lay users gave the reasons of the somewhat hard reading as no continuing in information ordering, and interpretation necessary of some terms. Too small prints of texts explaining result on drawing were also criticized in the 2nd round.

- **Information understanding**

The control region, contraindications (e.g. false positive result), further knowledge, many technical terms, and some terms need interpretation caused hard understanding in the 1st round. However, the incapability to locate some information was the only complaint in the 2nd round.

- **Information remembering**

A lay user expressed as hard information remembering due to no experience in using this test kit. However, most lay users talked about somewhat hard. They expressed the reasons as contraindications and further knowledge (test performance, hCG knowledge) those made them hard remembering in both rounds. Component of test strip with unnecessary to know, and reading only the needed contents caused them difficulty in remembering for the 1st round. The reading of all information was expressed as necessary to easier the information remembering. The hard understanding of precautions, long test method, and control with test line; were the complaints of somewhat hard in the 2nd round. A lay user suggested for easier

understanding by simple information that easy to understand after reading and that without prior translation before capable to understand.

- **Incomprehensibility issue**

The incomprehensibility details of this HPT labeling prototype expressed by the lay users in both rounds were respectively as contraindications [16], further knowledge [13], result reading [5], limitations [5], principle [3], and further action [1]. The details in such incomprehensibility details were as follows.

Table 5.12: Incomprehensibility contents on HPT labeling prototype expressed by lay users

degree	Incomprehensibility contents expressed by lay consumers
1st round	
much	e.g. contraindications, hormone hCG, etc.
somewhat	1. principle [2] 2. control region in result reading [1] 3. some contraindications & limitations [15] e.g. false positive (+ve) & negative (-ve) [10] (some cause confusion), names of medicine, remark about "no effect to the test result", etc. 4. further actions (one lay consumer suggested for better to place in knowledge part) [1] 5. further knowledge [6] e.g. hCG, item 1&2, precision 99% (should be accurate 99%), etc.
2nd round	
somewhat	1. principle [1] e.g. Ab to hormone hCG, etc. 2. result reading [2] e.g. • the notice of result reading on strip, • invalid result should be cited clearer about the distance from the band to the end of strip • the drawing should be clear as the actual product in both color & band; otherwise, it might be confused • need time to comprehend before utilization due to no experience in using this product 3. contraindications & limitations [4] e.g. • contraindications can cause error, false negative (–ve), • some limitations should be written directly (e.g. “one who take general medicines, food,.. can use this test kit”, etc.) • food, alcohol.. can't cause error 4. further knowledge [6] e.g. Na Azide, test efficiency [2], hCG [4] 5. due to small prints on outer label [1]

Note: Number in [ ] showed amount of lay users, opinions.

(4) Overall opinions

Perceptions of all aspects except the understanding were high in the 1st round and the overall opinions on reading, understanding, and utility of HPTs labeling prototype were improved to very high scoring in the 2nd round as illustrated in the following table. However, the contraindication was found to be expressed as hard to understand in both rounds of testing whereas no any complaint was found in their utility. As the users’ overall opinions in both rounds, design quality was involved to their reading perceptions in labeling prototype quality.

Table 5.13: Perceptions in the overall opinions on labeling prototype quality

testing round	**no. lay users with problems in overall opinions** poor/fair/good (mean score) (0-2)			**total lay users** (poor/fair/good) & mean score
	reading	**understanding**	**utility**	
1. **1st round** (22 lays)	0/7/15 (1.68) 1. somewhat hard because • some terms need to be interpreted • some not in continuous contents 2. very easy to read	0/12/10 (1.45) 1. somewhat hard because • some terms need to be interpreted • too many technical terms • hard for contraindication & further knowledge 2. easy for • test method • details on outer label & in 1st leaflet's column	0/3/19 (1.86) much because • we can test correctly	0/22/44 (1.7)
2. 2nd round (22 lays)	0/1/21 (1.95) 1. somewhat hard due to too small prints of texts provided with the drawing of result reading 2. easy due to • big prints of test method • red colour of prints in storage can ease reading than black colour	0/7/15 (1.68) 1. hard for contraindication 2. easy due to clear details providing	0/1/21 (1.95) much due to • result knowing by self-testing with no need to consult physician • prompt result knowing without prolong waiting time • unmarried ones' need to know result but dare not to see physician • ability to read & get knowledge • clear details providing	0/9/57 (1.86)

(5) Conclusion on the consumers' perception evaluation

- **Design quality**

The poor design quality was respectively found in lines spacing, print size and quality, and line length. However, their mean % and average mean scores were respectively as 82%, 1.81; which were quite good and better than the Phase I.

- **Utility**

The insufficient information was the only problem found in small degree. In the 2nd round testing, almost of the participants expressed their overall utility as much labeling utility (95%) and their average mean score was 1.95. Moreover, their perceptions in information completeness, value, sufficiency, and reassurance; had total mean % as 94% and the mean score as 1.89. Their new knowledge and no

experiences in using this kind of product (HPT) were expressed as the factors made them perceive as much utility and feel exciting during actual performing such testing.

- **Comprehensibility**

This aspect was much improved from the 1st round testing. The result of unachieved 80% of "easy to comprehend" as others was accepted due to the very high risks of lay participants rendered in this phase. Moreover, many limitations in design quality that affected the finding, reading, understanding, and remembering of the information in this labeling prototype were also affecting the results in this aspect.

2.2.3. General perceptions on labeling

2.2.3.1. Information necessary for using HPT

Table 5.14: Needed labeling information expressed by the lay users (Phase III)

No.	needed contents	% Number (f)		total % (f)
		1st round	2nd round	
1	test method	100 (22)	100 (22)	100 (44)
2	precautions	73 (16)	82 (18)	77 (34)
3	possible error	59 (13)	77 (17)	68 (30)
4	storage	45 (10)	73 (16)	59 (26)
5	manufacturer & add.	32 (7)	59 (13)	45 (20)
6	others	14 (3) e.g. manufacturing date, expiry date	14 (3) e.g. manufacturing date, expiry date, product price, strip composition	14 (6)

According to Table 5.14, the test method was needed by all lay participants in both round testing of this phase. The other needed information was respectively as precautions, possible error, storage, manufacturer and address, and others e.g. manufacturing date, expiry date, product price, and strip composition. It was found that "test method" was easily located by all lay users whereas "possible error" was most expressed as hard to find and unable to locate.

2.2.3.2. Comparison and explanations of lay consumers' attractiveness before and after testing

As Table 5.15, it's quite obvious that the lay users in both rounds testing of before and after their product utilization impressed in the same direction. The information in labeling prototype was most attracted by nearly half of lay participants in both rounds of before (43%) and after (46%) consumer testing. The advertising on outer label (e.g. contents & product name on outer label) was the 2nd most attractive information of lay users before testing while the result figure was found after testing.

For the 3rd most impression, the simple language was found before testing while the other factors (e.g. easy to understand and use; test strip; packaging

appearance, clear drawing of test method on outer label, fast and real result obtaining after labeling reading) were found after testing. The simple language was expressed by most lay participants in the 1st round before testing and some lay users in the 2nd round testing also impressed for the easy language. The other noticeable matter was that the attracted issues were mostly found on the outer label particularly the HPT name that was highly attracted by the lay uses before testing as their distinct large prints and its well communication to its benefits.

Table 5.15: Comparison of lay user most attractiveness on HPT labeling prototype before and after testing

Aspects of impression	testing				remarks
	before		after		
	1st	2nd	1st	2nd	
1. HPT name	0 (0)	18 (4)	0 (0)	5 (1)	**before:** - large, distinct prints on label 9 (4) - well communicate to its benefits **after:** like its print type & size 2 (1)
2. print size	0 (0)	9 (2)	5 (1)	0 (0)	**before:** large prints and nice color 5 (2) **after:** nice & clear print font in leaflet 2 (1)
3. labeling format	5 (1)	9 (2)	-	-	**before:** easy to understand after reading 7 (3)
4. simple language	13 (3)	9 (2)	5 (1)	0 (0)	**before:** 11 (5) **after:** easy to read & understand 2 (1)
5. package colour	5 (1)	5 (1)	5 (1)	0 (0)	**before:** beautiful pink package color 5 (2) **after:** 2 (1)
6.advertise on label	5 (1)	18 (4)	0 (0)	0 (0)	**before:** contents & product name on outer label 11 (5)
7. contents/ details	54 (12)	32 (7)	32 (7)	59 (13)	**before:** easy to read & understand after reading, interesting, know how to use 43 (19) **after:** - clear information; complete, clear, interesting, easy to read & understand contents in leaflet after reading, - benefits, warning/precautions, - test method with drawing on outer label & leaflet, easy to read & understand - clearly result reading with drawing - limitations & contraindications (know result in each urine situation, know whether true result or not) 46 (20)
8. result figures	5 (1)	0 (0)	32 (7)	18 (4)	**before:** 2 (1) **after:** - clear; comfortable; and easier in understanding, using, result reading; - inability to understand w/o it 25 (11)
9. others	13 (3)	0 (0)	22 (5)	18 (4)	**before:** lady picture on outer label can communicate to intended use & clear with easy to understand text on label 7 (3) **after:** easy to understand and use; test strip; packaging appearance, clear drawing of test method on outer label, fast and real result obtaining after labeling reading 20 (9)
total	100 (22)	100 (22)	~100 (22)	100 (22)	

2.2.3.3. Additional needed information, labeling image, and proposed opinion of lay users about HPTs labeling

There were respectively about 23%, 61%, and 43% of 44 lay consumers proposed for further details, product image, and proposed opinions to manufacturer. Their suggestions about HPTs labeling quality were as follows.

(1) Additional information

Most of additional contents in the 1st round testing were about drawings, contraindications, and packaging size; whereas those in the 2nd round were about drawings, product price, contraindications, and result reading. Their details would be presented in the same table with the labeling image and recommendations.

(2) Labeling image

The positive image of labeling prototype was expressed by nearly half of lay users in the 1st round testing but by about 90% of them in the 2nd round. Hence, the positive image was mostly found in the 2nd round while the negative one was mostly found in the 1st round. The details of such expressions were shown in Appendix L.

(3) Proposed opinion of lay users to the manufacturer

The details of 63 items for all the lay users' comments were illustrated in the Appendix L. However, the results could be summarized as follows.

- **Design quality** (37 items) e.g.

- print face: clearer and larger prints;

- printing quality: clearer leaflet, more distinction/highlighted of colour & prints on outer label;

- line spacing: 1 free line spacing among each title to ease reading;

- labeling format/design: more beautiful, both side printing of colour leaflet, product name at the beginning part of package leaflet should be enlarged to the right hand side of the 1st line of the leaflet;

- drawings: clearer (e.g. dipping drawing, etc.) and easier to interpret, beautiful picture of a lady on outer label for good image, need more text to explain drawing, consistent colour of strip drawing to the provided one, and more communicated picture on outer label to intended use;

- packaging interesting due to its nice, attractiveness and natural looking (e.g. colour of outer label, well communicated to specific use for women of nice lady picture); ease understanding by drawing of test method, provided with

drawing (suggestions for glazed looking and smaller size for less embarrassment & handling, ability to encourage the product utilization).

- **Utility** (20 items) e.g.

- contraindications and limitations should be concise but coverage with direct indicating and needed numbering;

- needed more details in amount/pack, possible error/false result, result interpretation/reading;

- lot number (useful to the entrepreneur, not the lay users), expiry date, and the manufacturer and should be in the main part of the outer label;

- unnecessary to indicate disposal of used test kit (due to its generally known by the lay users);

- uninterested terms e.g. hCG, medicinal names as Pergonal, Profasi, etc.;

- details on outer label and in leaflet caused the good image (but too much details in leaflet);

- product price for comparing with other brands and with cost in consulting with physician

- **Comprehensibility** (4 items) e.g.

- Thai labeling is very much necessary to the lay consumers due to their unknown in English;

- colourful format, interesting drawings, user intention to read and observe were needed to ease information finding.

- **Others (**2 items) e.g. too small test strip with hard to handle, a reason of no comment

2.2.4. Further details of labeling from individual interview

Such information was detailed in Appendix M but their titles were as

2.2.4.1. Buying decision information: amount/pack, intended use, expiry date, manufacturer/importer, distributor;

2.2.4.2. Product utilization information:

(1) Precautions, contraindications, component, urine collection, reading time, result reading in positive result, invalid result, false positive/negative result, source for further information, and

(2) Urine situation for testing: "1st morning urine", "before going to bed", "after alcohol drinking", miscarriage**,** ectopic pregnancy, ovarian cyst, "drug with hCG hormone", contraceptive, pain killer.

2.3. Calculation of Readability level of instructions for use

After all needed information for the HPT labeling prototype in the 2nd rounds of consumer testing was passed as required criteria, its final outer with inner label and the package leaflet were shown in Appendix J. Its instructions for use (urine collection and test method) were calculated for readability level using the Gunning's Fog Readability Formula. The result revealed that the Thai version of this HPT labeling prototype had the readability grade level 5. It means that this selected passage needs the user with at least educational grade level 5 to capable in reading and understanding such information. The readability calculation was as follows:

Testing method in English

"Urine collection (41 words)

1. The urine can be collected at any time of day, but it's best for the first morning urine.
2. Keep urine in the supplied cup.
3. Such cup should be clean, dry, and not polluted with soap or wax; to avoid unclear results.

Test method (67 words)

1. Remove strip after pouch opening.
2. Hold strip in vertical position.
3. Dip strip into urine with the arrow pointing towards urine.
4. Dip for 1 minute with the urine level under the max line (see figure 1).
5. Remove strip out of urine and lay it flat on the cup or dry non-absorbent surface.
6. Wait for 5 minutes before result reading, but not more than 15 minutes to avoid false results."

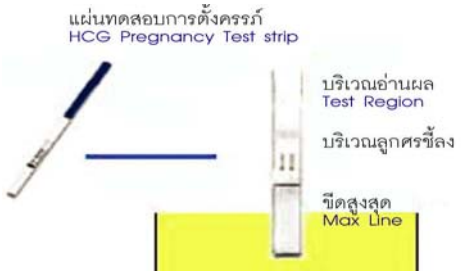


Figure 5.11 Urine Immersing of Test Strip (Do not exceed the max level)

Testing method in Thai language

"การเก็บปัสสาวะ (35 words)

1. เก็บเวลาใดก็ได้ แต่เก็บหลังตื่นนอนในตอนเช้าจะดีที่สุด
2. เก็บใส่ในถ้วยที่ให้มา
3. ถ้วยต้องสะอาด แห้ง ไม่ปนเปื้อนสบู่หรือขี้ผึ้ง เพราะจะทำให้ผลที่ได้ไม่ชัดเจน

วิธีใช้ (73 words)

1. ฉีกซอง แล้วนำแผ่นทดสอบออกมา
2. จับแผ่นทดสอบให้อยู่ในแนวตั้ง
3. นำปลายที่มีหัวลูกศรชี้ลง จุ่มไปในปัสสาวะ
4. จุ่มนาน 1นาที โดยจุ่มไม่เกินขีดสูงสุดที่ปลายหัวลูกศรชี้ (ดูภาพที่ 1)
5. นำแผ่นทดสอบขึ้นวางพาดในแนวนอนบนถ้วย หรือบนที่แห้งที่ไม่ดูดซับความชื้น
6. รอ 5 นาทีจึงอ่านผล แต่ไม่ควรเกิน 15 นาทีเพราะอาจทำให้ผลที่ได้ผิดพลาด"

Calculation:

Fog Score = 0.4 * (average Sentence Length + number of words having 3 or more syllables in the sample)

$$= 0.4 * \left(\frac{\text{words in passage } \sim 100 \text{ words}}{\text{Total number of sentences}} + \text{no. words} \geq 3 \text{ syllables}\right)$$

English = 0.4 * (110/ 9 + 1) = 5.28 (about readability grade level 5)

Thai = 0.4 * (108/ 9 + 1) = 5.2 (about readability grade level 5)

2.4. Thai FDA decision makers using interview

The 2 policy makers of Medical Device Control Division agreed with the 2nd draft guideline and the 4th draft of HPT labeling prototype as well as suggested for more control of all home-use IVDs by more stringent labeling control of home-use IVDs and other home-use medical devices as minimum. The final HPT labeling prototype was the same as that 4th draft labeling prototype. The 2nd draft guideline was thus adjusted to congruent with the 4th draft prototype as shown in the following topic.

3. Final revision of labeling Guideline for home-use in vitro diagnostic (IVD) test kit and HPT labeling prototype

There are 7 sections in this labelling guideline as following:

Section I: Introduction

Labeling and language requirements are the essential elements needed for the consumers to use device properly and safely, particularly the home-use device. In some certain devices, training and knowledge of the potential users are investigated and involved to achieve the intended benefits. Their risk-benefits information and instructions for use are therefore necessitated for the lay users to operate, interpret and manipulate the device. The importance of such information is not only to understand how to be cautious in its utilization but also to cooperate with the prevention, treatment, or diagnosis of an illness. However, one of the most popular with progressively used devices for the lay consumers is home-use in vitro diagnostic test kit (IVD). Furthermore, the trend in diagnosis replacement has become increasingly significant as the growing number of marketed home-use IVDs. Consequently, the ability to clearly communicate the important product information has become increasingly challenged and this guideline is devised to include both IVD reagent and instrument. Nevertheless, the emphasis will be on the IVD reagent due to its more popular among the lay consumers.

Concerning the general characteristics of information to be labeled in home-use IVD, the content must be accompanied each device and it should be proper to IVD and its intended use. Furthermore, the information should be complete and sufficient for the lay users to use the device properly with safety method, and capable to clearly understand the result reading. The required contents are needed to be labeled on both outside and immediate containers/wrappers, as well as in the package insert of the home-use IVDs. However, it could be allowed for some flexibility if there are any limitations which might be further specified in details.

In Thailand, the home pregnancy test kit is the most simple and popular test kit among home-use devices. It's comfortable to test with less complication. Moreover, its product property does not interfere the lay users' understanding of information in labeling and their product utilization. The home pregnancy test kit

(HPT) was then selected to be the model labeling in this study for a practical application of this guideline. The HPT product information in labeling would be therefore the most suitable examples rendered in this guideline to facilitate the implementation to all stakeholders.

Section II: Purposes of this guideline

1. to better serve/provide consumers and general public health by the availability of meaningful, reliable, useful, and adequately labeled IVD test kit;

2. to assist prospective manufacturers, producers, and marketers of home-use IVDs in a proper labeling; and

3. to assist Thai Food and Drug Administration (Thai FDA) rendering consistent decisions based on reliable, reproducible, and standardized commercial tests.

Section III: Definitions

1. Home-use in vitro diagnostic (IVD) test kit or IVD for self-testing refer to reagents, instruments, and systems intended for use in the diagnosis of disease or other conditions, including a determination of the state of health, in order to cure, mitigate, treat, or prevent disease or its sequelae. These products are intended for use in the collection, preparation, and examination of specimens taken from the human body (USFDA) in the home or similar environments by a lay person who will relate the result of the test to him- or herself (EN 376:2001) e.g. home-use pregnancy test kit, blood glucose monitoring test kit, etc.

2. Home-use Pregnancy Test Kit refers to the reagent, reagent product, calibrator, control material or kit) for the qualitative detection/measurement of hCG in human urine (GHTF: 2005).

3. Kit refer to set of components (reagents and/or other materials) packaged together (EN 375:2001)

4. Label:

4.1. written, printed or graphic information provided upon the device itself, on the packaging of each unit/multiple device (GHTF: 2005) , or

4.2. written, printed or graphic information placed on a container (EN 375:2001).

5. Labeling/information supplied by manufacturer refer to written, printed or graphic matter related to identification, technical description, and use of IVD that affixed to IVD (immediate container) or any of its containers or wrappers (outer label), or accompanying IVD (package insert) [ISO 13485 and GHTF]

6. The inner label (the label of immediate container/primary container) refers to

6.1. any image, design, symbol or statement displayed on the medical device itself or its container (33), or

6.2. the label of packaging which protects the contents from contamination and/or other effects of the external environments (EN 375:2001) e.g. sealed vial, ampoule/bottle, or a sealed plastic bag containing test strip, etc.

7. The outer label (the label of outer container/sales packaging) refers to

7.1. any image, design, symbol or statement displayed on its package (33), or

7.2. the label on material used in the packaging of the immediate container(s) of IVD reagent(s) consisting of a single entity or an assembly of different or identical components (EN 375:2001)

8. "accompany document/product insertion" or "package leaflet or directions for use" or "procedure/operating/user instructions" or "Instructions for use" refer to

8.1. The paper or any other material on which information about the medical device is displayed by; and image, design, symbol or statement, inserted in the container or package of the medical device, including the manual of instruction for use (33), or

8.2. Procedures suggested for achieving optimum performance of device, including warnings and precautions, contraindications, and possible side effects (90), or

8.3. Information supplied by the manufacturer with an IVD reagent concerning the safe and proper use of the IVD reagent (EN 376:2001).

9. Lay person

9.1. individual that doesn't have formal training in a specific field or discipline (ISO 18113-1)

9.2. individual who does not have specific medical education (EN 375:2001)

Section IV: Labeling requirements for the information on inner label/immediate containers and outer label/sales packaging label

The details in this part are usually the consumers' buying decision information and they should be illustrated on the outer label and foil (if possible). Generally, some of these details would be also specified in the package leaflet for more emphasis on their importance and clearer explanation to the lay consumers. However, the manufacturers usually indicate the contents with short detail on the inner label (foil). This might be due to their consumptions of smaller space than the other information, and their necessities for consumers' decisions in product purchasing.

The following information is required to be indicated on inner label/immediate containers and outer label/sales packaging label. However, some information could be exempted. The details of such requirements and their exceptions would be as follows.

1. The following details are all required to be labeled on outer and inner label

1.1. product name (proprietary and established name)

Example: - Proprietary name - Lady Preg Strip,

- Established name - Home Pregnancy Test Kit

1.2. batch code/lot number/control number/serial number (for proper action to trace its identity, safety issues of the product, and recall the devices with attachable components)

1.2.1 batch code/lot number (for single-use or disposable devices/reagents)

Example: -in English: Lot/ lot no. 10 Sep. 2004, or 100904, or 10/9/04; or

- in Thai: Lot/ lot no. 100947

1.2.2 serial number (for electrical powered medical devices)

1.3. manufacturing date (may be included in batch code or serial number)

Example: - in English: manufacturing date 10 Sep. 2004, or 100904, or 10/9/04; or

- in Thai: manufacturing date 10/9/47

1.4. name and place of manufacturer and distributor/sponsor

Example: - Manufactured by Thailand Diagnostics, 9 Sukhumvit rd., Banglamoong, Cholburi 20150, THAILAND. ☎ 0-38221260-1

- Distributed by Thailand Health, 1234 Sukhumvit road, Klongton, Bangkok 10110, THAILAND. ☎ 0-22601738-40

1.5. means to assure that product meet the required standard (particularly on devices supplied sterile, single-use or disposable devices or reagents)

1.5.1. the expiry date (the last day of the month indicated). It is based upon the stated storage instructions and should be presented in day/month/year, or at least in month and year.

Example: - in English: Expiry/Expiration date/Use before date/Exp. or exp. date 10 Sep. 2006, or 100906, or 10/9/06; or

- in Thai: Expiry/Expiration date/Use before date/Exp. or exp. date 10/9/49

1.5.2. statement of any visual indication of reagent alteration

1.5.3. instructions for simple method to determine that reagent meets standard

Example: A pink colored band visible in the control zone (C) is the internal procedural control. It proves proper working of chemicals, adequate specimen volume, and correct procedural technique.

1.6. intended use/purpose or benefits

Example: For the early indication of pregnancy in human urine by obtaining a visual result of test bands presenting on the test strip

1.7. contents/package

1.7.1. net quantity of contents or number of tests in one package (if contents are readily apparent)

The contents must be consistent with the instructions for use and the amount of materials provided, especially the case of more than single determination.

Example: “content: 1 test/pack”

1.7.2. size, net weight, length, volume or number of units of the device (if contents are not readily apparent)

The metric designation is encouraged for the units of devices in the indication of what the package contains.

1.8. Statements of warnings and/or precautions or any other limiting statements

Example: - “Carefully read labeling before use’, or “Read the instruction thoroughly before using the test, and the procedures should be followed precisely for accurate results”, etc.

- “For in Vitro Diagnostic Use”, or “not to be swallowed” (in lay term)
- “Do not use the kit or any kit component past the indicated expiry date”

1.9. storage and handling information/instructions

Example: "keep in cold, dry place and away from heat and sunlight; and do not freeze"

1.10. indication of microbiological state (when applicable) e.g. "sterile"

1.11. other information required for leaflet e.g. directions/instructions for use or specific operating instructions (if applicable)

Example of Test method (วิธีใช้) on the outer label (70) **(ภาพที่ 1)**

- Dip the test strip into urine for 1 minute. (จุ่มแผ่นทดสอบในปัสสาวะ 1 นาที)
- Remove it out of urine and lay it flat on the cup and wait for 5 minutes before result reading (not more than 15 minutes). [นำขึ้นวางพาดบนถ้วย รอ 5 นาทีก่อนอ่านผล (ไม่ควรเกิน 15 นาที)]

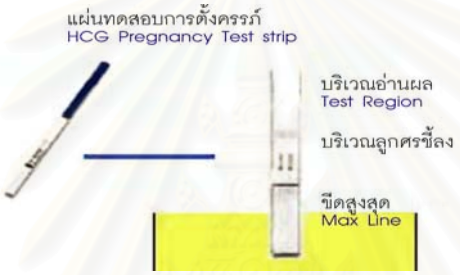


Figure 1 Urine Immersing of Test Strip: Do not exceed the max level

(**ภาพที่** 1 การจุ่มแผ่นทดสอบลงในปัสสาวะ: ไม่เกินขีดสูงสุดที่ปลายหัวลูกศรชี้)

Example of Result interpretation on the outer label (วิธีอ่านผลบนแผ่นทดสอบ) (ภาพที่ 2)

- Pregnant (ตั้งครรภ์): Two pink colored bands appear at "C and T". (พบแถบสีชมพู 2 แถบที่ตำแหน่ง "ซี และ ที)
- Non- pregnant (ไม่ตั้งครรภ์)**:** Only 1 pink colored band appears at "C". (พบแถบสีชมพูแถบเดียวที่ตำแหน่ง ซี)
- Invalid/inconclusive (สรุปผลไม่ได้): No any colored band visible; or appear only at "T" (ไม่พบแถบสีใดๆหรือพบที่ "ที")

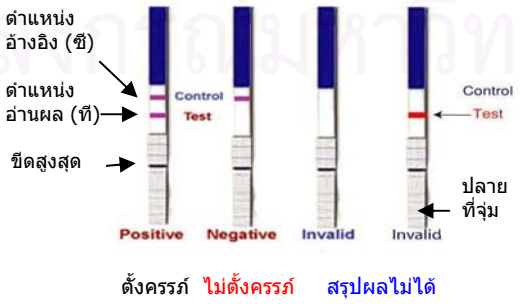


Figure 2 (ภาพที่ 2) Test results (ผลทดสอบการตั้งครรภ์)

1.12. Thai FDA License number (if required for licensing medical devices)

1.13. For reagents: the additional information will be as following

1.13.1. established name (common/usual name)

1.13.2. quantity, concentration, or proportion of all active ingredient reagent (in standard IU); and source and a measure of its activity (for biological materials)

1.13.3. net quantity of reagent contents in the package

2. Exemption for the inner labeling will be in cases of

2.1. the information on the immediate containers might interfere with the test,

2.2. the immediate container is too small or insufficient space.

In cases of where it is not applicable to be labeled on the immediate containers which are packed within the outer container from which they are removed for use, the exempted details to be indicated only on the outside containers/wrapper (outer label) would be the above 1.5.2 to 1.11.

3. Exemption for the outer package labeling will be in cases of

3.1. being easily legible through the outside containers/wrappers of home-use IVD.

3.2. too small outer package containing devices or space does not permit

In cases of some information is exempted, it must be appeared in the package leaflet and the referring statement is needed on the outer label (outside the package) for such information in the package insert. The examples of such information are "directions for use" that could be exempted from the outer label.

Example: "see directions for use, warnings and precautions, contraindications and limitations in the package leaflet"

Section V: Labeling Requirements for the information in the package leaflet

The necessary contents for the lay consumers to effective product utilization are generally indicated in the package leaflet because of much detail to be labeled for users' clearer understanding. However, it will be perfect if these contents could be labeled on both outer and inner label as well as in product insertion. The details needed to be on outer and inner label, would be the short contents or concise statements linking to more details in the package leaflet of the following issues. Most of them are necessary for the consumers' buying decisions whereas the information in package leaflet is needed in product utilization. Moreover, the consumer' education information was also required to be specified in the product insertion for the users in

more knowledge about the product. They were not directly involved with the product utilization but some of them would be useful for their further information and in the process of product information traceability.

1. The following details are all required to be orderly labeled in **package leaflet**

1.1. For (in vitro diagnostic) instruments: Operation manual/User manual/ Operating instructions for proper and safe operation, maintenance, basic trouble shooting

1.1.1. Name and model of instruments

1.1.2. Additional materials

1.1.3. Use or function or brief description

1.1.4. Installation procedure and special requirements

1.1.5. Principles of operation

1.1.6. Performance characteristics and specifications

1.1.7. Operating instructions

1.1.8. Calibration procedures including materials and/or equipment to be used to ensure proper operation and safety during intended life

1.1.9. Operational precautions (or possible errors) and limitations

1.1.10. Hazards

1.1.11. Service and maintenance information

1.2. For a Reagent/Reagents

They should declare about the following items to ensure proper and safe operation of reagent

1.2.1. Device/IVD name (product name) [Thai: with device category and type]

1.2.4.1. established name (common or usual name) e.g. Pregnancy Test

1.2.4.2. proprietary name (trade name) e.g. Lady Preg Strip

1.2.2. Purpose/intended use/intended purpose/indications for use/or benefits

1.2.2.1. nature of intended use e.g.

(1) screening: to test for the presence/absence of hidden blood in stool,

(2) monitoring: to check for changes in blood glucose (sugar level),

(3) diagnostic: to predict ovulation, to indicate pregnancy, etc.

1.2.2.2. type of test/procedure (qualitative, or quantitative detection)

1.2.2.3. concise claim of clinical utility (specific disorder, condition, risk factor of interest for which the test is intended, or the analyte to be measured) e.g.

early detection of hCG (a glycoprotein hormone secreted by placenta developing shortly after fertilization)

1.2.2.4. type of specimen(s) required (e.g. serum, plasma, urine, etc.)

1.2.2.5. who should use the test (clearly identify population characteristics of the user)

1.2.2.6. the conditions for its use e.g. indicate if

(1) "the device is for home use"/"For home use" or "For self-testing use"

(2) any special indication for use statement e.g. requirements for special facilities/any particular training

Example of intended use/benefits: "To early/rapidly indicate pregnancy by home-use visual qualitative detection of hCG (human Chrorionic Gonadotropin) hormone in human urine specimen."

1.2.3. Detailed description of the test

1.2.3.1. Device/kit identification and separate components with identifier/catalogue number or uniquely identify the device

1.2.3.2. Summary and explanation of the test (may be combined with the test principle or be separated in the part of "further knowledge" to avoid lay users' confusing)

(1) short history of the methodology

Example: - "Clinically useful HPT were introduced since 1927. Presently, HPT available use monoclonal or polyclonal Ab in an enzyme-linked immunoassay format. It is used to detect hormone hCG in human urine. The hCG is a glycoprotein composed of alpha and beta subunit, which is produced by trophoblastic tissue, appears around the 8-9th day after ovulation where fertilization has occurred, or around the 4th day after conception. The hCG levels rise rapidly, doubling approximately every 2 days, and peak around 100,000-200,000 mIU/ml in the latter part of the 1st trimester of pregnancy. Such levels will be decreased since the 2nd trimester of pregnancy." [USFDA guidance for OTC hCG 510(k)s]; or

The detection of hormone hCG in human urine to predict the pregnancy by observing the visible color band/bands of results on test strip. The hCG is a hormone rapidly produced in double amounts every 2 days after fertilization by placental development. Such amount would be highest during the 8th -11th week of pregnancy.

(2) type of antibodies (Abs) and antigens (Ags) used in the test (synthetic peptide, monoclonal, recombinant, etc.) as well as purification methods

Example: “Sandwich dye conjugate immunoassay that employs a unique combination of monoclonal and polyclonal Abs to selective identity hCG in test samples”

1.2.3.3. Principle of the method/Scientific test principle

(1) Chemical, physical, physiological or biological principles of assay/test procedure; or technique(s) and reactions (immunochemical, biological, chemical, microbiological) used; or technology of the IVD (e.g. ELISA, chromatographic, etc.) Example: “Immuno Chromatography Assay Technique”

(2) Simple explanation of how the test works

Example:

- The hCG in urine will be trapped and react with the anti-hCG Ab on the test strip to cause the visible color band/bands of results.
- “As the test sample diffuse through the absorbent test strip,

  - labeled Ab-dye conjugate binds to the hCG in the specimen forming Ab-Ag complex. This complex binds to the anti-hCG Ab in the test (T) zone → pink-rose color band when hCG concentration >25 mIU/ ml.
  - in the absence of hCG → no line in test zone
  - unbound conjugate binds to reagent in control zone → pink-rose color band”

1.2.4. Directions For Use/User Instructions [Instructions for preparation and use/detailed description of procedure in using device] (“Adequate directions for use”)

1.2.4.1. Components of kit/list of kit contents

(1) a list of all materials provided

- name of components e.g. reagents, supplies, instruments and equipment, etc.
- reagent and/or device name (proprietary name or established name)
- name of reagent should be sufficient (label for multipurpose reagent used with a number of kits)

(2) contents in terms of quantity (number, mass and/or volume or concentration) of each component and maximum number of tests be performed with stated contents of material provided

(3) composition of contents/reagents by nature, or “reagent description” and contents as amount(quantity) or concentration (proportion) in metric or in standard international units, or activity, etc. of

- each active/reactive ingredients
- reagent derived from biological materials (with sources and a measure of biological material activity)
- any catalytic or non-reactive ingredient (the presence of and characterizing of preservatives, buffers, stabilizers, etc.) for safe and effective use e.g. “protein matrix with 0.1% sodium azide”

Example of strip composition: “the test strip consists of

- a conjugate pad contains mouse monoclonal anti- hCG Ab [IgG (Ab)] dye-conjugated to Colloidal Gold (in protein matrix with 0.1 % sodium azide), and
- a nitrocellulose/ polyclonal Ab coated membrane strip contains
  - a test (T) line which is captured with rabbit anti-hCG Ab
  - a control(C) line containing goat anti-mouse Ab which should be bound to the conjugated monoclonal Ab regardless of the presence of hCG”

Example of kit components:

- a specimen collection container/ urine tray (and dropper/plastic pipette)
- a one step dipstick pregnancy test strip (Lady Preg Strip) or test device (Lady hCG Card); sealed in a foil pouch containing a desiccant bag
- a product package insert (test instruction/instructions for use)

(4) a list of all materials (components and/or special instruments/equipment) required but not provided

- Materials e.g. distilled water, buffer solution, etc.
- Equipment e.g. appropriate disinfectants or apparatus for disinfection procedures, etc.

1.2.4.2. Reagent preparation, or complete directions, or adequate instructions for preparation e.g. for reconstitution, mixing, dilution, statements of purification and treatment required for use, etc.

1.2.4.3. Storage and handling conditions/instructions (opened/unopened)

The adequate stability information and shelf life to protect product stability and to ensure safe handling should be declared basing on reliable, meaningful, and specific test method (or upon component having shortest projected useful life or stability of individual reagent).

(1) Any special/particular storage conditions and/or handling conditions applicable to the device

(2) Unopened state for both device and individual reagents; or unopened IVD or its components (reagents, Q.C. materials, calibrators, etc.) e.g.

• Storage temperature interval e.g. “2 °C to 8 °C” or “2…8 °C”; “-20 °C or below” or, “≤ -20°C”, etc.

• Other conditions/pertinent factors e.g. light, humidity, store in the dark, store desiccated, protect from freeze, etc.

Example of device storage during the unopened state: the test strip should be

- stored in cold and dry place,
- keep away from heat and sun light, and
- do not keep in frozen room of refrigerator.

(3) storage conditions and shelf life following the first opening of primary container

1.2.4.4. Warnings and restriction/precautionary statements for users (may be indicated in separated heading in package insert)

(1) Particular instructions/caution statements about hazardous chemicals, handling, some safety precautions e.g. Statement indicating as

• “The device contains other ingredients which might influence measurement”

• “HAZARD: The device may transmit [infectious agent] and should be handled with extreme caution. No known test method can offer complete assurance that products derived from human blood will not transmit infectious agents.” (USA) **or** “Handle all reagents as though capable of transmitting infection”

• “CAUTION: The device contains material of human or animal origin and should be handled as a potential carrier and transmitter of disease.” (For biological hazards)

• “This reagent contains sodium azide as a preservative and harmful if swallowed”

• “If this solution comes in contact with eye, rinse immediately”

(2) appropriate statement of warnings and/or restrictions/precautions for users, and any other contra-indications or limiting statements appropriate to intended use e.g.

- “Do not use the kit or any kit component past the indicated expiry date”
- “Bring all reagents or components to room temperature before use”
- “Read the instruction thoroughly before using the test, and the procedures should be followed precisely for accurate results”
- “Dry your hands before opening the foil pouch”
- “Do not open the foil pouch until you are ready for testing”
- “The test strip should not be wet before testing”
- The user must have no color-blinded condition
- “The result interpretation should be conducted under optimal light.”
- “Be sure to read the result at the right end of the strip”
- “For in vitro diagnostic use” or “For in vitro use” (in the lay term as “not to be swallowed” or “not for internal use”, etc.)

(3) Possible side effects/any “undesirable side effects” caused by IVD utilization e.g. “Prolong result reading will lead to false positive result”, etc.

(4) For reusable IVD test kit

The precautions should be indicated for the appropriate processes of reusable device e.g. the proper processes to allow reuse including cleaning, disinfection, packaging, re-sterilization or decontamination, and any restriction on the number of reuses, etc.

(5) For sterile products

- Statement indicate any special microbiological state or state of cleanliness; or sterile device indication/marking e.g. “Sterile” for sterile product or product sold in sterile condition (sterile packaging)
- Necessary instructions in event of damage to the protective of sterile packaging and appropriate description for re-sterilization/decontamination methods
- Indication/markings in case intended e.g. “for single-use only” (if applicable) [Thai: in visible clear red color] or “the test cannot be reused”

1.2.4.5. Means to assure reagent standard of identity, strength, quality, purity at time of use; were the information regarding

(1) possible deterioration of reagent or observable indication of an alteration of the product (physical, biological, or chemical indications of instability/deterioration) e.g. indicators of reagent: turbidity, precipitate, color change, beyond its appropriate standards

(2) instructions for a simple method for user to determine the meeting of appropriate standard (e.g. a form of user control) and to reasonably verify product's performance in meeting design specification at the time of use

1.2.4.6. Specimen type, collection, handling, and preparation for analysis, including help by illustrations and pictures in color coding

(1) description or type of specimen to be used with IVD, special conditions of collection, pre-treatment and storage conditions (if necessary)

Example **"**Urine collection" (การเก็บปัสสาวะ) (41) (35)

- The urine can be collected at any time of day, but it's best for the first morning urine (เก็บเวลาใดก็ได้ แต่เก็บหลังตื่นนอนในตอนเช้าจะดีที่สุด);
- keep urine in the supplied cup (เก็บใส่ในถ้วยที่ให้มา);
- such cup must be clean, dry, and not polluted with wax or soap to avoid unclear result (ถ้วยต้องสะอาด แห้ง ไม่ปนเปื้อนขี้ผึ้งหรือสบู่ เพราะจะทำให้ผลที่ได้ไม่ชัดเจน)

(2) criteria for acceptance/rejection of specimen samples

(3) special precautions and procedures regarding specimen collection as well as patient preparation (where necessary) for testing validity

Example:

- removal of particular matter by filtration; or
- urine sample exhibiting visible precipitates should be filtered, centrifuged, or allow to settle and clear aliquots obtained for testing, etc.

(4) recommended storage, handling, shipping instructions for protection and maintenance of specimen stability

Example: "If testing can not be performed directly, urine specimens should be kept cool below 25 °C for up to 24 hours; or may be refrigerated at 2-8 °C and stored up to 48 hours prior to assay (USA); and the urine sample must be brought to room temperature before use".

1.2.4.7. Test method/Test procedure/Operating instructions (description of procedure to be followed)/particular operating instructions/Procedure (a step by step from specimen reception to result obtaining)

(1) Pretreatment (may be specified in reagent preparation)

(2) For the test method

• description of required/necessary amounts of reagents, samples, and other parameters e.g. proper temperatures, and times required for specific steps, etc.

• performance/turnaround time

• calibration information/details of calibration:

- identify reference materials

- describe reference sample preparation, controls, use of blanks, standard curve preparation; indication maximum and minimum levels of detection or calibration range (highest and lowest value)

• statement describes

- stability of final reaction of product/material to be measured

- time within to be measured to assure accurate result

(3) For the individual reagents (may in separated section in package insert)

• complete instructions for preparing use-dilutions or mixing

• test volumes and directions for use of individual reagents

(4) If it is possible, the calculation for the readability grade level should be performed to ensure and facilitate the ease in reading, understanding, and utility of the labeling.

The recommended formula is the Gunning Fog Readability Formula.

Formula: Fog Score = 0.4 * (average Sentence Length + number of words having 3 or more syllables in the sample)

Example of Test method for test strip (วิธีใช้) (67) (73)

• Remove strip after pouch opening. (ฉีกซอง แล้วนำแผ่นทดสอบออกมา)

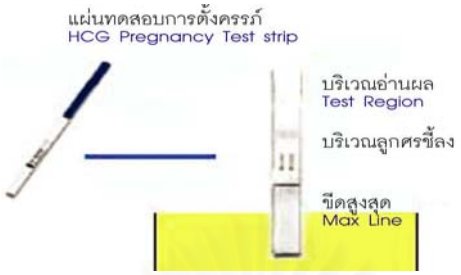
• Hold strip in vertical position. (จับแผ่นทดสอบให้อยู่ในแนวตั้ง)

• Dip strip into urine with the arrow pointing towards urine. (นำปลายที่มีหัวลูกศรชี้ลง จุ่มไปในปัสสาวะ)

• Dip for 1 minute with the urine level under the max line (see figure 1). [จุ่มนาน 1 นาที โดยจุ่มไม่เกินขีดสูงสุดที่ปลายหัวลูกศรชี้ (ดูภาพที่ 1)]

• Remove strip from urine and lay it flat on the cup or dry/non-absorbent surface. (นำแผ่นทดสอบขึ้นวางพาดในแนวนอนบนถ้วย หรือบนที่แห้งที่ไม่ดูดซับความชื้น)

• Wait for 5 minutes before result reading, but not more than 15 minutes to avoid faulty results. (รอ 5 นาทีจึงอ่านผลแต่ไม่ควรเกิน 15 นาทีเพราะอาจทำให้ผลที่ได้ผิดพลาด)



ภาพที่ 1 การจุ่มแผ่นทดสอบลงในปัสสาวะ

Example of readability grade level calculation

The words in the information about urine collection and test method were counted together and calculated for readability grade level. Their total score of the test method in the Thai (41+ 67) or English language (35 + 73) were 108. Moreover, there is only one Thai or English word that having 3 or more syllables in the details about urine collection and test method. It is "ปัสสาวะ" in Thai and "non-absorbent" in English.

Formula: Fog Score = 0.4 * (average Sentence Length + number of words having 3 or more syllables in the sample)

$$\text{Thai or English} = 0.4 * \left(\frac{\text{words in passage } \sim 100 \text{ words}}{\text{Total number of sentences}} + \text{no. words} \geq 3 \text{ syllables}\right)$$

$$= 0.4 * (108/9 + 1)$$

$$= 0.4 * (12 + 1)$$

$$= 5.2$$

= about readability grade level 5

It means that this testing method needs the user with at least educational grade level 5 to capable in reading and understanding such information in this HPT labeling protocol for their effective product utilization.

1.2.4.8. Test results or **result interpretation** (include trouble shooting information)

(1) Calculation principles/mathematical approach

(2) Explain procedure for calculating value of the unknown/test sample

• adequate description of expected results for the test providing other than quantitative results

• explaining the answer

(3) Assay procedure and reading with explanation of results (calculations and interpretation of results)

• maximum time for interpreting results or how long the results are stable, particularly for negative (–ve) results, which may become positive (+ve) over time

Example: Do not read the result after 15 minutes.

• criteria for acceptance/rejection

Example: rejection: if there is no visible band on control line

• indicate the significance of test results obtained

Example: positive: > 25 mIU/ml urine, negative: < 25 mIU/ml urine

• positive and negative as well as invalid/inconclusive result must be clearly defined with cut-off levels

Example:

- pregnant: positive (+ve) result with 2 pink bands appeared (1 at the control line (C zone) and 1 at the test line (T zone)

- non- pregnant: negative (-ve) result with only 1 pink band appeared at the control line (C zone)

- Invalid/inconclusive result: only one band on test line (none on control line); or no distinct band visible both on test line and control line

[NB] The test line can be lighter or darker than the control line. Its intensity depends on hCG concentration in urine, but it is normally distinguishable lines.

• explanation of expected results (for qualitative result)

• need high quality photograph or results reproduction (for visual results)

• whether further testing is required e.g. duplicate tests for reactive initial result

Example:

- if the test is invalid, repeat testing with new strip is recommended
- if the test is negative, test again after 7 days of missing the period
- if the test is positive, see physician to confirm your pregnancy

- if pregnancy is still suspected, retest using a first morning urine

Example of Result interpretation (วิธีอ่านผลบนแผ่นทดสอบ) (ดูภาพที่ 2)

- Pregnant (ตั้งครรภ์): Two dark or faint pink colored bands appear, one in the test (T) zone and the other one in the control (C) zone. [พบแถบสีชมพูเข้มหรือจาง 2 แถบที่ตำแหน่งอ้างอิง (ซี) และ ตำแหน่งอ่านผล (ที)]

- Non- pregnant (ไม่ตั้งครรภ์)**:** Only 1 pink colored band appears in the control (C) zone, no obvious pink colored band appears in the test (T) zone. [พบแถบสีชมพูเพียง 1 แถบที่ตำแหน่งอ้างอิง (ซี)]

- Invalid/inconclusive (สรุปผลไม่ได้)**:** No distinct pink colored band visible both in control and test zone; or only test band appears without a control band [ไม่พบแถบสีชมพูที่ใดๆหรือพบ 1 แถบที่ตำแหน่งอ่านผล (ที)]

ภาพที่ 2 ผลทดสอบการตั้งครรภ์

- possible errors (e.g. prolong reading, contamination, cross reactivity, etc.) and their sources

Example: The invalid/inconclusive result might be due to

- the test usually be invalid due to not following instruction

- store test kit under direct sunlight, or keep in the frozen part of refrigerator

- open foil pouch > 1 hour, or the test strip was moistened/wet before testing

- urine level higher than the end of arrow indicated on strip

- dip non-reactive end of strip in urine or dip in urine less than 1 minute

- read the result too fast (within 1-2 min.) or too late (after 15 min.) compare to the recommendation, etc.

(4) Precautions/measurements needed in the event of changes in the (analytical) performance/malfunction, of IVD (or should be in sticker on the outer label)

(5) Information appropriate for users to verify

• whether IVD is properly installed, can operate correctly and safely by citing the details of kinds of quality control procedures (internal Q.C.) including specific validation procedure and materials required (e.g. indicate need for positive and negative control, satisfactory limits of performance, etc.).

Example: The pink line/band occurring on the control area determines if chemicals are working properly, an adequate amount of sample was added, and the proper procedure was followed.

• nature and frequency of preventive and regular maintenance, any Q.C., replacement of consumable components, and calibration needed to the traceability of device calibration

1.2.5. Follow-up action:

The information should be stated about the need for any further procedure/handling/additional test if obtaining certain results for more specific/more sensitive further testing, and the action to be taken for such cases.

Example: In each following situation, it should include statement clearly directing the user

- not to make any decision without 1st consulting medical professional/ practitioner after testing ", and
- to consult physician to confirm the pregnant and obtain appropriate advice as soon as possible for your health, after obtaining the result of "pregnant", or
- to retest after 1 week of missing the period to make sure the correct test performing after obtaining the result of "non-pregnant". If the result of the second test is still negative and menstruation still has not occurred, the user should consult the physician.
- to review the procedure and repeat testing as instructions with new strip using a first morning urine collected 48 hours later, after obtaining the invalid/inconclusive result. If the problem persists, discontinue using the test kit immediately and contact your local distributor.

1.2.6. Limitations of the procedure/method and information about the use of available reference measurement procedures and materials by the user (test limitations and all known contraindications)

1.2.6.1. any known extrinsic factors/interferences/interfering substances affecting the results

(1) discusses/lists of any foods, medications, or other possible interfering substances ability to affect test results/assay performance (what substances should be avoided and for how long prior to testing to prevent the cross reactivity)

- prescription or over-the-counter (OTC) drugs (pain relievers, oral contraceptives, antibiotics, and other commonly used medications)

Example: "Normally taking alcohol and some medicines (e.g. oral contraceptives, pain relievers, antibiotics, etc.) including other commonly used medications would not affect testing results, except some injections containing hCG hormone e.g. Pregnyl, Profasi, etc.; which cause elevated hCG level and false +ve result."

- elevated levels of chemical analysts (e.g. caffeine, ascorbic acid), and biological analysts (e.g. glucose, protein, albumin, bilirubin, lipids or triglycerides), hemoglobin, anticoagulants, etc.

(2) various patients with certain health conditions or clinical factors ability to affect marker levels e.g. trophoblastic disease, some non-trophoblastic neoplasm, etc.

Example: "urine in certain health conditions can cause a false or an irregular result

- ovarian cyst or ectopic pregnancy,
- miscarriage or given birth in past 2 months, etc.,"

1.2.6.2.indication that results should only be used in conjunction with other data

1.2.6.3.factors be considered when interpreting test results e.g.

(1) time in reading result should be followed strictly as recommendation

(2) the user should be without colored-blinded

(3) the optimal light for reading

(4) be sure to read at the right end of strip

[NB] These factors might be indicated in the part of "warnings and precautions".

1.2.6.4.information for user on possibility of false-positive (+ve), false-negative (-ve), or indeterminate test results with such meaning explanation, about possible sources, and the implications of false results

(1) False-positive result (e.g. there is positive result when pregnancy does not exist)

Example of the false-positive result in HPT utilization: - the contraindications or the exclusions of self-testing to avoid the unreliable results for false positive (false +ve) in using of HPT product should be prohibited in patients with

- ovarian cysts or ectopic pregnancy,
- miscarriage or given birth in past 2 months,
- some injections containing hCG hormone e.g. Pregnyl, Profasi, etc.

(2) False-negative result (e.g. there is negative result when pregnancy exists)

Examples of the false-negative result in HPT utilization:

- The limitations or the interferences which might cause the unreliable results or false negative (-ve) results are such as refrigerated urine, use of waxed cups, soap residue, etc. (This information might be indicated in the part of "urine preparation")
- "A false negative result may occur if the urine is
  - too dilute or exhibiting visible precipitates,
  - with a very early stage pregnancy (if test done on or before the 1st day of missed period), or belonging to women with irregular period."

1.2.6.5. Contraindications or any (specific) contraindications for use (if applicable) e.g. "use of this device is contraindicated in recent influenza vaccine recipients…" when considerable cross-reactivity can be expected in recent influenza vaccine recipients, etc.

1.2.7. Expected values/Reference intervals for the quantities being determined including reference population

1.2.7.1. state range of expected values (based on study in various populations)

1.2.7.2. indicate how range(s) of expected values was established (& population study)

1.2.7.3. literature references (as appropriate)

Example:

- urine samples of healthy non- pregnant women and men show negative results. Levels of ≥20 mIU/ml hCG, may reach as early as 10 days after conception, approximately 3 days before expected period.

- "Detect pregnancy by the 1st day of the missed period and no sooner"

1.2.8. Performance characteristics

1.2.8.1. (Specific) Analytical performance characteristics (performance comparable to professional in clinical settings)

(1) Analytical sensitivity (lower/minimum detection limit)

The limits of detection by manufacturer and measurement range are such as 20 or 25 mIU/ml.

(2) Specificity (cross-reactivity, etc.)

(3) Accuracy (trueness and precision; or method comparison) e.g. accuracy of IVD determined by laboratory studies and in hand of OTC users

The statement summarizes data basing on specific performance characteristics.

Formula in calculation of % result accuracy:

$$\%\ \text{result accuracy (should not} > 99\ \%\ \text{accurate)} = \frac{(\text{true positive}) + (\text{true negative})}{\text{Total number of samples tested}}$$

- Accuracy is based on test efficiency but "100 % accurate" should be avoided

Example: % result accuracy = > 99 %

- The source of reference material that the standards or test are calibrated against (1st IRP, 2nd IS, 3rd IS) for hCG should be stated in the submission only

Example: It can detect concentration of 25 mIU/ml hCG, or more. The test has been standardized to World Health Organization Std: 1st IRP (International Reference Preparation) IRP75/537

1.2.8.2. Diagnostic performance characteristics/ (Specific) test Performance characteristics (summary data from clinical trials) (It should not be affected by anticipated variation in user technique and should include simple method for user to reasonably verify product's performance in meeting design specification at the time of use.)

(1) degree of accuracy claimed e.g. 99 % accuracy

(2) a sentence relative to the clinical sensitivity of the test (how early pregnancy can be detected) e.g. can detect at the 1st day of the missed period

1.2.9. Disposal

1.2.9.1 Installing sufficient information for appropriate decontamination and disposal procedures of used/expired kit and/or reagents e.g. "Must be disposed in a safe way"

1.2.9.2 Precautions/special protective measures against special, unusual risks related to use or disposal of

(1) IVD or its accessories e.g. lancets

(2) any consumables used with it (e.g. batteries or reagents, etc.)

(3) any potentially infectious substances of human/animal origin

1.2.10. Name and address (with contact phone number and fax number as well as website address) (postal address) of

1.2.10.1 manufacturer

Example: "Manufactured by U.S. Consumer Health, 1234 E. Hunter Ave., Anaheim, CA 92807, U.S.A."

1.2.10.2 importer/authorized representative in importing state

Example: "Imported by Thailand Diagnostics, Co Ltd., 100 Ramkamhang road, Hua Mark, Bangkapi, Bangkok 10240"

1.2.10.3 authorized representative/distributor

Example: "Distributed by Thailand Health, Co Ltd., 3 Sukhumvit road, Klongton, Bangkok 10240"

1.2.11. Revision date (date of issue or any/latest revision of instructions for use)

Example: in English: Revised 14/01/2006; or in Thai: ฉบับ 14/01/49

1.2.12. Bibliography (pertinent references keyed to text/pertinent up-to date references for cited information in the text and other related reference)

2. Exemption for pack insert labeling in case of [information depends on safety and complexity of test]

2.1. All required contents in leaflet labeling are already showed on outer label.

2.2. multiple-purpose instrument for diagnostic: indicate only

2.2.1. established name (not specific diagnostic procedure/systems)

2.2.2. intended use

2.2.3. instruments

2.2.4. name and place of business

2.2.5. date of issue or latest revision of labeling (manufacturer, packer, distributor)

2.3. reagent used as replacement in diagnostic system: information to

2.3.1. identify reagent adequately

2.3.2. describe its proper use in the system

Section VI: Specifications for self-testing devices/device sold to general public

1. Availability and accessibility of labeling

The availability of IVD inner and outer label with package leaflet is the obligation of the entrepreneurs in accompanying each device and it should be proper to IVD with its intended use.

2. Document characteristics of Information in labeling [format, content, location should be proper to IVD and intended use]

It should be in full labeling of each unit of IVD. The information required on the outer label should be legible and visible under normal conditions of sale. This is to let the lay users to make an informed choice and to easily permit the device identification for post market activities such as recall. However, the quality of such labeling will be as follows.

2.1. Utility (e.g. benefits, contraindications, directions, precautions, side effects, storage, etc.)

2.1.1. All information should be targeted to the anticipated user population.

2.1.2. The details should be sufficient for the lay user to use the device with proper and safety method, interpret result with capable to understand the result reading correctly, as well as to take appropriate follow-up action.

2.1.3. The fact of all information must be clearly stated.

2.1.4. The presented procedures should be readily understood by the lay person (may accompany with texts, symbols, diagrams and charts).

2.2. Design quality (e.g. format, print type & size, tone, spacing, organized, attractive, helpful, etc.)

2.2.1. Format

The information should be in legible format that is most likely to be understood by expected users. The format of labeling should be proper to IVD and its intended use as well as clearly written in a step by step especially in "directions for use".

2.2.2. Print type and size

2.2.2.1. The texts must be readable in legible characters/prints with

(1) certain distance and lighting intensity

(2) proper font size and color used

The technical recommendation of the prints is as follows

- font size is at least 12 points for general part and 14 points for title except the font type of "Tahoma". The print type of Tahoma with at least 8.5 points for general part and 10 points for title are found to be an proper example due to its nature of large font type and less space needed comparing to the other fonts.
- dark prints on the pale background
- render only 1 font type in printing except the title that is separated from the other contents e.g. the type of document ("instructions for use" "เอกสารแนะนำการใช้") or the product name at the beginning part of the package leaflet "Lady Preg Strip" "Home Pregnancy Test Kit" "ชุดทดสอบการตั้งครรภ์ เลดีเพร็กสตริป", etc.

2.2.2.2. The print size of content in other language should not be bigger than in Thai language.

2.2.2.3. The prints in labeling should be in legible characters/prints with proper print sizes for all ages of the lay users.

2.2.3. Spacing

According to the technical recommendation, it needs some spacing in labeling because too tightened in labeling might discourage the reading.

2.2.4. Information organization

According to the technical recommendation, the information organization should be in an appropriate ordering to the unfolding of the package leaflet in the labeling reading of the lay consumers.

2.2.5. Emphasis

The emphasis of labeling should be permanent and prominent manner by using the bold prints or other ways to highlight the headings or important information

(e.g. instructions for use, warnings & precautions, test interpretation, etc.). Moreover, the color coding of reagent containers should be provided (whenever practicable).

2.2.6. Graphics

The information in labeling should contain clear/liberal use of different types of graphics such as drawings, illustrations, diagram, charts, color identification, internationally recognized symbols. Drawings and diagrams are highly recommended in areas which no standard exist. These graphics could promote the lay users' understanding and effective use of devices.

2.2.7. Using symbol

2.2.7.1. Encouragement of internationally recognized symbols should not compromise device safety by a lacking of patient/user understanding.

2.2.7.2. It is necessary for words with harmonized symbols in all places of labeling to describe or explain their meanings especially for the lay users. Moreover, the text explanation in package insert is also required to describe symbols and color used particularly in case the meaning is not obvious to device user, the "directions for use", test results, result interpretation, etc. This is to prevent the product unsafe use to the users due to

(1) few lay people familiar with their meanings, and

(2) the concern about possible inability of end-user to symbol understanding.

(3) If device contains dangerous material or is considered to be dangerous; relevant danger symbols must be indicated on its label, and its details must be in leaflet.

2.3. Comprehensibility (read, understand, remember, locate, keep)

2.3.1. Language and translation

2.3.1.1. The labeling must include the information (or the translation) in the official or national language of country selling the product due to the absence of "learned intermediary" in safe and effective use of the lay consumers.

2.3.1.2. The information needed in all official languages by manufacturer e.g. the contents on the outer label, "Warnings and Contraindications", "Directions for use", etc.

2.3.1.3. The content in other language should be corresponded with that in Thai.

2.3.2. Ease factors for lay users

2.3.2.1. The information in labeling should be simple, concise, in terms easily to be readily understood and applied by the lay users at all stages. This is to reduce the risks in specimen and IVD handling, result interpretation, etc.

2.3.2.2. The "technical" or incomprehensible language should be eliminated and the text should be simplified with informal subheadings e.g. "the analyte being measured" instead of "intended use".

2.3.3. Location

The location of labeling should be proper to IVD and its intended use. All information should be obvious and clear enough to read and intended to last for the life of the device (permanent and prominent manner). It must be visible by intended user under normal conditions of sale.

3. any other requirements for

3.1. appropriate/special training needed (at the time of purchase) before adapting treatment for disease monitoring after using self-test device, or

3.2. test marketing of the device labeling in some cases.

Section VII: HPT Labeling prototype

The 4th draft or final version of HPT labeling prototype was composed of the outer and inner label as well as the package leaflet as shown in Appendix J.

CHAPTER VI

DISCUSSION

The discussion of the results would be separated into 3 parts on domestic problem assessment from content analysis and consumer testing of existing HPTs labeling; on the international regulations comparison on labeling of home-use IVD; and on the guideline development and validation. The details were as following:

Part 1: Discussion on Domestic Problem Assessment (Phase I)

The HPT is the kind of product that has been most favorite home-use In-vitro diagnostic test kit for lay consumers in Thailand and all over the world. Therefore, it was worth to be the representative of home-use IVDs in all phases of this study. The discussion in each part would be as following:

1. Content analysis and competency testing on existing HPT labeling (Phase I)

Some problems found from this analysis could cause the lay users some troubles in information finding as well as understanding, and the proper utilization including bad images to such products as following:

1.1. Design Quality

The problems of smaller Thai print sizes comparing to other language was highly found (65%) and violated to Thai Medical Device Act 1988.[38] It could be due to the effort to build up the product image for selling strategy but some labeling avoided this violation by no any English version. Furthermore, the problems of small print sizes, print quality, small and pale drawing, etc. were common to be found in nearly three quarters of the existing HPT labeling which was consistent with the study results of Krass I and colleague.[30] Such small print was revealed to interfere the ease of reading to the group members[51] which was consistent with the expressions of

some lay consumers in this study. However, the small print sizes were generally due to their space limitations and they could give negative impact to the lay users.

The above problems were found on lot number/manufacturing date and expiry date which were the important contents on the labels those involved the product traceable, stability, and the buying decision of the users. Moreover, inappropriate drawing quality made it hard to be seen and improper drawing with related information sequencing made the labeling hard to comprehend. Leaflet with these problems had possibilities to cause document unattractive to be read and put lay consumers at risk of being error particularly in the use instruction and result reading.

1.2. Utility/ Content

The analysis in Phase I was taken only basing on the average mean score due to the aim in problem finding on existing HPTs labeling in Thai market, not developing the new labeling. The discussion on the results obtained from the content analysis and consumer testing in each aspect would be as following:

1.2.1. Total competency of lay users on existing HPT labeling

The calculated competency score of each lay consumer on total contents of existing HPT labeling was quite low which might be due to the labeling quality itself; the non-indicated information of some aspects; and their ability to read, locate and understand the labeling information.

1.2.2. Competency of each content topic on existing HPT labeling

Other than the amount of information, the quality of information was concerned to complete the consumer protection activity. The finding in this study of non-indicated information and less Thai contents than English labeling might cause the risks to the lay users on understanding the required information. Hence, many countries including Thailand required the translation of home-use IVDs labeling into their official languages.[13, 32, 38, 55, 62, 77] The discussion would be as following:

1.2.2.1. Consumer buying decision information

It was noticeable that the product trade name was the only item that could pass the criterion score of the average competency ($\geq$81%)[67] which was a quite serious problem in consumer protection. The details in each aspect were as following:

(1) Product (IVD) name/trade name

Most of lay consumers could give the correct answers (87%) and easily found this information (90%), which were consistent with its indicating rate (85%). It was noticeable that the rate of correct answers and information locating were a little bit higher than the indicating rated. This could be explained by many following supported evidences. Almost HPT trade names were found to be generally specified at the top part of outer and inner label (foil) and at the beginning part of the details in package leaflet. Moreover, it's usually in big print size with bold type and locating in the most distinct part of the front/main part of the outer label. Therefore, the lay users could guess what would be the product name and its location.

For the smaller number of correct answers than the locating ones, it could be explained by non-indicating its trade name at the normal place as others but placing it in the details of its package inserts. Nevertheless, some lay users indicated for the difficult finding and not capable to locate the HPT name. This could be due to no HPT name in Thai and their poor knowledge in reading as well as spelling in English. Therefore, these factors could be the obstacles to lay people in finding and giving the correct answer of such content which affected their understanding.

From this study, the finding of very small print size of almost Thai trade names comparing to English name violated the Medical Device Act 1988 requirement.[38] Such law did not provide the penalty provision for HPT products which was general medical device with least control level. The problem of small print face of the contents in labeling was the classic issue with generally known.

It was noticeable that some incorrect answers could be due to the presentation of some HPTs trade name with the symbol of trade mark or any inappropriate styles as the following expressions of some lay users.

- "This product name should not be written like this because it was hard to read due to too many dots among alphabets in the trade name. It disturbed the eye-sight and the reading."
- "The product trade name specifying in package leaflet was easy to locate but it was hard to find on the outer label. This is due to its presenting as the symbol which the lay user might not know what it is."

As a result, the lay consumers might be confuse and misunderstood with their trade name and then gave the wrong answer. However, the consistency in the mean %

of the results between the locating and right answering of this content, and its achievable average % competency could support the non-serious trouble for lay users.

(2) Content/pack or amount/pack

The rate of information finding (81%) and correct answers (78%) were found to be quite high comparing to the indicated rate (65%) because the number of test/pack was easily assumed from the real HPT product. However, some small print sizes, the print colour nearly the same as its background, and the poor eye-sight of some lay users could also lead to the difficulty in locating and understanding this information in some existing HPT products.

(3) Intended use

The problems found in this topic were not serious due to several sources for the lay consumers to obtain the right answers e.g. statements, its common name, testing drawing, etc. The evidence was some lay users expression for the implication to obtain this information as "the drawing could communicate the benefits of this test kit". It was noticeable that most of inability to locate this topic and give the right answer was found in HPT without specific heading. They cited under the title "advantage" or "result known in 3 minutes" on the outer label, or cited in its leaflet as "for pregnancy test" but close to title "advantage" declaring about HPT quality (e.g. easy to use, accurate, fast, prompt, save, environmental preservation, etc.). Hence, many lay users used these claims as their answers.

The hard time in locating and recognizing this information were believed to be the unambiguous obstacles to the lay users' comprehension which might be due to their own potential. This conclusion was supported by the consistency of scores in their perceptions of easy finding (84%) and in their answers correctness (83%). However, its average % competency could not pass the criterion score ($\geq$81%).[67] Hence, the intended use should be indicated with clear title on both outer label and package insert as well as on the inner label (if possible) even if its common name and the drawings of test method could communicate to the product benefits.

(4) Lot numbers/ manufacturing date

The lot number was required and directly important to the regulators and manufactures, whereas the manufacturing date was useful to the lay users due to its practical meaning even if it was not directly required by the Thai law.[38] The problem**s** of different lot numbers or the different styles between label and foil of the

same HPT reflected their labeling quality control inconsistency and affected the product images.

(5) Expiry date

Expiry date was recognized to be one of the vital issues reflecting the quality and efficiency of all consumer products because it related to the product stability. It usually comes together in the same template with lot number and sometime with manufacturing date. Therefore, the product owners or manufacturers got easier possibility to design these contents on their labels with limited spacing and had fewer burdens on their sales marketing. Nevertheless, it could cause misunderstanding and confusing to some lay users among these 3 kinds of contents as supported by the most distinct problematic issue found among consumers' buying decision information which could lead to some risks in product utilization.

The above troubles might be due to non-indicated in Thai version; printing quality and print size; lacking of knowledge in English and the abbreviations; and some improper labeling e.g. all contents in English, or in Thai heading but English details, etc. Moreover, the poor printing quality of some outer label (e.g. dark print on dark label background) could be considered to affect the information finding and comprehensibility of the lay consumers. This analysis was supported by the evidence of all correct answers of 1 HPT product with clear Thai version in both heading and details of these 3 kinds of contents (expiration date, manufacturing date/lot number), and many wrong answers found on 1 HPT brand labeling with colour detaching during package opening. Hence, Thai heading with details of these contents in Thai language must be labeled on both outer and inner label for more consumers' protection. The package wrapping with transparent plastics should also be cautious to save the print colour from coming off during removing such plastic covering.

(6) Responsible organizations

Their names and addresses including telephone number could assist the lay users for further information with individual counseling for buying decision and using the product. However, there were some noticeable matters as following

- **Manufacturer name and address**

There were many issues related to this aspect to be discussed as following

- About half of existing HPTs in this study did not cite the manufacturer with address which contradicted to the reference regulations (Thai and U.S.A.). These could be explained by the reasons in product marketing for the value

added of their products which affected their possibilities in merchandise. For their marketing reasons, many of them did not give the address of their manufacturer (factory) which might be due to no intention to declare the country of product origin.

- The finding of different manufacturers (in U.S.A.) claimed between its outer label and packaged leaflet could make some lay users confuse and have hard time in right answering. The supported statement of a lay user was as “I don’t know which one of these 2 manufacturers to be selected for the answer because I don’t know which one is the correct one.”

- The labeling of foreign companies without any heading as “manufacturer” and the indication of the manufacturer (foreign company) name of raw material used in production might be due to their intention to present as overseas products especially the products with high marketing share and long time launching.

From the in-depth interview of some marketing CEO of HPT products, and observations as well as evidences found as a whole, all of those HPT products had the same origin in China and both distributors imported such products in the big lot and shared with each other in repacking somewhere in Thailand to lower their cost. This was one reason why they did not identify the manufacturer of those HPT products. Oppositely, they presented their products as imported from U.S.A or Canada, and sold in higher prices than the local ones which were not fair to the lay consumers.

The prices claimed on their outer labels and the actual retailed ones were much different depending on many factors e.g. the selling area, kinds of community pharmacies, the famous of the brands or the company image. However, there might be other likely cases and different reasons. Hence, these issues must be solved by the responsible agency especially by Thai FDA in labeling quality, and by the Consumer Protection Office in the issue of reasonable prices with some over claimed matter.

The problematic matter of this content should be aware by the stakeholders even if it was not serious. However, it could affect in buying decision of the lay consumers, the traceability in case of some adverse reactions and the product liability issue, etc. Consequently, the manufacturer name and its address must be clearly indicated in Thai language in outer and inner label as well as in packaged leaflet of home-use IVD especially the HPT product.

- **Importer and address**

Some companies tried to present their HPT products as the imported ones for their higher price setting even if they were actually locally manufactured in Thailand. Moreover, none of them indicated the importer and address in their Thai labeling. Hence, this problematic issue needs some controlling for more consumer protection.

As interviewing some importers and distributors, some of HPT products were really imported from some Asian countries in lower price than local HPTs but they were claimed as from U.S.A, Canada, or European countries and sold in high price. Moreover, the evidence from Thai FDA showed that only 1 HPT brand from 38 HPT products of 23 importers could be found in retail Thai market on the same name as the imported one. They were respectively imported from China, U.S.A., Korea, Canada, India, England, Germany, Taiwan, Australia, and Spain. However, only U.S.A., Canada, and Germany were found to be claimed on some HPT products.

- **Distributor and address**

This information was not the problem for the lay consumers in information locating and understanding due to its high citing rate (90%). This topic was usually in the attention of product owners for their merchandise and benefits. However, it was noticeable that correct answers of this detail were obtained quite low (77%) comparing to the amount of indicated information. This might be due to some non-indicated HPTs in Thai language. This circumstance supported the evidence that lacking of Thai labeling could decline the comprehensibility of information.

According to one manufacturer interviewing, the different distributor between the label and package insert of one HPT product was due to some errors in the labeling changing process as the problem of trade name patent of such product. However, it might be due to the need to safe costs as some old versions of package leaflets left. This could disturb the image and reliability of the product as well as the responsible companies. Hence, Thai labeling of this detail should be emphasized.

(7) Claims for their performance and sources

Inappropriate labeling for their various claims of performance, foreign sources, and other selling points could mislead the lay users. It was noticeable that the statement about easily use, fast result, sources of manufacturing, Quality System standard, and % accuracy were utilized to be the selling points for most of the HPT products in Thailand, particularly the production sources of several HPTs for 3 big

countries (U.S.A., Canada, Germany). Consequently, it was not suspicious why the prices of imported products were quoted and sold much higher than the locally ones. Nevertheless, there were no evidences to support for such claims due to no pre-marketing regulations for the price and quality control of this home-use product nowadays. Furthermore, Quality System standard certification should not be labeled anywhere of the packaging to promote the quality of product because it reflected the value of manufacturer system, not the product quality.

The discussion on product performance would be on 3 aspects as following:

- **Analytical Sensitivity**

According to Rosenthal MW and Briggs GC, the excellent-device could detect 6.25 mIU/mL urine hCG; the fair could identify 100 mIU/mL; and the values for very good and good were not given.[85] As no stringent control of home-used IVDs including the HPT labeling, all sampling HPT products were thus assumed to be good devices because they claimed as ability to detect urine hCG from 20 to 100 m.I.U./1 ml. urine hCG. The notification issuance to upgrade the control of HPT products was thus needed to ensure the product and labeling quality, and their claimed performance.

- **Diagnostic Sensitivity**

Testing at least 1 week after expected menstruation would give the most accurate testing result.[85] Hence, the declaration of most existing HPT products about their Diagnostic Sensitivity "as early as the 1st day of missed period" was consistent with the product labeling for the general HPT test kits. However, an imported HPT that claimed as ability to detect $\leq$ 30 mIU/mL urine hCG and declared as "1-3 days before expected period" was contradicted to the statement "the test with ability to detect hCG levels $\leq$ 25 mIU/mL could be used 3 days before missed period".[85]

In this study, there were 2 sampling HPT products claiming their ability to detect 20 mIU/mL urine hCG and claimed for their usage as 1-3 days (brand M), or 3 days before expected period and 10 days after conception (brand O). The claim of brand M was corresponded with the above suggestion[85] while brand O was suspected due to its second claim as 10 days after conception. However, these performance claims could be ensured by laboratory confirmation and clinical data.[78]

- **Result Accuracy**

USFDA suggested the expressing of data in term of % accuracy should never exceed >99%.[78] However, most HPTs declared over such advice which could be

considered as over claimed. Some stated as ">99.9% or 99.99%" which were the same meaning as "virtually 100% accurate" or "nearly 100% accurate", and were conflicted with the misleading statement "100% accurate" that USFDA suggested to be avoided.[78] Hence, this problem must be considered for more consumer protection.

(8) Overall results of buying decision information

The expiry date, amount/pack and the manufacturer in Thai language both heading and its detail presentation were the most urgent problematic issues to be improved due to their very low mean scores on both information finding and right answering. Their lower scores could be due to the high rate of their information unavailability. However, the problems found as the overall result about this information were not quite serious comparing to the product utilization information. It might be that buying decision information was rather short, easy to locate and to understand. They could be easily implied or guessed even they were unavailable or occupied in other languages. Moreover, some of them could be easily translated into Thai by the lay persons. However, it should not be neglected to emphasize the clear and genuine information for consumers' benefits, for tracing back activity of the entrepreneurs, and for recalling process of the government agency.

1.2.2.2. Consumer utilization information

(1) Precautions

Generally, the precaution was an important part to remind the lay users to give special attention for their efficient utilization and to prevent the possible false results. However, there were several involved statements those could not be all cited on the outer label. Hence, the linkage statement to the leaflet was needed.

It was noticeable that only about half of the subjects could easily locate and give the correct replies to this content which were quite much lower than the indicating rate (90%). Other than no specifying of this information, the reasons might be due to the nature of lay consumers especially the low educated ones. However, the results obtained from specific clear heading as "Precautions" in Thai language showed the facilitating of ability to information finding and right answering. The supported statement of a lay user was such as "the content of the precautions in product utilization was easy to find due to its clear visible title".

(2) Contraindications

These details were necessary to be informed to the consumers with no exception due to their effects on their safety, testing performance, and cost-

effectiveness. Quite high rates of non-indicated details and no Thai version found in this study might be due to no any labeling control of home-use IVDs in Thailand.

It was severe situation that all HPT products labeling in this phase were found to be highly encountered with the problems of incapability and difficulty in finding this information and wrong answering. This issue must be thus critical considered, found out, and urgent improved by all stakeholders particularly the liable companies and government agency (Thai FDA) for more consumer protection. However, the opposed rate between the rate of indicating and ability in locating this information could reflect the functional failure of the Q&A part of packaged insert.

The supported evidence was the obvious high rates of this content competency and the confirmation from the individual interview in many lay users. They expressed that they were not interesting in and did not pay attention to the content in Q&A part. They thought that such details were not important as those in the main part of packaged leaflet. Some expressed their awareness only on test method and its result, not other details. Moreover, smaller Thai print size in this part than the main part of this document was also claimed to cause some troubles in their information reading and finding as well as to lessen their interesting in acquiring this detail.

As analysis, the nature of its difficulty to understand and its long details might cause the lay consumers in boring to read. Many lay participants had hard time in locating the information in this Q&A part and gave the wrong answers or could not give the response. Hence, the labeling of this topic must be urgently improved to more attractive and easier to understand especially for the lay users. This content was suggested to be indicated in the labeling especially in the package leaflet with simple, concise, clear and under obvious heading, etc.[10]; and it should be rather presented with proper print size in the main part of its leaflet than in the Q&A part or in box.[93]

(3) Components

As the consumer testing, the rate in this information locating and right answering were found nearly the same as the indication rate. Beside the reason of indicated information, its easy content to be acquired from the real product could let some lay users give the correct answers by their implications from the packing and the details in its “test procedure” even if this content was not cited in Thai labeling.

The product components could confirm the users whether the elements essential in testing were attached with the package for proper HPT utilization. However, nearly half of the existing HPT labeling did not indicate this information.

Hence, the indication rate of this information was needed to be increase and it should be cited with clear specific heading in Thai labeling particularly in the package leaflet as more sufficient space to promote the higher rate in the information locating and right answering as well as the comprehensibility of the lay users.

(4) Urine preparation and storage

The very low rate of easy finding (46%) and right answering (30%) of this content comparing to its indication rate (80%) and other information could be due to no specific heading in many HPTs labeling but citing with the other details under either one of these headings of document (e.g. testing procedure, recommendation, precautions, Q&A part, etc.). The supported evidence was that the style of presentation with clear suggestion under specific heading “urine preparation” or “recommendation” in the main part of packaged leaflet had the trends to obtain lesser problems in locating this information. Moreover, the placement of labeling (e.g. main part, Q&A part, etc.) would be considered to affect the reading, locating, and understanding of this content.[93] The evidence were the finding of no any lay users’ ability to locate this information in HPT labeling with this detail under Q&A part. Hence, this information under specific heading “urine preparation” in the main part of package leaflet[93] would be proposed to be emphasized in product labeling development of home-use in-vitro diagnostic test kit for higher comprehensibility.

(5) Steps in testing method or testing procedure

As the content analysis, some contents those might be hard to understand or confuse the lay user and needed emphasis for the consumers’ awareness were such as “not exceed the level of arrow’s heading in strip”, or “not exceed maximum level on strip”, etc. for the dipping type. For the card type, the possible error might be due to the mistake in the well for result reading instead of the well for urine dropping. These problems related to 2 vital issues of testing method depending on the type of HPT product: the dipping time length or amount of urine dropping.

There was no official recommendation for exactly dipping time or amount of urine dropping in any guidelines due to its involving the concept for the sufficient amount of urine for testing and the sensitivity of product performance claimed for each HPT. These factors play as a concert which could affect the maximum time in result reading and the stability of testing result. Even the rate of indicating and locating as well as right answering of dipping time or amount of urine dropping were

very high; it must not be neglected due to their importance in facilitating the product utilization especially for the lay users.

As investigation, testing method was mentioned in text with drawing in both outer label and package leaflet of almost selected HPT products with clear specific heading as “testing procedure”. Moreover, some products also presented this information on their inner label (foil). This might be since this information was the key part of the labeling and was presumed to be most desired by the users. Otherwise, they might not capable to perform the test. Furthermore, the testing procedure of HPT product was not complicated. Hence, the lay users finding and understanding were found to have fewer problems than other contents. Moreover, the drawings of testing method were important factors influencing the comprehensibility of the lay consumers[10] as their expressions those already illustrated in the result part.

Finally, simple clear content and drawing under specific heading as “testing procedure”, consistency between drawing and explaining texts, proper clear print size for both normal and farsighted people, and the use of colour would be proposed for product labeling development for more attractive and understanding of the lay users.

(6) Optimum Time/waiting time before result reading

According to Rosenthal MW and Briggs GC, time to obtain results varied from 1-5 minutes and waiting 10 minutes before results reading could improve the test sensitivity.[85] All locally manufactured and almost of imported HPTs specified the result reading time in consistent with such reference. One imported HPTs cited wider range especially the lower limit of time (40 seconds) which was quite less than the suggested 1-5 minutes and it could affect the result interpretation by the users. However, such range of time depended on the supported data from their clinical trials because it related to the sensitivity/detection limit of the test.[78]

In addition to the non-specifying of this information, the inability or difficulty to locate and give the right answer might be due to much small pale print sizes with chaos design of some HPT labeling and their information sequencing, and the interpretation of some statements e.g. “knowing result within 3 minutes”; “read result after let the strip dried 3 minutes” and “after 3 minutes”. These analyzing contents were only the examples of labeling difficulty found in 2 problematic HPT products. The other explanation might not be ignored was the lay users’ potentiality themselves.

In conclusion, the indication of this information, proper design quality in print font and size with orderly information sequencing, the consistency of result reading

time range specified in each part of labeling, and the lay users' potentiality would be the key contents to be regarded in labeling developing and improvement.

(7) least time for result reading

This detail was indicated to draw attention to the lay consumers for their test results accuracy. The least time was not directly suggested with specific heading but it was indicated indirectly as the lower limit of their result interpretation which was 1-5 minutes.[85] However, the high rate of non-indicated HPT labeling for this issue was quite serious problem. Hence, the specific indication of the proper least time under the exact title for lay users' safety should be emphasized in labeling development to facilitate the testing result efficiency for the lay users in Thailand.

(8) Maximum time for result reading

According to USFDA, a maximum time for interpreting results or how long the results are stable should be included in the insert, particularly for negative results, which may become positive over time.[78] Moreover, 10 minutes to improve the sensitivity was recommended.[85] Fifteen minutes was found mostly declared and followed by 10 minutes which were consistent with the above suggestion. Hence, the maximum time for results reading as 10-15 minutes was suggested.

This content was very important particularly for the lay users because it could impact the improvement of test sensitivity.[85] Hence, the lay users might be at risks to result misinterpretation or failing in strictly following the instruction for the non-indication rate (60%) that was quite a serious issue and contradicted to the U.S.F.D.A. requirement.[78] Furthermore, the situation of only a quarter of lay consumers expressing as the easy information finding, nearly 3 quarters of incapability rate to locate this content, and very high rate of their incorrect answers (89%) reflected the problematic issues of this content on existing HPTs labeling quality in Thai market.

As investigation, the distributors on behalf of the owners of each HPT product did not pay attention to include this content in the labeling even if some of them claimed as imported from U.S.A. The reasons might due to lacking of knowledge or no strictly legal controlling of this product labeling. It was noticeable that all or almost of the indicated HPTs were locally manufactured in Thailand, whereas the non-indicated ones were mostly imported products. However, it was found that all indicated HPTs cited this content in Q&A part of their packaged leaflet which might not be attractive to the lay users as the above-mentioned reason from the individual interview and it was consistent with the study of Laughery et al.[93] Hence, this

information labeling was highly critical issue among all necessary information which needed more concern by the responsible companies.

First of all, they have to indicate this detail in their labeling with factors in design quality to enhance the lay users' information locating and comprehensibility. Moreover, this information must be emphasized in the testing procedure in the main part of their packaged insert, not in the Q&A part. Finally, the higher level of legal controlling of HPT labeling should be proposed to strengthen the degree of consumer protection in Thailand especially for the lay consumers.

(9) Result reading/interpretation

The discussion on problems found in this aspect would be as following:

- **Drawing and texts**

No labeling of test bands on drawing of result interpretation and the setting far apart between drawing and texts of result reading could cause difficulties and affect the risk-benefit of the lay users.

- **For the positive (+ve) and negative (-ve) result**

This information was assumed not to be problematic issue of HPT labeling due to only small amount of HPTs encountering with the incapability and the difficulty to find this information as well as the wrong answering by lay users, However, it is still needed to emphasize in labeling this information in both text and drawing. Moreover, this content should be directly cited following the test method to make logical sense to the reader in product utilization.

- **For the invalid or inconclusive result**

In general, this absolute information might include 2 situations of results (only control band and no any bands on test strip) and their further suggestions. The absolute information of invalid/inconclusive result was very important for the users to be aware. However, they might be at risks to result misinterpretation due to their lack of specific knowledge and experiences. These caused their content misunderstanding, or failing in strictly following the instruction. Furthermore, sometimes the inconclusive/invalid result was due to the poor quality of HPT products which the consumers had a right to make the complaints to Consumer Protection Board for legal proceedings to claim damages for such complaints if they were sure for their strictly following the use instruction.[88] Consequently, promotion of presenting in both text and drawing could facilitate these problems. Otherwise, the lay users might loss their

money and also miss their opportunities in benefits of their early detection of both pregnancy and non-pregnant women.

It was noticeable that the problematic existing HPTs indicated this detail in only text without drawing and having no specific heading in their leaflets whereas the HPTs with high rate of correct answers had text and drawing with clear specific heading. Consequently, it could be assumed that the good presenting of this information should be the simple text and nearby drawing with clear specific heading and describing to facilitate the lay consumers in more comprehensibility. These characteristics of good labeling presentation must be considered in improving all result reading of the existing HPT labeling and in developing the new labeling.

(10) Possible errors or false results or test limitations

There were several possible reasons those could lead to the false results those nearly half of existing HPTs in this study did not indicate in their labeling. First, this information was not specified clearly in detail of labeling requirement in Thai Medical Device ACT (1988)[38] or in any specific regulation because the HPT was classified as general medical device. Second, they did not give any specific heading or cite directly or clear enough to the false positive or false negative result of this test kit as suggested by the Australian guidelines of home-use IVDs[32] and USFDA Guidance for over-the-counter (OTC) hCG 510(k)s.[78]

Although this information might make some difficulties to the lay users due to its quite complex content, it was necessary to be emphasized in the labeling development of new HPT or the improvement of existing labeling for more consumer protection. Hence, this issue should be more regarded by all stakeholders due to its rather high rate of problematic issues comparing to the other matters.

(11) Storage and maintenance instructions of product

This information was essential for users and all suppliers (wholesaler and retailer) so it was needed to be on both labels and package leaflet. For the inner/immediate container (foil), this information could remind how to keep the product to the users who usually kept only its inner container and discarded the outer label with its package leaflet. However, this information was not specified in some HPTs labeling. Hence, more awareness and considerations by all stakeholders were needed on the finding of the existing HPTs labeling with non-indicated rate, varied details in labeling, declaration in unpractical way or confliction to Thai climate/room temperature, and the wrong conversions of product storage from degree of Celsius to

Fahrenheit. These were serious issues because this topic was required by law of all organizations including Thailand to protect their people health in product utilization.[13, 14, 18, 32, 38, 55, 62, 65]

As the analysis, this information must be indicated clearly in Thai labeling. Moreover, it should be under clear specific heading as "storage and maintenance instructions" to facilitate more information finding and understanding. For storage condition, it would be better to declare in practical content in texts rather than number of temperature degree or indicate in both text and temperature degree, but they must ensure for their content accuracy and consistency. Nevertheless, it might be perfect if it could be cited on outer/inner label and package leaflet. This is to make sure in its proper quality which might affect the test result.

(12) Sources of further information

According to U.S.F.D.A., this issue should be very easy in finding by the lay users and be as simple as putting the customer assistance number near the company name, device name, and model number.[18] Moreover, it should be designed as a clearly marked section in the end of the medical device patient labeling for the user assistance information, although it could be included in other places in addition to the end.[18] It was found that this detail without any specific heading was located near the company name at the end of most labeling particularly in their products' leaflets which were in consistent with the above U.S.F.D.A. suggestion.

As investigation, many labeling did not indicate their manufacturers but cited only the name of product distributor, the contact telephone, and facsimile numbers with anonymous source; with or without specific heading of "Sources of more information". Hence, the right answer of this information according to questionnaires needed some implication from the details in the document supplied particularly the case of no specific heading, and the lay consumers might get some troubles.

To facilitate the above problematic issues, the highlight of this information heading (e.g. the true heading which the title was appearing on a separate line to group information, bullet points, and bolding or a box/different colours to highlight key pieces of information the bold text, use line to separate different sections, etc.); was recommended to be the navigate tool in such information finding[87] even if a study showed the negative result of using a box to emphasize the important content.[93]

(13) Limitations and interferences of the test

It was noticeable that HPTs with higher rate of correct answers specified these contents in the main part of their leaflets under the clear title of "recommendation" and in proper print size as well as bold type face. Nevertheless, the inferior cases mentioned in the part of Q&A in their package leaflets. Moreover, the right answers of this information needed some implication because some indirectly specified statements in such document must be interpreted by the lay users before obtaining the answer such as "general medications", "..no interfering with the test", etc. The details would be further discussed as the follows:

- **Directly indicated information in package leaflet**

- First morning urine

The problematic issues about locating and right answering to this information might be due to the non-indicating HPTs and the indirectly citing as "..can test anytime of day..", "the hCG can be detected anytime of the day"; those needed the users' implication before obtaining the right answer.

- After taking the alcoholic

Other than the poor design quality and participants' competency as above mentioned; the non-indicated rate (two-thirds of existing HPTs); and the location of this content (Q&A part of HPT leaflet) in several style e.g. "alcohol doesn't affect the result", etc.; could cause high rates of problems to the lay users in finding and right answering. However, this content was not specific required by any countries but many of them cited specific type of food for clearer clarification to the lay users.[94]

- Oral contraceptives, drug incorporated with hormone hCG, and pain relievers with other commonly used medications

It was found that the indication rates of these 3 kinds of contents (oral contraceptives, hCG drug, pain relievers) were all the same (70%) and they were usually cited together in the Q&A part. Hence, the most reasonable cause of problems might be the non-indicated rate of this information. In addition, some HPT cited this content in general statement that needed to be implied or interpreted before obtaining the right answer such as "General medications do not hinder the test except medications with hCG hormone e.g. Profasi, Pergonal, etc." The word "general medications" needed to be directly clarified as pain relievers, oral contraceptives, etc. Moreover, "..do not hinder the test.." need lay users to interpret before their

understanding as “it could be used”. Hence, some lay users could not answer correctly because they might be unable to imply the answer from such statements.

Finally, these contents should be directly specified in positive sentence with specific examples of medications under clear title in the main part of HPTs labeling.

- **Indirectly indicated information in package leaflet**
  - **“before going to bed”**

The high rates of the problems in information finding and right answering for whether the test could be used in this urine condition, might be most due to the indirectly cited of this content in their labeling as “..can test anytime of day..”, and the non-indicated HPTs (30%). The correct answer of needed somewhat implication from the above general statement to be as “..can test 24 hours e.g. morning, afternoon, evening, before going to bed, etc.” that might cause some troubles to the lay users depending on their potentials. Hence, the result reflected that only some lay users could get the knowledge by their implication from the above general statement.

As observation, almost of the existing HPT labeling indicated this information in the Q&A part which the lay users usually didn’t read it or might not read it carefully according to the individual interview in many lay users. This was consistence with the finding of one research that only some lay users liked the Q&A format but the others did not.[51] Hence, this information should be cited in the main part of package leaflet to more attractive to the lay users to read it.

- **Non-indicated details in package leaflet (Certain health conditions e.g. miscarriage, ectopic pregnancy, ovarian cysts, etc.)**

These contents were necessary to know before using HPT test kit even if they were complex due to the technical terms and scientific knowledge that needed some specific knowledge in implication to get the correct answers. Therefore, they could really cause some difficulties for the lay consumers and lead to their feeling of boring, confusing, and unreliable to the product utilization.

It’s noticeable that no existing HPTs labeling indicated these 3 issues in their labeling. However, few of the lay users (1-4%) expressed as ability to find such information and some could give the correct answers (6-11%) by their own implication. Hence, all existing HPT labeling must be urgently improved to indicate these 3 conditions for more knowledge and proper use of the lay consumers. These issues should be emphasized to be directly indicated and concise but coverage all

important contents, less technical, and easy to be understood by the lay people. Moreover, the clear/highlighted heading with any strategies (e.g. bold print type or underlined item) and the direct presentation by simple wording for the lay users should be preferred to be specified in their package leaflet.

(14) Optimum time length in HPT strip dipping

Even if only 5% of existing HPTs did not indicate this information; 11% and nearly one-fourth of lay users were respectively still faced with the problems in information finding and wrong answering. Varieties of dipping time ranging from 3 seconds to 3 minutes were found which could be one cause of this problem**.** Therefore, more emphasizing in design quality, simplifying the context and improving the consistency of this detail in the same labeling could facilitate the lay users for easier locating and enhanced comprehensibility. These could be supported by many lay consumers' suggestions to improve these problematic issues e.g. optimum dipping time length as "1 minute" instead of "60 seconds", clearer drawing, and the same appearance of drawing presented in labeling with the supplied urine container.

(15) Overall findings for consumer utilization information

The average rate of finding (43.48%) and right answering (42.45%) of product utilization information in the existing HPTs labeling were quite consistent with each other; while the average locating rate of buying decision information (84%) was rather higher than its average right answering rate (69%). As their respectively equality of average indicating rate (63%, 62%), the results could reflect the easier nature of contents for buying decision than those for product utilization. Furthermore, the higher rates than the indicated ones of some contents could be due to the prior knowledge, the implications, and the right guess in answering of some lay users. However, the results consistency of the following examples obtained from hard and easy contents to understand could be the supported evidences to imply that the labeling was lay users' knowledge sources. They were such as

- 0.5%, 3%, 3% lay users' information finding; and 6%, 8%, 11% right answering for no any indicating of 3 specific health conditions (ovarian cysts, miscarriage, and ectopic pregnancy); and
- 94% lay users' information finding; and 91%, 88%, 89% right answering for 100% indicating rate of test method, positive result, and negative result.

The information that lay users had difficulty in finding would result in low comprehensibility of subjects through the rate of incorrect answers. These difficulties

were partly caused by unavailable of some information on labels and leaflets, i.e. information related to the limitations of certain health conditions like ovarian cysts, miscarriage, and ectopic pregnancy. Another causes of inability to locate the information could be from the content complexity, for instant instructions related to contraindications, contraceptive medication, drugs containing hormone hCG, painkillers, and some possible false errors.

1.2.2.3. Consumer education information

(1) Introduction and test principles

This issue had a significant role for the consumers and regulators in product liability but this content seemed not to be actually needed for the lay users due to the rich of scientific knowledge and several technical terms with hard to understand and looked boring. However, they might be interesting and could be benefits for some educated lay consumers and professionals especially retail pharmacists due to no separation between consumer and professional leaflet. It was still controversy for the benefits of this part for the lay users.

(2) Revision date

This information referred to the printing or issuance date or to the labeling revision which was important for all stakeholders. It was directly useful to the manufacturer in preventing their mixing up in packaging process and tracing back for the problematic cases or recall activity. Furthermore, this issue had a significant role for the consumers and regulators in product liability in case of problem occurrence as recommended by Australia[32, 54], Canada[14, 55], EU[13, 89], USA[18, 65, 77, 78]; but not by Thai Medical Device Act 1988.[38] Therefore, there should be some regulation amendment to better consumer protection in this aspect.

(3) Knowledge for pregnancy

According to individual interview of the product owner, this information was indicated due to the experiences in receiving several consultation calls from the lay consumers especially the unmarried teenagers about HPT utilization and their pregnancy situations. This issue was not the problem but it was the interesting and impressed issue for the pregnant women due to its educated benefits to the lay users. However, it might be a marketing strategy to make difference in their products and together lower their burdens in such consulting.

1.2.2.4. Overall results on contents/utility from content analysis and the consumer testing

Quite high rate of average problematic issues in right answering by the lay users for information of consumer buying decision (31%) and product utilization (58%); needed to be concerned by all responsible parties. As analysis in overall result, the incapability to locate and give right answer to such information was due to the company's lacking of information indication, the implications needed for right answering, and lay consumers' incompetence. Hence, the information for buying decision and for consumer utilization should be presented with clear specific heading on labeling to facilitate more realization of lay consumers and to ensure their easy information finding and comprehensibility.

1.3. Comprehensibility

Readability tests or the Readability grade level using readability formulae have been one of mostly used indirect methods to labeling evaluation but many warned about wide variation in estimating the same text and suggested for validity and reliability problems.[30] The EU requires the member countries with different official languages to use this method as a tool to assist in labeling assessment. Hence, it was reasonable to render in this study as a method to assess the labeling comprehensibility of the instruction for use of HPT products using Readability grade level not exceed grade level 6 to be the criteria. Such grade level was consistent with the former minimum educational level requirement to cover most of Thai lay users.

According to Gunning's Fog Index score, the ideal score was 7 to 8 and more than grade 12 was too hard for most people to read.[69] Even all of existing HPT labeling used the language over than the grade level 6, the labeling of HPTs with dipping type were found to some extent harder to read than the card type. The 66% of dipping type compared to 18% of the card type required the educational grade level higher than grade level 8 to understand their instructions for use. Moreover, nearly 50% of dipping type labeling and only about 18% of the card type had educational grade level >9 which is the present required educational level of Thailand. The HPT with dipping type was thus reasonable to be chosen to be the model HPT in this study.

2. Testing for lay user perceptions on existing HPT labeling (Phase I)

The factors of design quality were composed of print size, print quality, lines spacing, organization of information, attractiveness, clearness of contents, and the benefits of drawings which could influence the legibility of lay consumers and the comprehensibility as well as the utility of the labeling as the conclusion of many studies. For example, one study had found a significant positive correlation between the number of design criteria incorporated in the pharmacy leaflet and the consumer's rating of design quality, and they confirmed the importance of design characteristics in the production of written medication information.[30] Moreover, the effect of design quality to the reading and understanding of the written health information was found in a study[10] and in some other references. This could confirm that design quality directly influenced the reading and later leading to the comprehensibility.

As the result, every single aspect was rated with more or less poor quality. All aspects of design initiate more or less risks causing some difficulties to the lay users in reading and understanding such labeling which might influence the effectiveness in their product utilization. Quite high poor quality feedback on print size (32%) and attractiveness (29%) as well as their 2 lowest average score (1.27, 1.19) convinced that such 2 aspects needed more attention in labeling design. However, the line spacing and line length those received the top 2 highest good quality feedback (63%, 62%) should not be taken lightly since there were variations in ability of lay users in reading and understanding. Moreover, the other design quality characteristics should not be neglected due to their high rates in fair quality.

The above finding were corresponding to one study that many patients found limited line spacing and very small print size, which might limit the utility for elderly and sight-impaired users.[95] Hence, all design quality characteristics should be emphasized but more in prints size and lines spacing. However, the attractiveness, information clearness, print quality, lines spacing and line length of the existing HPTs labeling; should also be regarded due to their relatively the same average scoring.

2.1. Perceived Design quality

2.1.1. Print size

It was noticeable that the HPTs' labeling without perceptions on poor quality in this aspect had font type of Cordia New (10.5, 11 pt.), Browallia UPC (11, 12, 14.5 pt.), and Tahoma (9.5 pt.). A HPT (brand S) was found to have the labeling in Browallia UPC font type with 14.5 points which was obvious bigger than the font size of other HPTs' labeling. However, the group of higher problems in this aspect was found with font type Angsana New (7, 9, 9.5, 10.5 pt.), and Freesial UPC (10, 14 pt.).

The expressions from some lay users about print size could reflect the helpful opinions for improving and developing the consumer-based labeling to ease their reading and comprehension. The proper print size and type to be rendered in such labeling should be considered as big and clear enough to ease the consumers reading especially those with older age and poor eye-sighted. Moreover, there was no need for large print size and several places in labeling of trade name on the outer label. As the analysis from the consumer testing results, the suggested print fonts were such as Browallia UPC, Tahoma, Cordia New, etc.; the print size was up to each font type, the kinds of contents, and places of labeling. Such print type proposition of Browallia UPC was consistent with the suggestion from a research study in Thailand.[96] However; there were many kinds of print types to be selected. Tahoma was interested due to the finding in Phase I showed that it was about 2 points larger than the other print fonts and needed less spacing between each alphabet. Hence, the consumer testing was needed to confirm their fitness to best serve to the lay users.

2.1.2. Print quality

It was a quite serious case for the detaching of printing colour with the plastic covering the outer label during the packaging unwrapping of 1 HPT brand. Moreover, some lay users expressed that the print quality could affect the ease and difficulty in reading of the lay consumers. The suggestions of lay users in design quality were such as alphabet style and design (clear visible print type and normal style of alphabets with fewer designs), the print colour or printing clearness (e.g. the colours of prints and background, the clearness of the print face, etc.); and the highlight or bolding for title, information separation into each numbered section, non- reflective and dark prints (e.g. black, dark blue, etc.) on the white background, uncrowned prints, etc. Such proposed contrast colours by many lay users were consistent with Ayello's

finding about the booklet that met many criteria for written education materials e.g. using white background and black lettering for easier reading, etc.[68] Hence, these comments and above problematic issues should be more considered in improving and developing labels and leaflets of Home-use IVDs.

2.1.3. Lines spacing

The lines spacing might be the other factor affecting the labeling quality.[95] Hence, it should not be ignored in new labeling development due to its effects in encouraging the lay users in labeling reading. However, it was proposed to be large enough to ease the reading of lay consumers. One possible way to proper the lines spacing was to consider the amount of content to be included in labeling.

2.1.4. Information organization

The interesting issue was that the lay users proposed to place “precautions” before “the test method and result reading”. They expressed that it was reasonable as to indirectly forcing the lay users in reading the precautions. Otherwise, they might stop reading the labeling after they had already read the test procedure and the result reading. The supported evidence was their reasons that they usually only want to know the test method and the result.

2.1.5. Line length

The expressions of some lay users could confirm that too long sentence that might lead to difficult understanding should be avoided in labeling development.

2.1.6. Attractiveness

The interesting only the test method and its test result as well as precautions, not the other details (e.g. contents in the Q&A part, etc.) were consistent with the answers about their expressions of needed information. Thus was not surprising since the test method and result interpretation were prerequisite information for product utilization, other information would be required in case of special situation. However, it was opposite to the U.S.F.D.A. recommendation to provide the questions and answer formats (Q&A part) to assist the technical information with individually counseling to the lay users[86], and also conflicted to the suggestion of Griffin with colleagues in using client’s questions to frame information.[10] Hence, the key information those needed to be read and realized by the Thai lay users should be emphasized in main sections and simply avoided to be cited in Q&A part.

Finally, the proposition for more attractiveness of the labeling would consider the ability of the text and picture on the main part of the outer label to communicate to

product type, the placement of information in labeling, and the colourful testing method with result drawings to attract the users.

2.1.7. Information clearness

Even if this information mean score was close to the average of total mean score, this issue needs more attention from suppliers due to its high influencing on product utilization and its third lowest poor design quality. The lay users' comments on this aspect were found to much involve the kinds and places of labeling information. The kind of contents indicated in each place of labeling was usually different from each other. For example, the part of direction for use and its result reading as well as the precautions were generally placed in the main part of product leaflet. These details were generally more concise, simpler and easier to be directly understood, and contained drawings to draw attention of the lay users than those in the Q&A part which were usually scientific knowledge and harder to comprehend.

In conclusion, the use of simple words and concise statement, drawings, and the consistence of the texts explanation with its actual result were recommended by the lay users. This proposition was in accordance with the result from the research submitted to U.S.F.D.A. by Patricia A Kingsley on "Patients' and lay caregivers' medical device information and labeling needs" that the laypersons needed clear instructions with well labeled graphics, good trouble shooting sections, and useful warnings of OTC test kits.[51] Furthermore, it was also in line with the U.S.F.D.A. requirement for the clear and simple instructions, encouraging in using drawings and diagrams in the package insert of OTC drug testing kit.[94]

2.1.8. Drawings or table benefits

As the result, the drawings or illustration in the HPT labeling were perceived as very helpful and aide to clearly conveying the intended message to the layperson. According to the comments of lay users, much advantage of the drawings or diagrams in the package leaflet of HPT to the product utilization[94] was confirmed. Their opinions were also in line with the USFDA advice for using diagrams and pictures to make the package inserts simple and to strengthen the test for the lay users.[86]

Consequently, the drawings or diagrams must be labeled in the insertion with proper proportion to the text illustrated in Thai particular on "directions to use and its results reading". However, it would be more useful to the lay users for additional labeling on the outer label (if possible) and the inner label (if available spacing).

2.1.9. Overall discussion on design quality

The results on design quality illustrated that the consumers' rating score of the print size, print quality, and lines spacing of the existing HPT products labeling were found to be relatively low as a study of U.S.F.D.A. in consumer perception on the evaluation of nitro-glycerine labeling.[25] Therefore, these 3 characteristics of design quality should be concerned more by the suppliers for more lay users' comprehension.

2.2. Perceived utility/ contents

As overall investigation from the lay users' opinions, the details in each aspect of HPT labeling utility were varied in completeness, value, sufficiency and reassurance. The higher incomplete and lesser insufficient HPT supplied information of the existing HPT labeling could be evidence reflecting the lay users' need in only some information even if they realized in the importance of more labeling information. Nonetheless, the number of problems expressed by the lay users in unreassuringly and no usefulness were very small. Hence, it was high acceptable for the lay users that these HPTs labeling were reliable and useful to them.

2.2.1. Information quantity and adequacy

The feed back on information value and reassuring were consistent with the information sufficiency. However, these perceptions of twice higher than the perception on information completeness could be explained by most lay users satisfaction with their needed information (e.g. test method, result reading, etc.) even if they realized that there were still many details to be labeled. The other reasons could be the high rate of some non-indicated contents; their incapability to locate and answer some questions in the questionnaire, and several limitations on education, technical complexity of the contents, etc. However, the evaluation on sufficiency came purely from their sense of capability to obtain the test result successfully. This could be evidenced by the following discernments.

- "I think that I will directly read only the information useful for my testing which are test method and result reading."

- "It's enough information because we can understand after labeling reading and can get the result after performing the test. If we have any doubtful, we can call up for further information by the given phone number."
- "Most lay users will read only the test method, result reading, and the precautions."
- "The test method, result reading, precautions, manufacturer, distributor, and some contents on how this test can detect the pregnancy are enough for the labeling. They could ease some of our comprehensibility. Moreover, we can check during testing whether we perform the test as we understand or not."

The details of insufficient and incomplete issues from lay consumers were found respectively on contraindications, possible error or false results or its sources, precautions, interpretation of invalid or inconclusive result, storage, components, clear instruction of urine sample preparation, manufacturing date with expiration date in Thai, and HPT type, etc. These problems were reasonable due to their non-indicating rate those might cause such lay users' perceptions. The explanation of the deficiency was different due to the characteristic of each kind of information. Nonetheless, the discussion would be emphasized only on the contraindications. The result on contraindications was consistent with the finding of Krass Ines and colleagues in written pharmacy medication information leaflet.[30]

For this study, this information was found inadequately or not included in some HPTs labeling because it could lower the lay users' product reassurance and affected their decisions as well as confidence in using HPT products as the comment "The contraindications of this test kit make me confuse and worry whether the result obtained is correct or not. However, the detailed content shall be indicated by more concise and easier to understand language if it is necessary." Consequently, more details about the contraindications and other insufficient issues from lay consumers should be more emphasized to facilitate their utility.

2.2.2. Information valuable and reassuring

It was obvious that the average result in wrong answering of utility on buying decision and product utilization contents (44%) by the Diagnostic Testing in 2.2.1.1 (31%) and 2.2.1.2 (58%) of Phase I in chapter IV; were consistent with the perception rate of information incompleteness in such testing (43%) and were nearly the same as the summation of average perception rate of "no" and "fair" content utility (42%).

Nevertheless, they were higher than their average non-indicating rate (37.5%) because some contents were indicated but incomplete in the lay users' perception. These evidences could support the effect of information completeness to their utility and could confirm the relevance of lay users' competency in right answering and the information completeness as well as the perception on information utility.

2.2.3. Overall discussion on contents/utility

The adequacy and completeness of labeling information as above users' suggestions should be considered in new HPT labeling development and improvement of existing labeling for more lay consumer's desirable utility.

2.3. Perceived comprehensibility

2.3.1. Comprehensibility issue

The rate of easy comprehended items of content (55%) was consistent with the lay users' capability in average right answering on buying decision and product utilization information in the existing labeling (56%)(69% in 2.2.1.1. and 43% in 2.2.1.2. of chapter IV or in Phase I).

It was noticeable that the rates proportion of average mean score for fair (63%) and easy (34%) to comprehend, were opposite to that of "some comprehended items" (43%) and "no comprehended items" (55%). However, their combination was nearly the same (97% and 98%). There were higher rate in the answer of "no comprehended items" (55%) than "some comprehended items" (43%) which the respondents were asked to give the examples of their some incomprehensibility contents that might cause the lay user a hard time in giving such evidences. On the other hand, the perception answer had no need to give any evidences so the lay users might feel free to express their actually perception.

2.3.2. Incomprehensibility issue

As the result, the contents expressed by the lay users as incomprehensibility issue should be considered to be careful in developing the HPT labeling prototype. Moreover, several above mentioned strategies in design quality (e.g. clear print face, highlight, suitable line spacing and line length, etc.) should be helpful to facilitate the lay consumers' finding, reading, understanding, and remembering such contents.

2.4. Overall opinions

The result of lay users' perceptions and problematic issues found in the overall opinions of HPTs labeling was consistent with the study of Bonnie L. Svarstad and colleagues that consumer raters were more positive about the labeling usefulness (1.39) and comprehensibility (1.17) than the reading (1.08).[25] In conclusion, the consumer testing was recommended to be performed in developing or improving the quality of home-use medical product labeling to achieve their tangible benefits.

2.5. Conclusion on evaluation of consumers' perception (Phase I)

2.5.1. Problematic issues

Although there was no distinct problems in comprehensibility of this labeling, but most of the results showed the fair answers which must not be neglected. Hence, other comments and expressions from the lay participants as well as the information from the individual interview in the later part would be considered other than these problematic issues in developing the HPT labeling protocol.

2.5.2. Consumers' recommendations

It was noticeable that the lay consumers expressed as very high rate of easy finding in testing procedure (98%). This could be explained that this information was cited in all selected HPT labeling with clear specific heading in both outer label and in the main part of package leaflet and sometime in the inner label, not in the Q&A part or in a box. This clarifying could be confirmed by the finding of Laughery et al and the Communication Research Institute of Australia (CRIA) that the important information is unlikely to be in box outside the text and readers simply do not see or read what is in boxes as well as regularly scan headings more often.[93] However, some important information was not indicated or the lay couldn't find or give the right answer. For example, the high rate in obtaining their wrong answers for the maximum time in result reading (89%) was found in this study. This content was indicated in only one-third of existing HPTs labeling even if it was the important contents involving the test method as recommended by U.S.F.D.A.[78] and it might affect the acquired result, etc. Hence, the labeling quality must be considered in concert with their existence and placement in the labeling.

3. General perceptions on labeling (Phase I)

3.1. Information necessary for using HPT

It was noticeable that most necessary contents expressed by the lay users before consumer testing on labeling quality were information for product utilization (test method, precautions, possible errors, storage) whereas the buying decision information was proposed by about one-fifth of the lay users as the other contents (e.g. manufacturing and expiry date, lot number, amount/pack, etc.). This result was consistent with the finding that the novice user of medical device tends to focus on the risk benefit information first[51] which involved the contents for product utilization.

It was reasonable to find that the test method got high rate as needed information and easily finding by the lay users due to its importance as generally known and their outstanding presentation on both outer label and package leaflet. Nevertheless, the context of consumer testing that involved the product utilization affected to the other expressions of their needed contents. For example, the above other contents might get higher rate than this due to the situation of buying decision making at the point of sale.

3.2. Comparison and explanations of lay consumers' most attractiveness before and after testing

Test method was the most impression expressed by the lay users before and after testing. This result was consistent with the finding of primary interests of participants with OTC test kits those focused on clear instructions for use[51] and their expressions of needed information in the contents of test method in 4.1. This information involved in the amount and utility of information which resulted in product utilization. All attractiveness expressed by the lay consumers would be further considered in the phase of guideline and HPT model development. For example, the finding about attracted trade name involved the female so the HPT trade name of labeling prototype was chosen as "Lady Preg Strip". Furthermore, the drawing and legible language were also found to facilitate the understanding of test method and its results reading especially for the lay users as recommended by Janelle Griffin and colleagues.[10] All of these factors could be specialized blended to achieve

the good quality of product labeling.[12] Hence, the document characteristics besides contents were thus needed consideration.

3.3. Additional needed information, product image, and proposed opinion of lay users about HPTs labeling

The test method that was usually the main information for their proper utilization was the only information with no comments on their document quality by the lay users. This might be due to the easy to use characteristic of HPT and the complete contents of the test method with specific heading in all HPTs labeling that could facilitate their information finding and reading. However, the first 5 additional needed contents (precautions, contraindications, possible error or false results, result interpretation, and product storage) were all for product utilization and consistent with deficient information found in Phase I. Furthermore, the proposed issues in design quality by lay users might facilitate in information finding and reading for their easier comprehensions. Thai translation of HPT labeling was requested for more understanding of lay users who have no English knowledge or are poor in English.

The above results were consistent with the finding that novice users tends to firstly focus on the risk/benefit information, whereas the proposed formatting tools were consistent with the study to include simple language, table of content, informative headings, plenty of white space, large print, well-labeled graphics, and judicious use of highlighting for important information.[51]

Part 2: Discussion on International Regulations Comparison (Phase I)

1. Discussion on international regulations comparison

In Thailand, in vitro diagnostic device (IVD) is classified as a medical device. The proclamation would be issued to denote the details to be labeled for each medical device whenever it was controlled as licensing or notification medical device. Although, there is general requirement of Thai labeling for medical devices, the present labeling control has been limited only to some medical devices needed licensing (e.g. HIV test kits for diagnostic, etc.) and notification (e.g. HIV test kits for research use, etc.). The general controlled medical devices including self-tests (e.g.

HPTs, ovulation test kits, urine sugar test kits, etc.) which were in the least stringent control level; were supposed to but not urged to follow such labeling requirements due to no legal penalty.[38] Hence, quality of home-use IVD labeling in Thailand have some problems even they are also subjected to the other law (Consumer Protection Law) specifying the general labeling requirement of all general consumption products.[88] This was due to their existing overload responsibilities to all consumer products and the provision of this Act shall apply only in so far as it is not a repetition or contrary to specific law.[88]

As comparison, the home-use IVD labeling requirements for all countries except Thailand were quite complete and clear. Therefore, the specific home-use IVD labeling was found to be needed by the lay consumers to easier access of such information for their more protection. For readability, the proposed not higher than 6th reading grade level of home-use IVDs labeling was the same level of the former minimum requirement of education for Thai people to cover the middle age group of lay consumers. Furthermore, the proposed good quality of labeling was found to be consistent with the recommendation of a study to possess proper design quality (e.g. format, layout, legibility/print, illustrations, etc.); simple and clear language; and useful content (e.g. up-to-date, relevant, reliable, and accurate, etc.).[10]

According to WHO, the contents in labeling must be consistent with the regulations requirement of each country, and the policy as well as regulations of each country should be reviewed periodically to pave the changes in technologies by incorporating appropriate amendments.[1] Even so, the government could subsequently bring in legislation and enforcement to suit the country's conditions and needs.[1] Furthermore, the consumer education would be a key to safety and performance of Home-use IVDs. Hence, the legislation and regulations of each country should serve and be suitable to their people and problematic issues. Nonetheless, the request of GHTF to each nation to keep the minimum country-specific requirements for labeling text or format[62] was rather contrary to the concern of the government of most countries in this study those are all leading members of GHTF (Australia, Canada, EU, U.S.A) and might impose many burdens to the people in non-leading countries of GHTF especially on the lay consumers.

The analysis of this situation would be that GHTF was originated by 5 countries, U.S.A., Canada, EU, Japan, and Australia.[62] The group of leaders and their sponsors were from the large international companies involving large scale of trading in medical devices of the world. Their claimed concepts in medical device regulatory harmonization for global trade facilitation and public health safeguard[62] seemed to be sound. Nonetheless, some of their requests[62] were not get enough attention by small and developing countries whose problematic issues were specific to the nature and problems of each country according to the differences in education, culture, and perception of their people. It was also inconsistent with the requirements in many countries especially the nations with non-English or different languages e.g. E.U.[13] However, the troubles due to the above GHTF request would be in following aspects.

1.1. Design Quality

All countries and GHTF concerned for the design quality of IVD labeling particularly Canada but GHTF looked less attend and concern to the people facility.

1.2. Contents/Utility

GHTF asked for minimum country-specific labeling requirement as possible, elimination of the currently exist ones, and for encouraging to provide the internationally recognized symbols.[62] Moreover, the instructions of low or moderate risk medical devices as manufacturer aspect may not be needed or may be abbreviated.[62] These were opposed to the obligations of countries with specific language and quite risky to their people including Thai lay users.

For the issue of labeling translation into national or official language, it was emphasized by EU, Canada, and Thai regulations. Australia and U.S.A. had no problem because English was their official language. GHTF stated that a Regulatory Authority may authorize labeling to be in one or more language(s) other than its national language which was opposite to the former requirement for minimum national language. Australia clearly specified the necessary to have labeling in English as the official language.[32] EU needed labeling with translation into the official language of the member states in which device reached its final use.[13] Canada required French and English labeling for the medical devices sold in the

country.[55] Thai labeling has been required by Medical Device Act 1988 for consumer protection of Thai people[38] that was consistent with EU, Canada, and Australia.

According to Thai regulation, the contents and print size in Thai labeling must correspond with those in the other language.[38] Although the translation of contents into Thai edition might cause some burdens to the entrepreneurs for their costs and liability issue, it was necessary and reasonable for consumer protection. However, many importers especially the international companies tried to ask for regulations amendment to no translation of their labeling into Thai language particularly those for professional use. Actually, some professionals could not well understand in English and technical terms because English is not the official language in Thailand. Furthermore, many of such devices were currently come into the utilization by the non-professionals, particularly for the general health promotion and beauty or cosmetics purposes. Some were adapted to be home-use or self-test so Thai labeling was still necessary for preventing the possibilities of improper use or false results.

The required contents of labeling information of all countries in this study could reflect their concerns in the utility of device labeling for the consumers. However, the GHTF recommendations of document to be supplied for the users as various media and several means might be risk for lay users especially in the developing countries and Thailand. The people of these countries could not equally or conveniently access to some means or media (e.g. internet, etc.).

According to GHTF, the requirements of no instructions or only abbreviated labeling of low/moderate risk medical devices[62] was opposite to the EU requirement[13] and unfair to the lay users. This issue needed more considerations to find the best practice due to the possible risk caused by a shift from institution-based professional users to their employment by lay users in using home-use IVDs.

The indication of directions for use on both outer label and in package leaflet would promote the labeling comprehensibility of the lay users. This was consistent with the result from the consumer testing of Phase I which a lay user gave an interesting opinion about the culture of labeling information reading as “The lay users generally firstly read on the outer label than in package leaflet due to the privacy and more comfortable in reading the less information. However, they usually do not like to label reading”. Consequently, this evidence could confirm the necessary of product labeling of home-use IVDs for the lay consumers in Thailand.

For more stringent controlling of home-use IVDs to better consumer protection, the Notification with the requirements of entrepreneur obligations and product labeling would be issued by virtue of such Act. The Notification issuance for more rigorous labeling control of home-use IVDs could be done by reference to Section 33 (10) of Medical Device Act, 1988.[38] In case of most stringent control, the Thai FDA number and other details on the outer label would be needed to be observed by the lay users before buying decision making of home-use IVDs. Hence, the Thai government authority has performed many campaigns for years to encourage the user/consumers to notice such number and other details on the outer label before making decisions in health product buying and utilization.

1.3. Comprehensibility

Keeping to the minimum[62] country-specific requirements for labeling asking by the GHTF might be ambiguous to follow due to the culture and education difference of people in each country. Furthermore, the lay consumers might be directly affected by misuse or inappropriate use of home-use devices and the patients could be indirectly suffered from medical devices used by the medical professionals. Hence, the above conflicted issue must be discussed for further resolution especially for the human right and health protection to people in developing nations.

According to WHO, the public should be fully aware of certain risk in all medical devices which might affect the safety and performance through self education and by putting "customer pressure" on manufacturer to comply with the standard.[1] Furthermore, the government has the responsibility to oversee the efforts of manufacturers and vendors as well as to ensure the safety and effectiveness of available medical devices in the country.[1] The manufacturer or vendor should be careful to avoid making misleading or fraudulent claims about their products or issuing false compliance certificates.[1] Consequently, the cooperation of all these stakeholders by shared understanding and responsibility through communication and mutual education could help alleviate this problem.

2. Discussion on extracted labeling contents for Guideline development

The extracted definition of "Home-use IVDs" and their labeling requirements on 3 aspects on design quality, utility/contents for information of both buying decision and product utilization, and comprehensibility; seemed to be quite long than the other countries to pave up the international requirements and also to best serve the development of labeling guideline of Home-use IVDs and its labeling prototype for Thailand. However, some requirements those suitable to Thai culture and people were still reserved to ensure consumer protection particularly to the Thai lay users such as the requirement for labeling in official/national language which was consistent with other countries except GHTF. Therefore, the interesting issues from each organization were pooled in this labeling guideline and some problematic issues found from Phase I were also emphasized in its labeling prototype development.

It was noticeable that the specific information for buying decision was required to be illustrated on the outer label and foil due to their consumptions of smaller space than the other information, and their necessities for consumers' decisions in product purchasing. For the product utilization information, the nature of its longer details made them allow to be placed in the package leaflet due to its more available spaces. However, the Q&A part and the use of a box disconnected to the rest of the text for some contents that was proposed by some countries (e.g. U.S.A., Canada, E.U., etc.) was improper for Thai people according to the result from consumer testing in Phase I. This issue was consistent with the evidence from CRIA document testing, showed that information placed in a box and separated from the rest of the text will often be skipped over, not noticed ("filtered out") or ignored.[93]

Part 3: Discussion on Guideline Development and Validation (Phase II and III)

The information communicated through the labeling is vital for all home-use medical devices and many studies have shown that the leaflets are difficult to read[39] which could impact on the consumers' health safety and economics.[1] Hence, it was a challenge to develop the labeling guideline and validate through the HPT labeling prototype. The discussion of consumer testing on labeling prototype were as follows

1. Participants characteristics

It was noticeable that the age range of the participants of this phase (64:27:9) was almost the same proportion comparing to the 1st phase (62:29:9). However, the education level of ≤ grade 12: > grade 12 in this phase was 50:50 which was in the higher risk group than in the 1st phase (39:61).

2. Data collection

This study was a descriptive research work but quite attempted to be complete designed by applying "Diagnostic Testing" of the CRIA to be as the consumer testing, and adapting the consumer rating form (CIRF) of USFDA to be one part of questionnaire as perception test of consumers.[16, 25, 30, 67] Unlike the previous studies, the outer and inner label as well as package leaflet was used together at the same time in this study as labeling. This was to replicate the real situation in product utilization of the lay users even if it might cause some limitations on detecting the specific source of problems on labeling prototype quality. However, the results did show that such applications could detect flaws in the effectiveness of this labeling prototype. This study would be presented to Thai FDA policy makers for some policy change.

3. Testing for total competency and competency of each content topic

The "Diagnostic Testing" set the criterion score of about 15 topics of contents to be achieved by at least 16 out of 20 users as the above-mentioned ≥ 81%.[30, 67] However, about 29 contents were asked in this study which burdened quite much to the lay users but it were required to be informed in HPT labeling.[13, 32, 55, 62, 77, 78, 85] Even the 1st draft prototype failed to reach such criteria in both total competency and competency of each content topic; those in the 2nd draft were improved to achieve such criteria. These failed items also could not pass in the 1st draft but their scores were much improved in the 2nd draft. This could reflect the consumer testing benefit.

4. Testing for lay user perceptions on HPT labeling prototype

The problems in both drafts were found respectively in comprehensibility, design quality, and utility/contents which were consistent with the results in Phase I. The result of unachieved but nearly 80% of "easy to comprehend" as other aspects in the 2nd draft was accepted due to the high risks of lay users rendered in this study. However, some noticeable issues to be discussed in details would be as following:

4.1. Design quality, utility/contents, comprehensibility, and open questions

The problems associated with the 1st draft HPT labeling prototype appeared to relate to it being small print size, poor printing and drawing quality, too long, too wordy, too unwieldy, complicated information (e.g. possible false errors); indirect indicated or needed implication before obtaining the answer; lacking of drawing of invalid/inconclusive result; and some uncomprehending issues respectively as contraindications, further knowledge, result reading, limitations, principle, and further action. These could support the effect of design quality to the reading and understanding of the written health information.(10)

4.1.1. Design quality

The problem finding on design quality was corresponding to one study that many patients found limited line spacing and very small print size, which might limit the utility for elderly and sight-impaired users.(95) However, almost of them were improved for the 2nd version testing but some criticized issues were still existing e.g. print size, print quality, and lines spacing.

The same perception rate of print size and print quality as well as their less mean scores than the other aspects in both rounds, and the low improvement in lines spacing might be due to the availability of the spacing area and the limitations in labeling format as well as the lack of potential in printing as those merchandised in the market that performed by the printing house and cost much more than this. However, the offset system could larger the print size for the same size of the paper and all of these problematic issues could be solved.

The other reason of their same quality on print size and print quality might be due to more lay participants in the age range of 25-39 years old in the 2nd round than

the 1st round testing. It might be possible that some of those people might have earlier presbyopia condition which could cause the trouble in the small type reading[81] and difficulty in finding, reading, and remember such information. This situation could be confirmed by an opinion of poor print size that was belonging to a lay user with 38 years old and she wear eye-glasses with short eye-sighted.

In this study, the % reading was compared to average overall perception of the lay users in design quality due to the researcher's reviewing and analysis about the effect of design quality on the reading and understanding of the written health information.[10] Their consistent results with each other were found to confirm that design quality directly influence the reading and later leading to the comprehensibility. As overall result in design quality, this HPT labeling prototype was thus appropriate to the lay consumers. However, there were still noticeable issues on design quality of few lay users in the 2nd draft as above-mentioned those would be some considered to revise and need retesting for absolute labeling quality, not only passing the setting criteria. According to their involvement, the concert of all aspects in design quality was thus needed to facilitate the labeling comprehensibility.

4.1.2. Utility/contents

As the overall findings, more problems were expected to be discovered on contents for lay consumers' utilization than the information for consumer's buying decision due to their nature in more lengthy contents and harder to understand. Some compulsory knowledge with difficulties by their nature, and involved the scientific knowledge and many technical terms (e.g. contraindications, test limitations, possible false errors, chemical composition, knowledge of hCG, etc.); needed time to realize. They were found to be barriers in labeling revision and caused some feelings of unconfident in product utilization or fears about possible false errors. The supported statement was as "I felt confusing after reading the limitations and interferences of the test because the contents were too long. It should be as short as they could, and must cover all the needed information. Some details (e.g. the false negative result) caused me worried whether the result is correct or not. Hence, I felt unsure with the result obtained".

The example of some problematic details in the package leaflet was as "The urine can be collected at any time of day, but it's best for the first morning urine." This information therefore needed some ability of the lay users to imply for the correct answer which actually burden much to them. The lay consumers had to

interpret “at any time of day” for the answers of the question “could the urine before going to bed be proper for HPT testing? This problematic issue was also found in the other topics such as contraindications and limitations (positive/negative false results), further action after result reading, etc. The other problematic cases were as “doesn’t affect”, names of medicines, etc.

These titles were also found to be expressed as hard to find and understand by the lay consumers in the 1st round of consumers’ testing. However, the results in the 2nd round could pass the above criterion after such issues were improved by rewriting and rearranging the labeling. The use of directing indications, shorter sentences with Arabic numbers, more simple words those needed no interpretation or much time to think about before questionnaire answering, and etc.; could give much help and were the factors to facilitate well communication to the lay consumers.

The other noticeable issue was that the source of further information could not pass the criteria and got quite low competency score even if it was emphasized and indicated in a separate box with bold prints near the end of package leaflet of labeling prototype as suggested by U.S.F.D.A.[18] and as popular with the regulators in many jurisdictions in Australia, Europe, and North America[93] and suggested to highlight key pieces of information.[87] In addition, the incorrect answer was found to be due to inability of a lay consumer to find the distributor even if it was also indicated in the same separate box as above-mentioned. This negative impact could be confirmed by the finding of Laughery and colleagues as well as the Communication Research Institute of Australia (CRIA) that the important information is unlikely to be in box outside the text and readers simply do not see or read what is in boxes as well as regularly scan headings more often.[93] Hence, it was needed to be further considered.

The other obstacle was the placement of information labeling and the view point of many lay users as needed only test method and result reading to get the result by their expressions as “I only need to know the result of testing whether I am pregnant or not. I am not interesting to know about the other information especially the contents in the Q&A part”. This expression was consistent with the well-known conclusion-that readers are reluctant to read more than they think they need-have often been confirmed and are now widely accepted by professional information designers.[93] Hence, the attractiveness by various approaches to motivate their reading should be more emphasized as recommendations of many countries[13, 16, 18, 67, 86] and reviewed literatures.[10, 25, 30, 75, 94]

Many lay users expressed that they usually read only the details on the outer label and in the main part of package leaflet and did not read the contents in Q&A part because they thought that it might not be important as in the main part. An example of their expressions was as “For the details in Q&A part, the users might choose to read only the significant because such information might or might not be interesting to the users”. The Q&A part was set apart from and placed after the main part as well as not in the same logical sense to the reader as the contents in the main part. This situation was consistent to the placing words inside a box outside the text or the main part of package leaflet that was repeatedly found in many studies of Laughery et al to be ignored and totally missed by the people.[93] The Q&A part suggested by U.S.A.[18] and Canada[16] was thus confirmed improper to Thai lay users.

The other noticeable matter was that “test method” was easily located by all lay users whereas “possible error” was most expressed as hard to find and unable to locate. It might be due to the test method was presented with drawings on the main part of both outer label and package insert while “possible error” was cited only in the leaflet and usually in the Q&A part with more difficult details those hard to read and understand due to its nature of contents involving scientific terms and knowledge.

The labeling prototype in the 1st round was adapted but sometimes couldn’t exactly follow the lay users’ suggestions especially the issue of information sequencing that was adapted only in small degree after consulting with some experts and stakeholders to solve this problem. For example, there were various comments on too much information, the unreassuringly after their reading, and the sequencing of precautions and contraindications. Hence, the precautions were placed before test method whereas the contraindications were placed after result reading which most of lay users agreed for this sequencing. The other issue was the lay users’ suggestion to indicate "C" & "T" on the test strip which might burden the product quality and need some advance technology. However, the average utility mean scores of this HPT labeling prototype was found very high (1.89) in the 2nd round.

As the results in both rounds of testing, the high rates of buying decision information average scores those usually presenting on the outer label could be the case of short and simple contents. According to some CEO opinions, the distinct large prints of product names on the outer label and their well communication to the intended use were also the 2 reasonable characteristics to be impressed by the lay users for their brands recall as the marketing and advertising strategy. Moreover, the

result also showed that the attracted issues were mostly found on the outer label which was consistent with the lay's expression as already mentioned in 1.2 of this part 2. These could be the confirmation that the outer label was the first place that the lay consumers might look for their needed information. Hence, the outer label should have enough information to serve the lay users' benefits unless no available space. However, the linkage indication to package leaflet must be cited on the outer label.

As overall opinion, the contraindications and further knowledge were the first 2 incomprehensibility details of this HPT labeling prototype expressed by the lay users in both rounds. The finding of above contraindications was consistent with the study of Krass I and colleague for being most deficient in information as judged by consumers.[30] The contraindications which focus on risk assessment[30]; and further knowledge in this study that consisted of the knowledge of hCG, composition of test strip, and test performance which involved some technical information or scientific knowledge; were sound to be hard to comprehend due to their nature of contents.

4.1.3. Comprehensibility

Comparing to the rate of fair and easy comprehended items in the perception testing, the much lower rate of perceived less comprehended items might be due to the counting of only 1 item of hard comprehensibility as the fair answer. However, small number of hard comprehensibility might be ignored by the lay user in the opinion of somewhat hard finding, reading, understanding, and remembering.

The need for legible print size were supported by many lay users requesting in Thai labeling to suit the specific problems in different approaches to product buying and utilization, and the perceptions found in this study. This finding was consistent with the requirements in Thai Law and most of the countries with cultural and education differences.[13, 32, 38, 55, 62, 77] Hence, the global harmonization particularly in minimum country-specific requirements for labeling including text and format[62] as requested by GHTF has been a strong divergence for variety in information providing rather than one set of universal requirements applied for all nations especially the developing countries and non English ones. Besides, it was contrary to Thai consumer right in information stated in Thai Constitutional Law[92] and the Consumer Protection Act 1979.[88] Therefore, consumer testing could help in addressing various needs of lay users in labeling of each product and its context in consumption. As the results, all

aspects were involved to each other; the concert of such aspects was thus needed to facilitate such labeling prototype comprehensibility.

4.1.4. Open questions

The comments of lay users in the 2nd draft were definitely only small numbers due to much improvement as their suggestions in their 1st draft. No doubt in all aspects of labeling utility as their most positive comments except the issue of information sufficiency as unreliable feeling due to their expressions of no experience in product utilization as the novice users and no enough knowledge to judge its labeling adequacy. However, the design quality and comprehensibility exposed more negative comments in both drafts but less in the 2nd draft. Most of the 1st draft problems were found on the false positive and false negative results, contraindications, further knowledge e.g. test performance, no need to know about hCG; which involved scientific knowledge, technical terms, and the concepts those difficult and needed some interpretation to understand and looked boring to read.

The comments were also found on test method with result reading (e.g. unclear drawing with its texts in leaflet, drawing of invalid/inconclusive result). In addition, the misinterpretation of lay users in content of "no effect to the test result" into "did not give any result" was found to be quite serious issue that alerted the researcher to be much more careful in labeling development and improvement.

For general question about needed information of the lay users, it's interesting for their suggested details of "other issues" because such details were not given in the choices of questionnaire. Moreover, this question was asked before they started to generally screen such documents so they had not been yet getting into much details of the labeling. Their proposed contents were reasonable because they were required by related regulations and important to the product use (e.g. the manufacturing date, expiry date, the strip component)[13, 32, 38, 55, 62, 77] and fair to users (e.g. product price).[88]

The product price was concerned by the lay users for over retail price and it was required by the Ministry of Trade and Consumer Protection Law for the reasonable price. Besides, the Consumer Protection Act 1979 also sheltered the consumer right to receive correct and sufficient information and description as to the quality of goods or services, and required the entrepreneurs to prepare the label of such goods before the sale in accordance with the rules.[88] However, the provision of this Act shall apply only in so far as it is not a repetition or contrary to specific law.[88]

Furthermore, Thai Constitutional Law[92] called for the right of a person as a consumer shall be protected as provided by law. Hence, these requests of lay users for additional needed information could well reflect their senses of awareness in consumer protection which should be in lay users for their most benefits and safety.

For the most attractive issue, nearly 50% of lay users' expressions in the same direction as labeling information might be due to their new knowledge according to no experiences in using this test kit as their opinions from the individual interviews. Moreover, their much perceived utility, interesting with easy to read and understand were also the factors to confirm the good quality of this HPT labeling prototype.

The other interesting and reasonable issue was that the advertising on outer label was the second most attractive information of lay users before testing while the result figure was found after testing. This might be due to the human nature in trying to get some information from the advertisement before performing the test whereas their perceptions after actual product utilization would relate to their real experiences. After testing, about a quarter of the lay users expressed that the result figure could help them in clear, comfortable, and easier understanding, using, and result interpretation. The above evidence could support the quality of the results got by the Diagnostic Testing that was more accurate than the perception obtained from the general questionnaire without actual performing the test.

For the third most impression, it was noticeable that the participants who expressed as simple language were quite the risk group of people due to their graduation $\leq$ grade 12 and their occupations as the daily employee. Hence, it was quite primarily convinced in the good quality of this HPT labeling prototype for the lay users' benefits in aspect of easy language. This aspect was generally known as the other good factor affecting the labeling quality and was recommended by the regulations of many countries[13, 32, 55, 62, 77] in this study except Thailand.[38]

As above discussion, every wordings rendered in the labeling must be aware and well screened by all the stakeholders, as possible. It was clear to be necessary for the entrepreneurs' responsibility in conducting the consumers' testing for the labeling of self-testing or any home-use health care products before launching them into the market. However, this HPT labeling prototype had already developed according to the principle of the reliable regulations of several countries and improved step by step relating to the consumers' testing to serve proper design quality, the contents sufficiency and suitability, and the comprehensibility to the lay users.

The quality and appropriateness of the 4th draft of this HPT labeling prototype for Thai lay users was also confirmed by its readability grade level 5 that less than the required educational level in Thailand and that suggested by the Gunning Fog index (the ideal score of 7 or 8).[69] Moreover, it was consistent with the study of Janelle Griffin and colleagues[10] that proposed for a grade 5 or 6 reading level as one of the principles for designing effective education materials for clients.

All home-use IVDs labeling were not required any pre-marketing approval so many problems were found on existing accessible HPT labelling. However, the developed guideline with HPT labeling prototype could solve these problems.

CHAPTER VII

CONCLUSION AND RECOMMENDATION

1. Conclusion

The labeling control in Thailand was performed only on stringent controlled medical devices, not on home-use in-vitro diagnostic (IVD) test kits. There were no any user test or readability test or separating requirement among patient information leaflets (PILs). In this study, the domestic problem analysis on existing HPTs labeling and international regulations comparison were performed on design quality, contents/utility, and comprehensibility for labeling guideline development and validation of home-use in-vitro diagnostic (IVD) test kits and its labeling prototype.

The data collections were intensively performed since November 2005 to October 2006. Various methods were rendered to complete the results in 3 phases of the study as the content analysis, readability calculation using the Gunning's Fog Index, regulations comparison, technique from the Diagnostic Testing of CIRA and the Consumer Information Rating Form (CIRF) of USFDA, peer reviewing, and Individual interviews. The existing problems and results were as following:

1.1. Existing problems on Thai labeling of home-use IVD particular on HPTs

1.1.1. Content analysis

As the content analysis of 20 existing HPTs' labeling marketing in Thailand according to the Medical Device Act 1988[38] and guidelines in IVD including hCG[77, 78] labeling of U.S.F.D.A., the problems were found as the follows.

1.1.1.1. For design quality

About two-third of HPTs labeling in Thai language encountered with the problems on small print sizes, much smaller prints than the English ones, and the same colour of very small prints and the background. All products buying decision information especially lot number/manufacturing date and expiry date, faced with poor print quality and half of them had small and pale drawings.

1.1.1.2. For utility or contents in Thai labeling

(1) All contents except testing method, positive and negative result reading were found in different degree as non-indicated contents but average as 63%.

(2) Many different contents were claimed on the same labeling e.g.

- 2 product trade names in 1 leaflet, and between label and leaflet;
- different manufacturer and distributor between its label and leaflet;
- dissimilar details or styles of lot number/manufacturing date and expiry date between its outer and inner label;
- product performances (% accuracy) varied from 99% to 99.99%;
- various and impractical storage, urine dipping time and dropping, waiting and maximum time in result reading of the same and different HPTs, etc.

(3) Some misleading claims to product promotional or selling points e.g.

- over claimed for product performance (exceed >99%),
- claimed for foreign sources with conflicting evidence,
- cited overseas company without any status and its manufacturer,
- various manufacturer's certification marks (e.g. Quality System standards, Environmental Quality standards, etc.),
- various claims e.g. fast result, easily use, precise/accurate/sure, 100% guarantee with money back, etc.

(4) Others e.g.

- 4 different HPT brands with same immediate containers (foil) and lot number were found to cite different country of origin in each brand.
- English contents under Thai heading e.g. lot number/manufacturing date, expiry date, etc.

1.1.1.3. For the comprehensibility issues

Many scientific knowledge and technical terms were found and had possibility to cause boring and hard to understand for some lay users even they might be needed by some users and professionals. Some contents were cited in non logical sequence and had no provided drawing of negative and invalid result reading which could cause some difficulties to the lay users. Moreover, all of the existing HPTs had readability level higher than former minimum required educational level (grade level 6) and about one-third had educational grade level higher than the present requirement of Thailand (grade level 9). The dipping HPT labeling reflected the harder comprehensibility due to their higher readability grade level than the card type.

However, HPT labeling of both types had nearly the same degree of weakness in labeling according to Thai Medical Device Act 1988 and U.S.F.D.A. requirements.

The conclusion of the above 3 aspects of problems found from the content analysis of the existing HPT labeling were shown in the following table:

Table 7.1: Content analysis of problems found on existing HPT labeling

Aspects	issues	details
1. Utility/ content		
• Buying content	non-indicate	HPT name on foil; high rates on expiry date & manufacturer
	different in/among label & leaflet	trade name, mfg. date/lot & exp. date, producer, distributor
	claims	Q.S, U.S. product but local telephone number, various promotions, different foreign sources of same appearance
• Utilize content	varied details	storage, urine drops, dip & wait & maximum reading time, sensitivity, over claimed accuracy, no band labeled
• Education content	Q&A part	print size < main part
	revised date	outdated, none on imported HPTs
2. Design quality	drawing, print, color, no title	small pale, nearly same background color, poor print quality
3. Comprehensibility	hard level of readability	scientific matter, technical terms, result far from method, all HPTs ≥ grade 7

1.1.2. Consumers testing on 20 existing HPTs' labeling

The problems from 90 lay users basing on average finding were found as

1.1.2.1. Total Competency of 90 lay consumers in total information finding and understanding showed that no one could pass the criterion score (≥ 81%).

1.1.2.2. Quality of information on labeling revealed that only HPT name, testing method, and interpretation of positive and negative result could pass the criteria of ≥ 81%. The quite high rate of non-indicated labeling information (62.5%) was found risky to influence the labeling quality. The results were as following

(1) Testing for competency of each content topic

- **Buying decision information**

Only HPT name could pass the criteria (≥ 81%) while the expiry date had the lowest score. Their average indicated rate was 63%. However, the intended use had the highest indicating rate because their trade names could refer to its intended use.

- **Product utilization information**

The average indicating rate (62%) was nearly the same as buying decision information. Only 3 topics of contents with high indicating rates those could pass the minimum 81% were testing method, positive and negative result reading. Quite

serious issues were respectively found as the limitations in case of ovarian cysts, miscarriage, and ectopic pregnancy which were not cited in any HPTs labeling; other limitations; contraindications; maximum read time; etc.

(2) Testing for lay consumers' perceptions about HPT labeling

The problems were respectively found in comprehensibility, design quality, and utility and their average mean score (~ 1.3-1.4) were found to be nearly the same. The problems found in each aspect were as following:

- **Perceived design quality**

The attractiveness and print size of the existing HPT labeling were the 2 worst characteristics but the drawing benefits were the best. The lay users expressed their problems as too small and pale print size, poor line length and lines spacing, unappreciated in Q&A part or use of "box" for labeling, etc.; and proposed to improve for larger and legible print size, type, and colour (not reflective); title highlighting; clearer information and drawing with better symbolism; brighter, beautifier, more attractive labeling design; proper logical sequencing, line spacing, and line length; and smaller pack size for easier handling with less embarrassment.

- **Perceived utility**

The information completeness had very low mean score and was found to be most affected the lay users' perception on labeling utility. Some hard comprehending contents and the incomplete with insufficient information expressed by lay users; were found in contraindications, expiration date, possible error or false results, precautions, storage, result reading, manufacturer, manufacturing date, etc.

- **Perceived comprehensibility**

The difficulty was respectively found in information reading, understanding, finding, and remember. The fair answers were found most in comprehension which must not be neglected due to their hidden problematic matters. The uncomprehending contents were found most in result reading and test limitations especially the medicinal effect to the test. The other confused contents were respectively found in the principle, some English wordings e.g. hCG and CICA technology, urine collection, false error, etc. Moreover, Thai language was asked to be emphasized in the labeling due to their poor English.

Table 7.2: Lay user perceptions on existing HPT labeling (Phase I)

Design quality	**print size**	**print quality**	**lines space**	**information organization**	**line length**	**attractive**	**information clearness**	**draw benefit**	**average**
poor (%)	32	7	22	5	22	29	4	1	**15**
fair (%)	9	53	15	54	16	23	59	38	**33**
good (%)	59	40	63	41	62	48	37	61	**52**
mean (0-2)	**1.27**	**1.33**	**1.41**	**1.37**	**1.40**	**1.19**	**1.32**	**1.60**	**1.36**
Utility/contents	**complete**		**valuable**		**sufficient**		**reassure**		**average**
no (%)	43		2		23		1		**17**
fair (%)	25		38		7		31		**25**
much (%)	32		60		70		68		**58**
mean (0-2)	**0.89**		**1.58**		**1.47**		**1.67**		**1.41**
Comprehensibility	**find**		**read**		**understand**		**remember**		**average**
hard (%)	3		6		1		1		**2**
fair (%)	61		68		69		56		**43**
easy (%)	36		27		30		43		**55**
mean (0-2)	**1.32**		**1.21**		**1.29**		**1.42**		**1.31**

- **For overall opinions**

The problems were respectively found in reading, understanding, and the utility of the existing HPTs labeling. The HPTs with dipping type were encountered with more difficulty than the card type.

- **General expectations of necessary information**

They were found respectively as test method, precautions, possible errors, storage instruction, manufacturer with address as well as telephone number, and others (e.g. expiry date, manufacturing date, lot number, content/pack, intended use, compositions, adverse reaction, price, etc.).

- **The attractive issues before and after testing**

They were respectively found most as the contents and result figures.

1.2. The necessary information for consumer-based labeling guideline and its prototype development of Home-used IVDs

All countries (AU, CA, EU, US) except Thailand and GHTF had their own labeling regulation for home-use IVD with the requirement on readability calculation. The U.S.A. had most complete requirements whereas Thailand and GHTF had only general labeling regulation for the medical devices. The extracted details were as

1.2.1. Design quality

They consisted of requirements in proper labeling format by AU, CA, GHTF; legible prints by CA, EU, TH; emphasis using permanent/prominent manner by AU,

CA, US; and liberal use of graphic and/or symbol by all countries except Thailand. The request of GHTF for minimum country-specific requirement for labeling text or format was excluded due to its inequity particular to Thai people.

1.2.2. Contents or utility of the labeling

The general characteristics consisted of the sufficient contents proper to IVD and its intended use; the proper placement in labeling and be visible under normal sale conditions; and the corresponding details between Thai and other language.

For buying decision information those usually on the outer or inner label; were required by all organizations as product name, intended use, contents/pack, lot/batch/control/ serial number, expiry date, name and place (and address) of manufacturer and distributor, and warnings and precautions statements.

The details for product's utilization were suggested as storage conditions, warnings and precautions, instructions/directions for use. Except for Thailand; the requirements also included components, device description and its parts with accessories, specimen collections and preparation, contraindications and/or test limitations, assay procedure (result reading and follow-up action), expected values, performance characteristics, and other specific requirement.

For consumer's education, test principle and revision date of leaflet were needed by all organizations except for Thailand. Test summary and explanation, and bibliography were not required by Australia and GHTF while Thailand had additional channel for other obligations as prescribed by the minister.

1.2.3. Comprehensibility

The translation into official language of the selling country was obligated by all countries excluding GHTF that former requested to minimum requirement of national language but now asked for minimum country-specific requirement for labeling text or format. Moreover, the terms with simple, concise, and easy to understand and apply by the lay users were the ease factors necessitated by all except Thailand. The placement in labeling was also needed to proper IVD and intended use.

The conclusion of extracted details from international regulations comparison was illustrated in the following table:

Table 7.3: Extracted details from international regulations comparison

Aspects	requirements	countries
1. specific regulation	Home-use IVD, readability & user test	all but Thai, GHTF
2. design quality	• proper format • legible prints • emphasis permanent/prominent • graphic/symbol use • min. country-specific for text & format	• AU, CA,GHTF • CA, EU, TH • AU, CA, US • all but Thai • GHTF
3. comprehensibility	• locate proper to IVD & use • official/national language • "simple, concise, easy recognize & use"	• AU, GHTF • all but GHTF • all but Thai
4. utility	• enough details • available & visible at sale conditions • on IVD/outer label/leaflet/with device	• EU, US, • CA • AU, GHTF, EU

1.3. Guideline Development and Validation (Phase II and III)

The development of labeling Guideline for Home-use IVD and its labeling prototype using the inputs from the international regulations comparison, the content analysis of the existing HPTs labeling; the consumers' testing, and some information from reviewed literatures. The 1st draft guideline was thus reviewed by the experts to obtain the 2nd draft guideline (see Appendix F) and its 1st draft labeling prototype (see Appendix G).

After 2 rounds of experts' reviewing, the 1st draft HPT labeling prototype was respectively improved to be 2nd (see Appendix H) and 3rd draft (see Appendix I). The 3rd and the 4th (final) draft (see Appendix J) of such labeling prototype was further respectively tested for 2 rounds by 22 lay consumers in each round, using the technique as Phase I. The Guideline was thus revised again to be consistent with such final HPT labeling prototype and they were also further agreed by the 2 policy makers of Thai FDA for the practical implementation of such guideline. The validation of HPT labeling prototype and readability calculation were as following:

1.3.1. Validation by experts

In 2 rounds of experts' assessment, their perceptions and suggestions were as

1.3.1.1. Design quality

The 1st round suggestions were on prints size and type, title highlighting, lines spacing, and information sequencing. The line spacing and revising of some information sequencing in leaflet were asked in the 2nd round.

1.3.1.2. Utility

The 1st round suggestions were on concise, not too length and depth, or shorter explanation and those in the 2nd round were to add few contents in the leaflet.

1.3.1.3. Comprehensibility

In the 1st round, the hard information finding was expressed and the advices were to improve the inconclusive result and to revise language of some contents. For the 2nd round, some uncomprehending details were asked to be improved.

1.3.2. Validation by consumer testing

The consumer testing on the 3rd and 4th (final) draft labeling prototype were as

1.3.2.1. Total Competency for lay consumers on HPT labeling prototype

The ability to find and understand the information on labeling prototype showed the improvement from failing the criterion score (≥81%) in the 1st round (11 out of 22 lay users) to passing such criterion in the 2nd round (18 out of 22 lay users).

1.3.2.2. Testing for quality of HPT labeling prototype

Basing on the average information finding, the concluded results were as

(1) For the 1st round, all buying decision information and only 10 out of 23 contents for product utilization could pass the criteria (≥ 81%). The unqualified items were as contraindications, components, source of further information, false positive and false negative result, and all test limitations, etc.

Table 7.4: Lay user perceptions on HPT labeling prototype (1st round of Phase III)

Design quality	**print size**	**print quality**	**lines space**	**information organization**	**line length**	**attractive**	**information clearness**	**draw benefit**	**average**
Poor (%)	0	0	9	0	5	0	0	0	**2**
Fair (%)	41	41	14	36	32	18	23	23	**28**
Good (%)	59	59	77	64	64	82	77	77	**70**
mean (0-2)	**1.59**	**1.59**	**1.68**	**1.64**	**1.59**	**1.82**	**1.77**	**1.77**	**1.68**
Utility/contents	**complete**		**valuable**		**sufficient**		**reassure**		**average**
No (%)	0		0		5		0		**1**
Fair (%)	23		23		27		18		**23**
Much (%)	77		77		68		82		**76**
mean (0-2)	**1.77**		**1.77**		**1.64**		**1.82**		**1.73**
Comprehensibility	**find**		**read**		**understand**		**remember**		**average**
Hard (%)	0		0		0		5		**1**
Fair (%)	50		32		54		59		**49**
Easy (%)	50		68		46		36		**50**
mean (0-2)	**1.5**		**1.68**		**1.45**		**1.32**		**1.49**

(2) For the 2nd round, most information could pass the required criteria (≥ 81%) except the 5 contents which were acceptable. They were the answers about

“possibility to get false positive/negative results?”, “the use of some urine conditions e.g. the urine before going to bed, after taking alcohol, contraceptive, and pain killer”.

Table 7.5: Lay user perceptions on HPT labeling prototype (2nd round of Phase III)

Design quality	**print size**	**print quality**	**lines space**	**information organization**	**line length**	**attractive**	**information clearness**	**draw benefit**	**average**
Poor (%)	5	5	0	0	0	0	0	0	1
Fair (%)	32	32	18	9	14	14	14	5	17
Good (%)	64	64	82	91	86	86	86	96	82
mean (0-2)	**1.59**	**1.59**	**1.82**	**1.91**	**1.86**	**1.86**	**1.86**	**1.95**	**1.81**
Utility/contents	**complete**		**valuable**		**sufficient**		**reassure**		**average**
No (%)	0		0		0		0		0
Fair (%)	0		0		14		9		6
Much (%)	100		100		86		91		94
mean (0-2)	**2**		**2**		**1.86**		**1.91**		**1.89**
Comprehensibility	**find**		**read**		**understand**		**remember**		**average**
Hard (%)	0		0		0		0		0
Fair (%)	23		5		32		41		25
Easy (%)	77		95		68		59		75
Mean (0-2)	**1.77**		**1.95**		**1.68**		**1.59**		**1.75**

1.3.2.3.Testing for lay consumers’ perception

The results revealed quite satisfaction in both rounds and they showed quite much improved to very high score in the 2nd round testing. The degree of problems was respectively found in comprehensibility, design quality, and utility which were consistent with the results of lay consumer testing in Phase I as following.

(1) For the **design quality**, the comments were found in all aspects by lay users but the bigger print size especially on the outer label was most emphasized for both rounds. Their perceptions in print size and print quality were the same and lower than the other characteristics in both rounds.

(2) For the **utility**, the mean scores in all aspects were much improved from quite high in the 1st round to very high scores in the 2nd round.

(3) For the **comprehension** in both rounds testing, the difficulty in information remembering was mostly found whereas the reading was the easiest one. This result was opposite to that in Phase I. Nevertheless, all aspects were much improved in the 2nd round particularly in the reading aspect. The difficulties in information comprehensibility in both rounds were respectively on contraindications, text explaining result reading on drawing, further knowledge and some technical terms (e.g. hCG hormone, test performance, etc.), test limitations, precautions, and test strip composition.

The lay user perceptions on the above 3 kinds of labeling quality of Phase I and Phase III (round 1 and 2) were compared in the following figures 7.1 to 7.3.

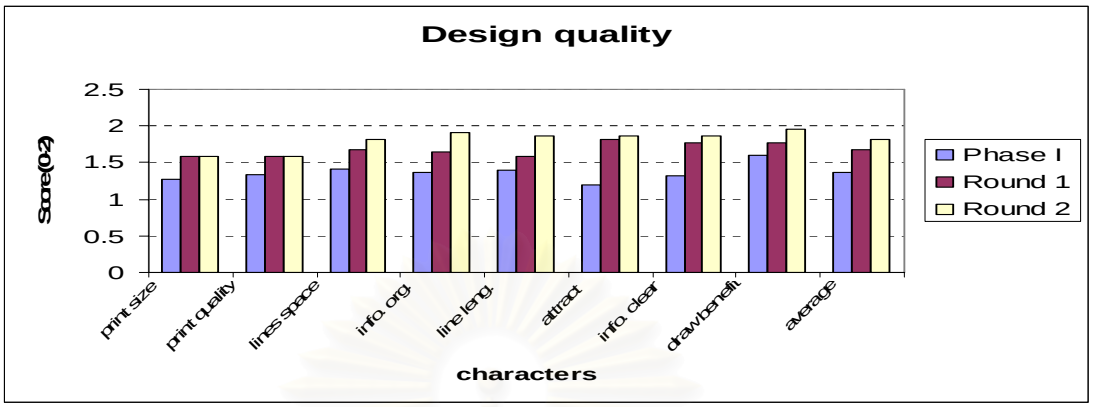


Figure 7.1 Lay user perceptions on labeling design quality (Phase I and III)

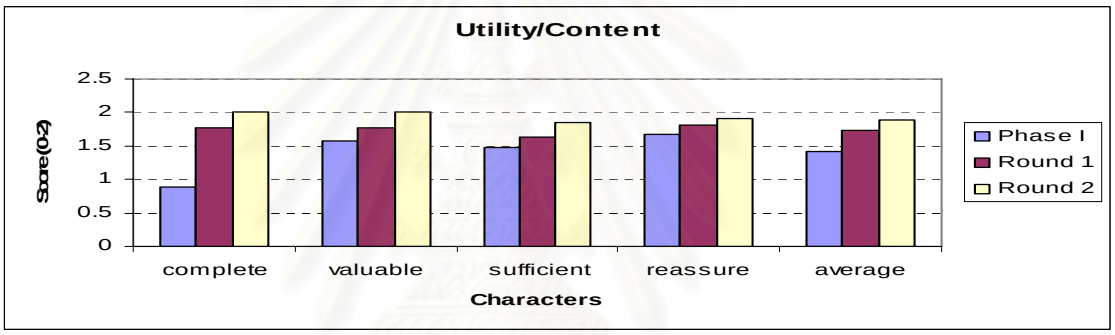


Figure 7.2 Lay user perceptions on labeling utility/contents (Phase I and III)

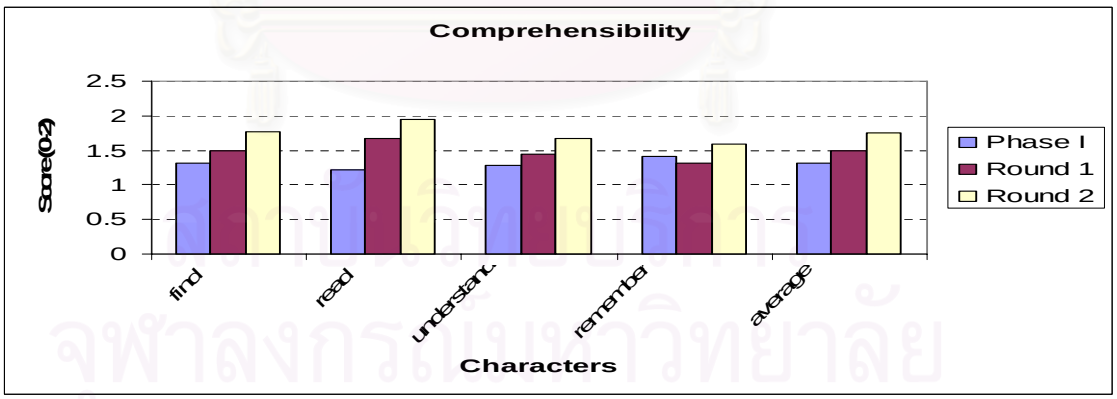


Figure 7.3 Lay user perceptions on labeling comprehensibility (Phase I and III)

(4) For overall opinions in both rounds, the problems were also respectively found in understanding, reading, and utility of this HPT labeling prototype; and those mean scores were much improved in the 2nd round testing.

(5) General expectation of needed information and the most attractive issue

The results of both rounds were found the same and consistent with those in Phase I. Test method was most expected and the content was most attracted.

1.3.2.4. Validation by Readability Formula

The testing instruction in final HPT labeling prototype was calculated to ensure the appropriateness to Thai lay users. As the Fog Readability Formula, the readability grade level was about grade 5 in both Thai and English version.

As conclusion, this HPT labeling prototype had already developed and improved step by step according to the principle of the reliable regulations of several countries and the consumers' testing to serve the proper contents, design quality, and comprehensibility of labeling. Its labeling quality was also confirmed by the readability level. The finalized version of HPT labeling prototype was shown in Appendix J and a guideline for home-use in-vitro diagnostic test kit was illustrated in the end of Chapter V.

2. Strengths and limitations of the study

2.1. Strengths of the study

2.1.1. The good representation of subjects to strengthen the result obtained

The participants in this study could reflect the expectations of target group/lay consumers those likely to use HPT. Optimal studied populations included a broad base so that quality of labeling was assessed by individuals from a wide variety of age-range, socioeconomic, educational, and cultural backgrounds, using questionnaire and some interviewing. The subjects in consumer testing with age range < 25 years old in both phases were consistent with the trend of HPT utilization and the rate of miscarriage found in the same age range in Thailand.[80] Besides, most of lay users in this study were in the age range of 18-34 years old which were consistent with the study in U.S.A. that most HPT users were women 18-34 years old.[79]

About one-third of users in both phase had education level in Grade 12 or lower which considered having a risk to comprehend in labeling as suggested by CRIA.[67] Even their ages in both phases were in the reproductive age range (15-49 years old) but it served the coverage of all users of home-used IVD. According to

Tom Lichty; the people over 40 years old often suffered from presbyopia which causes trouble in the small type reading.[81] Hence, the sample size of this age range (15-49 years old) could represent the users of home-used IVD.

2.1.2. The coverage of this study

This study was conducted as the complete loop starting from the problem finding to developing and validating HPT labeling prototype. The scope of this study included perspectives from various groups, i.e., both local and international regulatory, lay consumers, entrepreneurs, as well as experts both health and linguistics. These methods were consistent with the summary of one study revealed that patient information leaflets should be evidence based as far as possible, peer reviewed, contained references, be dated, give an objective measure of readability grade level and be evaluated by lay people.[2]

2.1.3. Several methods utilized in this study

Both qualitative and quantitative methods including direct and indirect methods were rendered in this study to obtain the complete information and for further development as well as improvement of the guideline and its labeling prototype to suit the lay consumers and all stakeholders. The consumer testing tool used the technique of the Diagnostic Testing of Australia in combination with the consumer information rating form (CIRF) of U.S.A. to balance their actual performance and perceptions. The Diagnostic Testing was also adapted to be the technique rendered in consumer testing of many countries (e.g. Australia, Canada, E.U., U.S.A.), which could confirm its strength as an proper tool in labeling development and evaluation.[16, 25, 30, 67]

The other strength of this study was that the combined measures of cognitive measure through the lay users' knowledge and perception, and affective measure through their feeling of satisfaction with written patient information; could enhance the potential validity of the results in assessing the "quality" of patient information.[72]

2.2. Limitations of the study

2.2.1. The selection of lay participants

The lay participants should have no experience in using the HPT product to avoid the bias in the questionnaire answering about the information in such tested materials (labeling). Many lay women were single but living in with their partners.

The asking for their experiences in using such product was impolite in Thai society. Thus, it was hard to screen for the novice user to participate in the consumer testing of this study. In addition, the testing rendered about 1 hour to read such labeling, locate information, answer the questionnaire, actual performing the test, and be individual interviewed. Hence, this study needed high contribution from the participants. The subject inclusion criteria could have been compromised one way or the other.

Some lay participants graduated only grade 4, 6, 9, 12 which were in the high risk group of being hard to understand such information and took longer time in testing. Moreover, many of them had no or little knowledge about English. This factor to a certain extent affected their reading and comprehensibility of the labeling prototype and also influenced their product utilization. Consequently, the English and the scientific jargons had to be translated or written in Thai for the lay users.

2.2.2. Design quality in print size, print quality, line spacing

The potential in labeling design and package developing of this HPT labeling prototype did not reach the same standard as the art work of the print house. The overall quality of this labeling prototype was, thus, not as good as the case of commercialized labeling but these problems could be solved by the printing house.

2.2.3. Labeling quality of locally manufactured comparing to imported ones

The variations in quality of contents and pattern of HPT labeling for each brand depended on its manufacturer, distributors, or the products owners. The results of locally produced HPTs in Phase I was found better than the imported ones because most local ones were from the same large producer but different distributors or proprietors. Most imported ones were belonging to different vendors with the same or different manufacturers. The other limitation was acquiring as much as possible HPT brands from retail pharmacies without regarding their manufacturers. Hence, more locally produced HPTs should be tried to access and obtain more reasonable results.

3. Recommendations

3.1. Policy recommendations for implementations

The results were expected to strengthen the policy and regulation and to be the reference in evaluating and improving labeling quality for most benefits to lay users. Therefore, the policy recommendations from all phases of this study would be as

3.1.1. The improvement of existing HPTs labeling would be urgent preceded by Thai FDA and responsible entrepreneurs in the following aspects:

3.1.1.1. For design quality, the results might trouble lay users in hard information reading, locating, and understanding. Attractiveness, print size (e.g. larger prints, equal Thai and English prints, etc.) and print quality (clearer prints and drawings) especially on the outer label, improper to use Q&A part and box for important information would be more emphasized to enhance the labeling quality.

3.1.1.2. For contents/utility, it needs higher indicating rate, information completeness and consistency on the same labeling, and non-misleading information particular on product performance, manufacturer, limitations, contraindications, etc. Moreover, the contents should be directly indicated and no need to imply before ability to understand. Scientific knowledge and technical terms caused boring and hard information comprehensibility to the lay users.

3.1.1.3. For comprehensibility, it needs short and concise as well as simple language with more facilities to improve its readability level (e.g. drawing of negative and invalid results, Thai translation, texts explaining test bands on drawings, etc.).

3.1.2. The guideline and its labeling prototype should be the model for the other home-use medical devices and supplies, drug-medical device combination, medicinal products, and other health products (e.g. food, cosmetics, hazardous substances, etc.) under the authority of Thai FDA for more compliance of the users and the most efficiency with safety in such product utilization. Moreover, they could be the reference for the entrepreneurs in developing and improving their product labeling, and for the authorized regulators in their assessment of the product labeling.

3.1.2.1. The results from the regulation comparison of different countries showed that Thailand had the least level of control which could jeopardize consumer's safety. Moreover, the labeling requirements of Home-use IVDs are still lacking many necessary issues and items of contents to satisfactory for Thai people particularly to the lay users. Therefore, Thai FDA under the Ministry of Public Health should concern and set the policy in emphasizing and supporting the urgent amendment of law, regulations, and requirements in all health products labeling to serve the proper consumers' protection, particularly for the lay users. This is to pave up the international trend and enhance the quality of consumer protection. The notification issuance to upgrade the controlling level of the home-use in-vitro diagnostic reagents and instruments was recommended. Examples are Home-

Pregnancy test kit, Blood Glucose monitoring instruments for self-testing, etc. Their labeling as medical device with licensing (most stringent controlled) or with notification (moderately controlled) basing on their degree of possible risk to users was also suggested.

3.1.2.2. The problem analysis illustrated that most labeling required high readability level which did not conform to Thai educational requirement. The readability level calculation using readability formula particularly the Gunning Fog Index, should be required and applied to the test method and result reading of all home-use medical devices and supplies, drug-medical device combination, medicinal products, and other health and household products e.g. toys, electrical appliances, etc. This is to confirm the labeling quality and to facilitate the lay users' comprehensibility in such labeling for more consumer protection.

3.1.2.3. The questionnaire in this study was proved to facilitate the labeling quality improvement, thus, could be adapted for the regulator and entrepreneur in evaluating and improving the labeling quality of home-use medical devices with supplies, other health products, and any household appliances.

3.1.2.4. The campaign to encourage the careful labeling reading before product utilization was still needed and the complete information and attractive outer label should be emphasized for more consumer protection. These were confirmed by the results of this study that outer label was the 1st information source and the content particularly test method and figures of result reading were the two most needed and interested by the lay users. Furthermore, the incomplete information and unattractive labeling were the 2 problematic issues most encountered by them.

3.2. Recommendations for further study

The following further studies were suggested to be worked together among all stakeholders (agency, manufacturers, academia, health care providers and regulators) to complete results for more consumer protection.

3.2.1. Two kinds of home-used IVD test kits were reagents and instruments. This study emphasized on Guideline of home-used IVD reagents and rendered home pregnancy test kit (HPT) labeling as prototype. Hence, the same methodology of consumers' testing of this study was suggested for further study on the instruments

e.g. Blood Glucose monitoring, etc. to further validate this guideline for other instruments.

3.2.2. The study in developing and validating a simple and reliable method to be the tool for the evaluation of the labeling quality of each type of home-use medical devices and supplies by adaptation from the questionnaire in this study was recommended.

3.2.3. Comparative study for the result of experts' and patients' assessment on design quality, utility, and comprehensibility of home-used medical devices labeling should confirm the need for consumer testing.

The study in labeling evaluation, improvement, and development of the other consumer goods under supervision of Consumer Protection Department (e.g. toys, stationery, electrical and electronic appliances, etc.) should be encouraged by applying the techniques in consumer testing obtained from this study.

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APPENDICES

APPENDIX A

Accessible HPT Brands for Labeling Quality Assessment

The details of accessible HPT brands for labeling quality assessments of were shown as following:

1. The details of 15 entrepreneurs and 26 brands of accessible HPTs

1.1. Local manufacturers: (2): 2 brands

1.1.1. Company 10:

1.1.1.1. manufactured and distributor of brand D and brand U

1.1.1.2. manufactured for some distributors: brand B, C, E, F, P, R, V, X

1.1.2. Company 5: manufactured brand L for 1 international distributor

1.2. Importers & distributors (13):

1.2.1. Local pharmaceutical manufacturer & distributors (5): 6 brands [Company 1 (brand P, brand B); Company 3 (brand W); Company 4 (brand V); Company 9 (brand H); and Company 13 (brand R)]

1.2.2. Local pharmaceutical importers & distributors (3): 8 brands[Company 7 (brand E, brand F); Company 11 (brand S, brand T, brand Y); Company 12 (brand A, brand M, brand Z)]

1.2.3. International pharmaceutical distributors (2): 4 brands [Company 8 (brand O, brand L); Company 15 (brand X, brand C)]

1.2.4. Local IVD importers & distributors (3): 6 brands [Company 2 (brand G, brand N); Company 14 (brand J, brand K, brand Q); Company 6 (brand I)]

2. Conclusions of HPT brands accessible for this study

2.1. Companies (1 to 15) and HPT brands (A to Z) were respectively represented to the entrepreneurs and their products as alphabetical ordering.

2.2. HPTs with dipping type were brand B, F, H, I, L, S, U, V, W, and Z.

2.3. HPTs with card type were brand A, C, D, E, G, J, M, N, O, P, Q, R, T, Y, and X.

2.4. HPT with midstream type were brand K.

2.5. Brand M and V were respectively the worst HPTs with card and dipping type.

2.6. Brand L was illustrated as imported HPT and its manufacturer was not indicated, but company 5 was found by the researcher as its actual manufacturer.

2.7. Brand E, G, J, P, I were discarded due to same distributors and/or manufacturer and/or document characteristics; and brand K was the only accessible 1 midstream type.

The 20 labeling of HPT brands (as table 3.4) were selected to be further evaluated by content analysis and consumer testing.

APPENDIX B

Pattern of Print Types and Print Sizes for Labeling Quality Assessment

The pattern of print types and sizes for labeling assessment were shown as follows:

I. Alphabet Type and Size template

(7, 7.5, 8, 8.5, 9, 9.5, 10, 10.5, 11, 11.5, 12, 13, 14, 15, 16 points)

1. Angsana New:

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2. Angsana UPC:

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3. Cordia New:

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4. Cordia UPC:

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5. Browallia UPC:

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6. Freesia UPC:

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7. Microsoft Sans Serif:

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8. Tahoma:

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II. Print type and size 7, 7.5, 8, 8.5, 9, 9.5, 10, 10.5, 11, 11.5, 12, 13, 14, 15, 16 points

1. **Angsana New:**

ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์
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2. **Angsana UPC :**

ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์
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ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์

3. **Cordia New:**

ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์
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ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์

4. **Cordia UPC:**

ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์
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5. **Browallia UPC:**

ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์
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6. **Freesia UPC:**

ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์
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7. **Microsoft Sans Serif:**

ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์
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ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์
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8. **Tahoma:**

ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์
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ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์
ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์ ชุดทดสอบการตั้งครรภ์
ชุดทดสอบการตั้งครรภ์

APPENDIX C

Questionnaire for Consumer Testing

แบบสอบถามผู้บริโภค
เกี่ยวกับข้อมูลในฉลากและเอกสารกำกับเครื่องมือแพทย์

เรียน ท่านผู้ตอบแบบสอบถาม

การศึกษานี้เป็นส่วนหนึ่งของวิทยานิพนธ์ของนักศึกษาในหลักสูตรปริญญาเอก สาขาเภสัชศาสตร์สังคมและบริหาร คณะเภสัชศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย เพื่อศึกษาปัญหาและความต้องการของประชาชนเกี่ยวกับข้อมูลในฉลากและเอกสารกำกับเครื่องมือแพทย์ที่ประชาชนสามารถซื้อมาเพื่อใช้ได้ด้วยตนเองที่บ้าน ทั้งนี้ผู้วิจัยจะได้นำข้อคิดเห็นของท่านไปใช้ในการปรับปรุงคุณภาพฉลากและเอกสารกำกับเครื่องมือแพทย์ รวมทั้งจะได้นำไปใช้ประกอบการจัดทำแนวทางการแสดงข้อมูลในเอกสารดังกล่าวเพื่อประโยชน์สูงสุดต่อผู้บริโภค

ตัวอย่างเครื่องมือแพทย์หรืออุปกรณ์การแพทย์ที่ใช้ในการศึกษานี้ คือ ชุดทดสอบทางการแพทย์ที่ประชาชนสามารถซื้อมาใช้ได้ด้วยตนเองที่บ้าน การตอบแบบสอบถามนี้เป็นการประเมินคุณภาพฉลากและเอกสารกำกับชุดทดสอบทางการแพทย์ ไม่ได้เป็นการประเมินตัวท่านซึ่งเป็นผู้ตอบแบบสอบถามแต่อย่างใด ดังนั้นข้อคิดเห็นของท่านจะมีความสำคัญยิ่งต่อการศึกษาในครั้งนี้ ผู้วิจัยจึงใคร่ขอให้ท่านแสดงความคิดเห็นอย่างเต็มที่ โดยกรุณาตอบแบบสอบถามนี้อย่างตรงไปตรงมาตามความเห็นของท่านเอง

ทั้งนี้ผู้วิจัยขอขอบคุณที่ท่านได้กรุณาเสียสละเวลาตอบแบบสอบถามและให้ข้อคิดเห็นอันเป็นประโยชน์มา ณ ที่นี้

ผู้วิจัย

ความหมายของคำต่างๆในแบบสอบถามนี้

เครื่องมือแพทย์หรืออุปกรณ์การแพทย์ เช่น ปรอทวัดไข้ เครื่องวัดความดันโลหิต ถุงยางอนามัย ที่นอนแม่เหล็ก ถุงประคบร้อน ถุงประคบเย็น ผ้าห่มไฟฟ้า กระบอกฉีดอินซูลิน ชุดทดสอบทางการแพทย์ ฯลฯ

ชุดทดสอบทางการแพทย์ หมายถึง ชุดทดสอบที่ประกอบด้วยอุปกรณ์และ/หรือน้ำยาในการบ่งชี้ความผิดปกติของร่างกายเช่น ชุดตรวจน้ำตาลในปัสสาวะ/เลือด ชุดทดสอบการตั้งครรภ์ ชุดตรวจการติดเชื้อต่างๆ ชุดตรวจสารเสพติดในปัสสาวะฯลฯ

ฉลาก หมายความรวมถึง รูป รอยประดิษฐ์ เครื่องหมาย หรือข้อความใดๆซึ่งแสดงไว้ที่ชุดทดสอบทางการแพทย์ ภาชนะบรรจุ (ซองฟอยล์) หรือหีบห่อบรรจุ (กล่อง)ชุดทดสอบทางการแพทย์นั้นๆ

เอกสารกำกับหรือเอกสารแนะนำการใช้ หมายถึง กระดาษหรือวัตถุอื่นใดที่ทำให้ปรากฏความหมายด้วยรูป รอยประดิษฐ์ เครื่องหมาย หรือข้อความใดๆ อันเกี่ยวกับชุดทดสอบทางการแพทย์ซึ่งสอดแทรกหรือรวมไว้กับภาชนะหรือหีบห่อที่บรรจุชุดทดสอบทางการแพทย์นั้นและให้หมายความรวมถึงคู่มือการใช้ชุดทดสอบทางการแพทย์นั้นด้วย

ผลผิดพลาดจากความเป็นจริงจากการใช้หรือการอ่านผลชุดทดสอบได้แก่ผลบวกปลอมและผลลบปลอม

ผลบวกปลอม หมายถึง ผลการทดสอบระบุว่า ตั้งครรภ์(ตั้งท้อง) ทั้งๆที่ไม่ได้ตั้งครรภ์

ผลลบปลอม หมายถึง ผลการทดสอบระบุว่า ไม่ได้ตั้งครรภ์ทั้งๆที่ตั้งครรภ์

โปรดทำเครื่องหมาย ✓ ในช่อง ❒ หรือ ❍ หน้าข้อความที่ท่านเลือก

1. ท่านเคยซื้อชุดทดสอบทางการแพทย์ใดๆมาเพื่อใช้เองที่บ้านหรือไม่

❒ ไม่เคย (ให้ข้ามไปตอบข้อ 4)

❒ เคย (ตอบได้มากกว่า 1 ข้อ)

- ระบุชนิดชุดทดสอบ ❍ ชุดทดสอบการตั้งครรภ์ ❍ ชุดตรวจน้ำตาลในปัสสาวะ/เลือด
  ❍ ชุดทดสอบการตกไข่ ❍ ชุดตรวจหาสารเสพติดในปัสสาวะ
  ❍ ชุดตรวจการติดเชื้อต่างๆ ❍ อื่นๆ.....
- ซื้อบ่อยเพียงใด ❍ เดือนละครั้ง ❍ เดือนละหลายครั้ง ❍ หลายเดือนครั้ง ❍ อื่นๆ.....
- ผู้แนะนำให้ซื้อคือ ❍ แพทย์ ❍ เพื่อน/ ญาติ ❍ สื่อโฆษณา ❍ อื่นๆ.....

❒ อื่นๆ.....

2. ปกติท่านจะอ่านฉลากและเอกสารกำกับที่มาพร้อมสินค้าดังกล่าวในข้อ 1 หรือไม่

❒ ไม่เคยอ่านเพราะ(กรุณาระบุเหตุผล).....

❒ อ่านทั้งหมดโดย ❍ อ่านเฉพาะครั้งแรก ❍ อ่าน ทุกครั้ง ❍ อ่านบ้างไม่อ่านบ้าง ❍ ไม่ค่อยได้อ่าน

❒ อ่านบางส่วนโดย ❍ อ่านเฉพาะครั้งแรก ❍ อ่านทุกครั้ง ❍ อ่านบ้างไม่อ่านบ้าง ❍ ไม่ค่อยได้อ่าน

❒ อื่นๆ.....

3. ปกติท่านเก็บฉลากและเอกสารกำกับดังกล่าวไว้สำหรับอ่านประกอบการใช้เครื่องมือแพทย์ในครั้งต่อๆไปหรือไม่

❒ ไม่ได้เก็บ ❒ เก็บบ้างไม่เก็บบ้าง ❒ เก็บ ❒ อื่นๆ.....

4. ข้อมูลใดที่ท่านคิดว่าจำเป็นต้องระบุในฉลากและเอกสารกำกับเครื่องมือแพทย์ที่ท่านสามารถซื้อมาเพื่อใช้เองที่บ้าน (เลือกได้มากกว่า 1 คำตอบ หากไม่มีตามที่ระบุหรือมีเพิ่มจากที่ระบุ ให้ใส่ในช่องอื่นๆ)

❒ วิธีการใช้ ❒ ข้อควรระวังในการใช้ ❒ ข้อผิดพลาดที่อาจเกิดขึ้นได้จากการใช้หรือการอ่านผล

❒ วิธีเก็บรักษา ❒ ผู้ผลิต ที่อยู่และโทรศัพท์ ❒ อื่นๆ.....

ข้อ 5 ถึงข้อ 25 ขอให้ท่านค้นหารายละเอียดในฉลากบนกล่องสินค้า บนฟอยล์และในเอกสารแนะนำการใช้ชุดทดสอบทางการแพทย์นี้เพื่อตอบคำถามต่อไปนี้

5. ถ้าท่านจะซื้อชุดทดสอบนี้ ท่านคิดว่าจะสามารถหาข้อมูลตามที่ท่านตอบในข้อ 4 นั้นจากฉลากและเอกสารแนะนำการใช้ที่แนบมาพร้อมชุดทดสอบนี้พบหรือไม่ และหาพบได้ยากหรือง่ายเพียงใด (ระบุทุกข้อมูลที่ท่านเลือกในข้อ 4)

❒ ข้อมูลที่หาไม่พบ เช่น.....

❒ ข้อมูลที่หาพบยาก เช่น.....

❒ ข้อมูลที่หาพบง่าย เช่น.....

❒ อื่นๆ.....

6. สิ่งใดในฉลากกล่องและเอกสารแนะนำการใช้ของชุดทดสอบนี้ที่ดึงดูดใจท่านมากที่สุดคือ(เลือกตอบเพียงข้อเดียว)

❒ ชื่อสินค้า ❒ ขนาดตัวอักษร ❒ รูปแบบฉลากและเอกสารกำกับ ❒ ภาษาเข้าใจง่าย

❒ สีกล่อง ❒ ข้อความโฆษณาบนกล่อง ❒ เนื้อหา เช่น วิธีใช้ การอ่านผลฯลฯ ❒รูปภาพแสดงการอ่านผล

❒ อื่นๆ.....

7. โปรดอ่านรายละเอียดจากฉลากและเอกสารแนะนำการใช้ที่แนบมาพร้อมชุดทดสอบ แล้วดำเนินการดังนี้

7.1 เติมรายละเอียดลงในช่องว่าง.....และใส่เครื่องหมาย ✓ ในตารางข้างท้ายเพื่อระบุความยากง่ายในการค้นหาข้อมูล

รายละเอียดชุดทดสอบทางการแพทย์ที่ระบุไว้ในฉลากและเอกสารแนะนำการใช้	**หาพบง่าย**	**หาพบยาก**	**หาไม่พบ**
1. ชุดทดสอบทางการแพทย์ที่ท่านได้รับครั้งนี้ชื่อ.....			
2. ชุดทดสอบที่บรรจุใน 1 กล่องมีจำนวน……ชุดทดสอบ			
3. ชุดทดสอบทางการแพทย์นี้มีการระบุข้อมูลในหัวข้อต่างๆต่อไปนี้อย่างไรบ้าง			
3.1 ประโยชน์ของชุดทดสอบนี้คือ…….....			
3.2 มีคำเตือนและข้อควรระวังในการใช้ดังนี้……..……..... …….....			
3.3 ห้ามใช้กับผู้ที่มีสภาพร่างกายดังต่อไปนี้ .....….....…..... …….....			
3.4 มีสิ่งที่บรรจุมาในกล่องดังนี้……..... …….....			
3.5 มีวิธีการเก็บปัสสาวะที่จะใช้ในการทดสอบอย่างใดและควรเก็บในเวลาใด.....			
3.6 มีขั้นตอนในการใช้ดังนี้…….....… ..... …….....			
3.7 ควรจุ่มแผ่นทดสอบลงในปัสสาวะนาน.....นาที			
3.8 ให้อ่านผลการทดสอบหลังนำแผ่นทดสอบขึ้นจากปัสสาวะแล้ว.....….....นาที			
3.9 หลังนำแผ่นทดสอบขึ้นจากปัสสาวะแล้ว ไม่ควรอ่านผลการทดสอบเลยเวลาที่กำหนดไว้นานกว่า..... นาที			
3.10 มีวิธีอ่านผลการทดสอบดังนี้ • กรณีตั้งท้อง จะพบว่า.....			
• กรณีไม่ได้ตั้งท้อง จะพบว่า.....			
• กรณีไม่แน่ใจว่าตั้งท้องหรือไม่ จะพบว่า..... และควรทำอย่างไร.....			
3.11 หากยังไม่เปิดออกใช้ ชุดทดสอบนี้จะหมดอายุในเดือน.....พ.ศ.....			
3.12 ผู้ผลิตชุดทดสอบนี้คือ.....			
3.13 ผู้จำหน่ายชุดทดสอบนี้ คือ.....			
4. ชุดทดสอบนี้สามารถให้ผลผิดพลาดจากความเป็นจริงได้หรือไม่.....			
5. ท่านควรเก็บชุดทดสอบนี้อย่างไร หากยังไม่ได้เปิดซองฟอยล์ออกใช้…….....			
6. ท่านสามารถปรึกษาหรือขอข้อมูลเพิ่มเติมเกี่ยวกับชุดทดสอบนี้ได้ที่.....			

7.2 ใส่เครื่องหมาย ✓ ในตารางเพื่อระบุความเหมาะสมในการใช้ชุดทดสอบนี้กับปัสสาวะของผู้มีสภาพร่างกายต่างๆและความยากง่ายในการค้นหาข้อมูลดังกล่าวในฉลากและเอกสารแนะนำการใช้ที่แนบมาพร้อมชุดทดสอบนี้

ปัสสาวะของผู้ใช้ชุดทดสอบการตั้งครรภ์ในสภาพร่างกายต่างๆ	**การใช้ชุดทดสอบ**			**การค้นหาข้อมูล**		
	ใช้ได้	**ใช้ไม่ได้**	**ไม่ทราบ**	**หาพบง่าย**	**หาพบยาก**	**หาไม่พบ**
1. ภายหลังการตื่นนอน						
2. ก่อนเข้านอน						
3. หลังการดื่มสุราหรือของมึนเมา						
4. หลังคลอดลูก/แท้งลูกมาแล้วไม่เกิน 2 เดือน						
5. ท้องนอกมดลูก						
6. มีเนื้องอกหรือซีสต์ในรังไข่						
7. อยู่ระหว่างได้รับยาที่มีฮอร์โมนเอชซีจี						
8. อยู่ระหว่างกินยาคุมกำเนิด						
9. อยู่ระหว่างได้รับยาแก้ปวด						

8. ฉลากและเอกสารแนะนำการใช้นี้ให้**ข้อมูลเพียงพอ**ต่อการใช้ชุดทดสอบนี้หรือไม่

❒ ไม่เพียงพอ (ระบุข้อมูลที่จำเป็นต้องเพิ่ม.....)

❒ เพียงพอปานกลาง ❒ เพียงพอ ❒ อื่นๆ.....

9. **รูปภาพหรือตารางประกอบ**ในฉลากและเอกสารแนะนำการใช้นี้มีประโยชน์ต่อท่านในการใช้ชุดทดสอบหรือไม่

❒ ไม่มี ❒ มีบ้าง ❒ มีมาก ❒ อื่นๆ.....

10. มี**ข้อความ**ใดในฉลากและเอกสารแนะนำการใช้ชุดทดสอบนี้ ที่ท่าน**อ่านแล้วไม่เข้าใจ**หรือไม่

❒ มีมาก เช่น.....

❒ มีบ้าง เช่น.....

❒ ไม่มี ❒ อื่นๆ.....

ให้ท่านเก็บปัสสาวะของท่านและทดลองใช้ชุดทดสอบนี้ก่อนตอบข้อ 11 ถึงข้อ 26 ต่อไป

11. **ขนาดตัวอักษร**ในฉลากและเอกสารแนะนำการใช้ชุดทดสอบนี้

❒ เล็กเกินไป ❒ เล็กแต่พออ่านได้ ❒ เหมาะสม ❒ อื่น.....

12. **ความคมชัดของงานพิมพ์**ของฉลากและเอกสารแนะนำการใช้ชุดทดสอบนี้

❒ คุณภาพไม่ดี ❒ คุณภาพพอใช้ ❒ คุณภาพดี ❒ อื่นๆ.....

13. **ระยะห่างระหว่างบรรทัด**ในฉลากและเอกสารแนะนำการใช้ชุดทดสอบนี้

❒ แคบเกินไป ❒ แคบบ้างไม่แคบบ้าง ❒ เหมาะสม ❒ อื่นๆ.....

14. **การจัดระบบหรือการเรียงลำดับข้อมูล**ในฉลากและเอกสารแนะนำการใช้ชุดทดสอบนี้

❒ ไม่เหมาะสม ❒ พอใช้ ❒ เหมาะสม ❒ อื่นๆ.....

15. **ความยาวของประโยค**ส่วนใหญ่ในฉลากและเอกสารแนะนำการใช้ชุดทดสอบนี้

❒ สั้น/ยาวเกินไป ❒ พอใช้ ❒ เหมาะสม ❒ อื่นๆ.....

16. **ความน่าสนใจ**ของฉลากและเอกสารแนะนำการใช้ชุดทดสอบนี้

❒ ไม่น่าสนใจ ❒ น่าสนใจบ้างไม่น่าสนใจบ้าง ❒ น่าสนใจ ❒ อื่นๆ.....

17. **ความชัดเจนของเนื้อหา**ในฉลากและเอกสารแนะนำการใช้ชุดทดสอบนี้

❒ ไม่ชัดเจน ❒ ชัดเจนบ้างไม่ชัดเจนบ้าง ❒ ชัดเจนดี ❒ อื่นๆ.....

18. ท่านคิดว่าข้อมูลในฉลากและเอกสารแนะนำการใช้ชุดทดสอบนี้**ช่วยในการใช้ชุดทดสอบ**นี้ได้เพียงใด

❒ ไม่ช่วย ❒ ช่วยปานกลาง ❒ ช่วยมาก ❒ อื่นๆ.....

19. ข้อมูลในแต่ละหัวข้อในฉลากและเอกสารแนะนำการใช้นี้มี**เนื้อหา**ส่วนใหญ่**ครบถ้วน**ตามที่ท่านต้องการหรือไม่

❒ ไม่ครบถ้วน ❒ ครบถ้วนบ้างไม่ครบถ้วนบ้าง ❒ ครบถ้วนดี ❒ อื่นๆ.....

20. ท่านมี**ความเชื่อถือ**ในฉลากและเอกสารแนะนำการใช้ชุดทดสอบนี้หรือไม่

❒ ไม่เชื่อถือ ❒ เชื่อถือบ้างไม่เชื่อถือบ้าง ❒ เชื่อถือ ❒ อื่นๆ.....

21. ท่านสามารถ**ค้นหาข้อความสำคัญ**ที่ต้องการทราบในฉลากและเอกสารแนะนำการใช้ที่มาพร้อมชุดทดสอบนี้ได้

❒ ยาก ❒ ยากบ้างง่ายบ้าง ❒ ง่าย ❒ อื่นๆ.....

22. ท่านคิดว่าข้อความในฉลากและเอกสารแนะนำการใช้ที่มาพร้อมชุดทดสอบนี้มี**ความยากง่ายต่อการจดจำ**เพียงใด

❒ ยาก ❒ ยากบ้างง่ายบ้าง ❒ ง่าย ❒ อื่นๆ.....

23. **โดยภาพรวม** ท่านคิดว่า ฉลากและเอกสารแนะนำการใช้ที่มาพร้อมชุดทดสอบนี้

- **อ่าน** ❒ ยาก ❒ ยากบ้างง่ายบ้าง ❒ ง่าย ❒ อื่นๆ.....
- **เข้าใจ** ❒ ยาก ❒ ยากบ้างง่ายบ้าง ❒ ง่าย ❒ อื่นๆ.....
- **ประโยชน์** ❒ ไม่มี ❒ มีบ้าง ❒ มีมาก ❒ อื่นๆ.....

24. ภายหลังจากอ่านฉลากและเอกสารแนะนำการใช้ แล้วลองใช้ชุดทดสอบนี้ อยากทราบว่าส่วนใดของฉลากและเอกสารแนะนำการใช้ชุดทดสอบนี้ที่ท่าน**ประทับใจ**มากที่สุด.....

25. ท่านมี**ข้อเสนอแนะ**เกี่ยวกับฉลากและเอกสารแนะนำการใช้ที่แนบมาพร้อมชุดทดสอบ ในหัวข้อต่างๆดังนี้หรือไม่

- ข้อมูลที่ควรเพิ่มเติม ❒ ไม่มี ❒ มี ระบุ.....
- ภาพลักษณ์และความรู้สึกต่อบรรจุภัณฑ์ ❒ ไม่มี ❒ มี ระบุ.....
- ข้อคิดเห็นที่ต้องการเสนอต่อผู้ผลิต ❒ ไม่มี ❒ มี ระบุ.....

26. โปรดระบุ**ข้อมูล**บางประการ**เกี่ยวกับตัวท่าน**

- **อายุ** ..... ปี
- **อาชีพ** ❒ นักเรียน/นักศึกษา ❒ รับจ้าง ❒ พนักงานร้าน/บริษัท ❒ รับราชการ/รัฐวิสาหกิจ ❒ ประกอบธุรกิจส่วนตัว ❒ แม่บ้าน ❒ อื่นๆ.....
- **การศึกษา** ❒ จบชั้น..... ❒ จบอนุปริญญา ❒ จบปริญญาตรี ❒ จบมากกว่าปริญญาตรี ❒ กำลังศึกษาในระดับ..... ❒ อื่นๆ.....

ขอขอบคุณในความร่วมมืออย่างดีของท่านในครั้งนี้

APPENDIX D

Comparable Requirements in Design Quality, Utility, and Comprehensibility For IVD Labeling of Different Countries

Table 1: Comparable details in design quality for IVD labelling

No.	Title	TH	AU	EU	US	CA	GHTF	remarks
1	**Format**							
1.1	proper to IVD type & intended use		opi				opi	
1.2	clearly written in step by step					p		especially in "directions for use"
2	**Prints**							
2.1	in legible characters/prints	opi		i		p		
2.2	corresponding print sizes between Thai and other language	opi						
3	**Emphasis/Focus**							
3.1	permanent & prominent manner					p		
3.2	use bold print or other ways to stress warnings & precautions		opi		p			AU: infectivity warnings to IVD nature, highlighted/ bold print
4	**Graphic**							
4.1	make liberal use of drawings, illustrations, diagram, charts		p		p	p		CA: especially in directions for use
4.2	color identification		p	p	p			US: provide color coding of reagent containers EU: be explained in leaflet
4.3	use symbols		p	pi	p			EU: be explained in leaflet
4.4*	encouragement of internationally recognized symbols should not compromise device safety by a lacking of patient/user understanding						opi	need explanation with device if meaning not obvious to user e.g. lay-user or newly introduced symbol
5*	**country-specific requirements for labelling text or format**						opi	be kept to minimum

[NB] o = outer label, p = package insert, i = inner label

Table 2: Comparable details in contents for IVD labelling

No.	Title	TH	AU	EU	US	CA	GHTF	remarks
1	**General characteristics**							
1.1	corresponding details	opi						Thai and other language
1.2	proper to IVD type and intended use		opi				opi	
1.3	form of user control		p					to verify IVD performance
1.4	enough details to know safely proper method and understand result reading			p	p			US: “adequate directions for use”
1.5	All required contents for users							to identify & use device safely and properly
1.5.1	on outer package & be visible under normal sale conditions (or cite on outer label referring to leaflet)					o/p		to make an informed choice for lay users & for post-market activities e.g. recall (in leaflet if too small pack)
1.5.2	on IVD itself, or outer label/leaflet/ both		i/op/ o/p					
1.5.3	on IVD itself, or on the packaging for each unit/multiple devices						opi	
1.5.4	must accompany each device			p				
1.5.5	in various media & several means						opi	
1.6*	instructions of moderate/ low risk may not be needed or abbreviated						p	if it’s safe to use & as producer intention
2	**Consumer’ buying decision information**							
2.1	product name (Thai: & category & type)	o/i	opi	opi		opi	o/p/i	GHTF: + phone, fax. no., website for technical assistance
2.1.1	proprietary name				opi			
2.1.2	established name				opi/ op			
2.2	product identification/ catalogue number		p	o		opi	p	AU: all IVDs EU: if the name doesn’t uniquely identify the product
2.3	intended use (USA: + quantitative/qualitative	op/ pi/p	o/p/i	opi	opi /op	opi	o/p/i	GHTF: e.g. monitor/screeni

No.	Title	TH	AU	EU	US	CA	GHTF	remarks
	type)							ng /diagnostic EU: e.g. pregnancy test
2.3.1	user/population						o/p/i	
2.4	Contents/pack (number of tests per pack)	o/i	o/p/i	oi	o/oi	opi	o/p/i	US: net quantity
2.5	lot/batch/control/ serial number	o/i	opi (o/p/ i)	oi	oi	oi	o/p/i	CA: control number for class III or IV device
2.6	manufacturing date						o/p/i	
2.7	means to assure std.				o/oi			
2.7.1	expiry date	o/i	opi (o/p/ i)	oi	oi	oi	o/p/i	GHTF: yy/mm, AU: month & year, EU: CCYY -MM, CA: based on shortest useful life of opened & unopened, Th: prescribed by Minister
2.7.2	visual indication for alteration statement				o/oi			
2.7.3	simple check				o/oi			
2.8	name & place of							
2.8.1	producer/ manufacturer	o/i	p	opi		opi	o/p/i	AU: all IVDs
2.8.2	importer	o/i					o/p/i	for imported IVDs
2.8.3	business (US)/ sponsor (AU)		opi		opi			US: manufacturer, packer, or distributor; AU: manufacturer, importer, exporter, arranger
2.9	indication of situation in performance evaluation						o/p/i	
2.9.1	License number	o/i	opi					AU: AUS L number; Th: for medical devices need licensing
3	**Consumer' utilization information**							
3.1	storage conditions	op/ pi/p	opi	opi	opi or//	pi		EU: and handling; CA: opened and unopened state
3.1.1	special storage and/or handling conditions		(o/p/ i)			o	o	
3.2	maintenance	op/ pi/p			p		o/p/i	install, preventive & regular, Q&C, calibration

No.	Title	TH	AU	EU	US	CA	GHTF	remarks
3.3	Components							CA: descriptions [provided & not provided reagents, and supplies (instruments/ equipment, software)]
3.3.1	list of materials provide		op		op	op		
3.3.2	list of material not provide				p	p		
3.4	Reagents					p		
3.4.1	reagent description and any limitations						o/p/i	
(1)	name of IVD					i		
(2)	reagents' name and quantity		opi		opi /op	i		AU: std. IU
(3)	reagents' identifier					i		Catalogue no.
(4)	composition (nature, amount, concentration)		p	p	opi/ op			EU: active ingredients & those affect test result
3.4.2	cautions & warnings				p	i		
3.4.3	further treatment & handling before use				opi /op		o/p/i	e.g. reagent preparation (mixing, reconstitution, dilution)
3.4.4	storage instructions			p	opi/ op	i	o/p/i	GHTF & EU: +shelf life after 1st opening & + stability of work solutions
3.4.5	purification/ treatment				p			
3.4.6	physical, biological, chemical indications of instability				opi/ op			
(1)	expiration date					i		
3.4.7	lot/control number					i		
3.4.8	name & place of producer					i		
3.5	special equipment needed			p	p	p		US: requirements in details
3.6	warnings & precautions (statements)	op/ pi/p	opi (o/p/ i)	opi	o/oi	pi	o/p/i	CA: statements, EU: danger symbols for dangerous IVD; AU: + restrictions for IVD use; Th: prescribed by Minister
3.6.1	identity & nature of					o		

No.	Title	TH	AU	EU	US	CA	GHTF	remarks
	materials; precautions in handling, storage, disposal to avoid an explosion							
3.6.2	performance intended & adverse side effects						o/p/i	
3.6.3	precautions in event of performance change/ malfunction with contact phone number						o/p/i	
3.6.4	information regarding any biological material incorporated						o/p/i	
(1)	Cautions for biological hazards					p		"The device contains material of human or animal origin and should be handled as a potential carrier and transmitter of disease."
(2)	HAZARD				o/oi	p		"The device may transmit [infectious agent] and should be handled with extreme caution. No known test method can offer complete assurance that products derived from human blood will not transmit infectious agents."
3.6.5	"the instructions for use are to be read carefully"			o/p				
3.6.6	precautions against unusual risk related disposal of device		p			p	o/p/i	
3.6.7	"For in vitro diagnostic use"				o/oi	p	o/p/i	CA: all IVD
3.6.8	"not be swallowed"			opi				for IVD
3.6.9	"FOR HOME USE"		o/p/i					
3.6.10	microbiological state		o/p/i	opi		oi	o/p/i	CA: "sterile", EU: "sterile", "microbiologically controlled"
3.6.11	"for single use"	o/i					o/p/i	Th: for disposable products

No.	Title	TH	AU	EU	US	CA	GHTF	remarks
3.6.12	"Do not use the kit or any kit component past the indicated exp. date"					p		
3.6.13	"Bring all reagents or components to room temperature before use"					p		
3.6.14	statement clearly directing the user " not to make any decision without 1st consulting medical professional/ practitioner"		p	p			o/p/i	
3.7	Limitations of procedure/ contraindications		p	p	p	p	o/p/i	EU: limitations (e.g. fasting, medications) & possible errors
3.7.1	interfering substances/ conditions				p		o/p/i	GHTF: affect assay performance
3.8	specimen collection & preparation							CA: specimen collection & handling
3.8.1	specimen type			p		p	o/p/i	CA: specimen description
3.8.2	accept/reject criteria					p		
3.8.3	specimen collection, handling, preparation			p	p	p	o/p/i	US: precautions/preparation, additives, interferences, storage, handling, shipping; EU: pre-treatment, storage, patient preparation
3.9	instructions for use/ directions for use/ procedure	op /pi/p	p (o/p/ i)	p	p	opi		AU: particular operating instructions
3.9.1	test procedure		p	p		p	o/p/i	GHTF: measurement procedure, AU, CA: clearly explanation
3.9.2	calibration, identifying, listing, preparation of reference material, samples, blanks			p	p	p	o/p/i	EU: preparation of working reagents
3.9.3	Quality control procedure & materials			p	p	p	o/p/i	EU: function of internal control (most in Q&A / result reading)
3.9.4	final reaction stability & time restriction		p	p	p	p		AU, CA: clear explanation of result
3.10	Assay procedure						o/p/i	GHTF:

No.	Title	TH	AU	EU	US	CA	GHTF	remarks
								calculation & interpretation
3.10.1	explanation of calculation procedure				p	p	o/p/i	
3.10.2	result interpretation (clearly explanation)		p	p	p	p	o/p/i	• AU, CA: false +ve & -ve result & its implication • EU: +max. reading time
3.10.3	Follow-up action		p	p	p	p		• AU: in case +ve & -ve or indeterminate result & false +ve & -ve result; • EU: if got false results
3.11	Expected values				p	p		
3.11.1	reference intervals			p	p	p	o/p/i	
3.11.2	special facilities/ training/ user qualifications		p		p	p	o/p/i	AU: needed details in all IVDs for safe use (training & knowledge of potential users)
3.11.3	literature references				p	p		
3.12	Performance characteristics				p	p		US: (specific) e.g. sensitivity, specificity, etc.
3.12.1	analytical performance characteristics e.g. sensitivity, specificity, accuracy		p				o/p/i	GHTF: accuracy (trueness & precision); AU: specific analytical performance characteristics
3.12.2	diagnostic performance characteristics e.g. sensitivity, specificity						o/p/i	
3.12.3	degree of accuracy claimed						o/p/i	for device with measuring function
4	**Consumer' education information**							
4.1	Summary & explanation of the test			p	p	p		US: short history (merits & limitations, methodology) EU: "limitations & possible errors" under "methodology"

No.	Title	TH	AU	EU	US	CA	GHTF	remarks
4.2	Test principles/ principles of the procedure		p	p	p	p	o/p/i	EU: under "methodology" US: chemical, physical, physiological, or biological principles, etc. CA: in 4.1
4.3	issued/last revise date		p	p	p	p	o/p/i	
4.4	Bibliography				p	p		
5	**other information prescribed by the Minister**	opi						

[NB] o = outer label, p = package insert, i = inner label

Table 3: Comparable details in comprehensibility for IVD labelling

No.	Title	Th	AU	EU	US	CA	GHTF	remarks
1	**Language & translation**							
1.1	use official language in country selling product	opi	opi	opi		opi		Th: Thai; AU: in Eng.& other language; CA: min. in Eng. & French except manufacturer name & address, device identifier, control number (either one & other official language prompt available as purchaser request)
1.2	labelling must include translation into the official language of the Member States in which device reach its final users			opi				
1.3*	national language requirements be kept to the minimum						opi	
2	**Ease factors for lay users**							
2.1	simple, concise		p		p			
2.2	in terms easily understood by users		opi	p	p	p	opi	
2.3	easy applied by lay users		opi	p				AU: at all stages to reduce risks in specimen & IVD handling, result interpretation
3	**Location: proper to IVD type & intended use**		opi				opi	

[NB] o = outer label, p = package insert, i = inner label

APPENDIX E

The 1st Draft Labeling Guideline of Home-Use IVD

Guideline for labeling of Home-use in vitro diagnostic (IVD) test kit in Thailand

I. Introduction

The labeling and language requirements are the essential elements needed for the consumers to use device safely and properly particularly the home-use device. In some device, the training and knowledge of the potential users are involved to achieve the intended benefits. Therefore, their risk-benefits information and instructions for use are necessitated for lay users to operate, interpret, and manipulation the device; to know how to be careful in its utilization; to cooperate with the prevention, treatment, or diagnosis of an illness (US Guidance on medical device patient labeling). However, the home-use devices those are necessary for the lay consumers and are in the trend of their progressive used are the home-use in vitro diagnostic (IVD) test kits (7, 8). In Thailand, the home pregnancy test kit (HPT) is the most simple and popular test kit among home-use devices. Its easiness in testing and less complicated product might not interfere the lay users' understanding in labeling reading with product utilization. Moreover, their trend in diagnosis replacement has become increasingly significant as the growing number of marketed HPT. The ability to clearly communicate important product information becomes increasing challenge. Consequently, this guideline was devised to include both IVD reagents and instruments but the highlight will be on the IVD reagents. The home pregnancy test kit (HPT) was selected to be the model labeling in this study for more practicality in implementation of this guideline.

II. Purpose of this guideline

1. to better serve/provide consumers and general public health by the availability of meaningful, reliable, useful, and adequately labeled IVD;

2. to assist prospective manufacturers, producers, and marketers of home-use in vitro diagnostic (IVD) test kit in proper labeling; and

3. to assist Thai Food and Drug Administration (Thai FDA) rendering consistent decisions based on reliable, reproducible and standardized commercial tests**.**

III. Definitions

1. Home-use in vitro diagnostic (IVD) test kit refer to reagents, instruments, and systems intended for use in the diagnosis of disease or other conditions, including a determination of the state of health, in order to cure, mitigate, treat, or prevent disease or its sequelae. These products are intended for use

in the collection, preparation, and examination of specimens taken from the human body (USFDA) e.g. home-use pregnancy test kit, blood glucose monitoring test kit, etc.

2. Home-use Pregnancy Test Kit refers to

2.1 the test kit intended for home use as an in vitro diagnostic (IVD) test (EN 375:2001)

2.2 the reagent, reagent product, calibrator, control material or kit) for the qualitative detection/measurement of HCG in human urine (GHTF: 2005)

3. label:

3.1 written, printed or graphic information provided upon the device itself, on the packaging of each unit/multiple device (GHTF: 2005)

3.2 written, printed or graphic information placed on a container (EN 375:2001)

4. labeling/information supplied by manufacturer (ISO 13485) was defined as written, printed or graphic matter related to identification, technical description, and use of IVD that affixed to IVD or any of its containers or wrappers, or accompanying IVD (GHTF)

5. labeling in this guideline refer to the label of immediate and outer container with package insert

6. the inner label (the label of immediate container/primary container) refers to

6.1 any image, design, symbol or statement displayed on the medical device itself or its container (33)

6.2 the label of packaging which protects the contents from contamination and/or other effects of the external environments (EN 375:2001) e.g. sealed vial, ampoule/bottle, sealed plastic bag containing test strip, etc.

7. the outer label (the label of outer container/sales packaging) refers to

7.1 any image, design, symbol or statement displayed on its package (33)

7.2 material used in the packaging of the immediate container(s) of IVD reagent(s) consisting of a single entity or an assembly of different or identical components (EN 375:2001)

8. "accompany document or product insertion" or "package leaflet or directions for use" or "procedure/operating/user Instructions" refer to

8.1 The paper or any other material on which information about the medical device is displayed by and image, design, symbol or statement, inserted or included in the container or package of the medical device, including the manual (Thai definition) (33)

8.2 procedures recommended for achieving optimum performance of device, including warnings and precautions, contraindications, and possible side effects (Canada definition) (90)

9. lay person:

9.1 individual that doesn't have formal training in a specific field or discipline (ISO 18113-1)

9.2 individual who does not have specific medical education (EN 375:2001)

IV. Contents on inner label, outer label, in the package leaflet or product insertion

1. Device/IVD name (Product name) [Thai: with device category and type**]**

1.1 established name (common or usual name) e.g. Pregnancy Test

1.2 proprietary name (trade name) e.g. Lady Preg Strip

2. use/Intended use/ intended purpose/ purpose or indications for use e.g. for qualitative detection of HCG in human urine (Ca)

2.1 nature of intended use

2.1.1 screening: to test for the presence/absence of hidden blood in stool, etc.

2.1.2 monitoring: to check for changes in blood glucose (sugar level), anticoagulant monitoring, etc.

2.1.3 diagnostic: to predict ovulation, to indicate pregnancy, etc.

2.2 **type** of test/procedure [qualitative, or quantitative] e.g. for qualitative detection

2.3 concise claim of **clinical utility** (specific disorder, condition, risk factor of interest for which the test is intended, or the analyte to be measured) e.g. early detection of HCG (which is a glycoprotein hormone secreted by the developing placenta shortly after fertilization)

2.4 **type of specimen**(s) required (e.g. serum, plasma, urine, etc.)

2.5 **who** should use the test (clearly identify population characteristics of the user) e.g. women in reproductive age range

2.6 the **conditions** for its use: indicate if

2.6.1 "the device is for home use"/"For Home Use" or "For self-testing use" (where appropriate)

2.6.2 "for In Vitro Diagnostic Use" or in the lay term as "not to be swallowed"

2.6.3 any special indication for use statement e.g. requirements for special facilities/any particular training

The example of the intended use will be "to early/rapidly indicate pregnancy by home-use visual qualitative determination of hCG (human Chrorionic Gonadotropin) hormone in human urine specimen"

3. Detailed description of the test

3.1 Device/kit identification and separate components e.g. identifier/catalogue no. or uniquely identify the device

3.2 Summary and explanation of the test (may be combined with test principle)

3.2.1 short history of methodology with pertinent reference and balance statement of its (clinical/medical) benefits and limitations e.g.

- Clinically useful HPT were introduced since 1927. Presently, HPT available use monoclonal or polyclonal Ab in an enzyme-linked immunoassay format. It is used to detect hormone hCG in human urine. The hCG is a glycoprotein composed of alpha and beta subunit, which is

produced by trophoblastic tissue, appears around the 8-9th day after ovulation where fertilization has occurred, or around the 4th day after conception. The hCG levels rise rapidly, doubling approximately every 2 days, and peak around 100,000-200,000 mIU/mL in the latter part of the 1st trimester of pregnancy. Such levels will be decreased since the 2nd trimester of pregnancy. [USFDA guidance for OTC hCG 510(k)s] or

- "In normal subjects, hCG in urine provides an early indication of pregnancy. It is a glycoprotein hormone secreted by placenta development shortly after fertilization in normal pregnancy. In a 28 day cycle with ovulation occurring at day 14th, hCG can be detected in urine or serum in minute quantity around day 23, or 5 days before the expected menstruation. The hCG levels rise rapidly, doubling approximately every 2 days, and peak around 100,000-200,000 mIU/mL in the latter part of the 1st trimester of pregnancy."

3.2.2 type of antibody (Abs) and antigen (Ags) used in the test (synthetic peptide, monoclonal, recombinant, etc.) as well as purification methods e.g. "sandwich dye conjugate immunoassay that employs a unique combination of monoclonal and polyclonal Abs to selective identity hCG in test samples"

3.3 Principle of the method

3.3.1 chemical, physical, physiological or biological principles of assay/test procedure**;** or technique(s) and reactions (immunochemical, biological, chemical, microbiological) used**;** or technology of the IVDD (e.g. ELISA, chromatographic, etc.) e.g. "Immuno Chromatography Assay Technique"

3.3.2 simple explanation of how the test works (ca: under heading 3.2) e.g. Monoclonal Ab are highly sensitive to one specific site along the hCG molecule. The hCG in urine will be trapped by the anti hCG Ab that is bound to a solid surface. The other Ab in device that linked to an enzyme will react with the anti- hCG complex to cause a color change, produce a +ve result. e.g.

"As the test sample diffuse through the absorbent test strip,

- labeled Ab-dye conjugate binds to the hCG in the specimen forming Ab-Ag complex. This complex binds to the anti-hCG Ab in the test (T) zone → pink-rose color band when hCG conc. >25 mIU/ ml.
- in the absence of hCG → no line in test zone
- unbound conjugate binds to reagent in control zone → pink-rose color band"

4. Contents of the packaging

4.1 net quantity of contents e.g. no. of test in 1 package [must be consistence with instructions for use and the amount of materials provided (for > single determination)]

4.2 if contents are not readily apparent; indication of what the package contains, include size, net weight, length, volume or no. of units of the device (metric designation be encouraged)

5. Batch code/lot number/control number/serial number for proper action to trace and recall the devices and attachable components (GHTF) [Standard convention of immediate container for most IVD, need lot number]

5.1 batch code/lot number for single-use disposable devices/reagents

5.2 serial number for electrical powered medical devices

6. manufacturing date (may be included in batch code or serial number)

7. Expiry/expiration date/ "Use before" date [in day/month/year; or at least in year and month (month/year)] particularly on devices supplied sterile, single-use or disposable devices or reagents

8. Specimen **type**, **collection, handling, and preparation for analysis**, including help by illustrations and pictures in color

8.1 description or the type of specimen to be used with IVD, special conditions of collection, pre-treatment and storage conditions (if necessary)

8.2 criteria for acceptance/rejection of specimen samples

8.3 special precautions and procedures regarding specimen collection as well as patient preparation (where necessary) for testing validity e.g. removal of particular matter by filtration, etc.

8.4 additives, preservatives, etc. to be added, to preserve specimen integrity

8.5 any known interferences/interfering substances to specimen

8.6 recommended storage, handling, shipping instructions for protection and maintenance of specimen stability

9. Directions For Use/Procedure/Operating/User Instructions [Instructions for preparation and use (a step by step from specimen reception to result obtaining)**/ testing procedure** & **result interpretation/**detailed description of procedure in using device**]**

9.1 "Adequate directions for use"

9.2 Components of kit and its composition

9.2.1 a list of all materials provided or list of kit contents including quantities, descriptions, volumes, no. of tests, etc. **or list of all apparatus or components**; all reagent products by nature, amount/ concentration of active ingredient(s) [AU] e.g.

- reagents, supplies, instruments & equipment, with instructions for use, etc.
- name of the components (AU, CA)
- contents in terms of quantity (no., mass and/or volume or concentration) of each component (CA)

9.2.2 a list of all materials/components and/or special instruments/ equipment required but not provided

- materials: e.g. distilled water
- equipment: e.g. appropriate disinfectants & disinfection procedures

9.3 A Reagent/ Reagents (to ensure proper & safe operation of reagent) should declare about

9.3.1 reagent name (proprietary name or established name)

- reagent name + IVD name (label for reagent used within single kit)
- name of reagent should be sufficient (label for multipurpose reagent used with a no. of kits)

9.3.2 Composition of contents/reagents by nature & contents as amount(quantity) **or** concentration (proportion) in metric or in standard international units, or activity, etc., of (GHTF: use "reagent description")

- each active/reactive ingredients (CA, EU, US)
- reagent derived from biological materials (sources and a measure of biological material activity) (CA, US)

The example of the composition declaration is "the test strip consists of

- a conjugate pad contains mouse monoclonal anti-hCG Ab [IgG(Ab)] dye-conjugated to Colloidal Gold (in protein matrix with 0.1% sodium azide)
- a nitrocellulose/ polyclonal Ab coated membrane strip contains
  - a test (T) line which is captured with rabbit anti-hCG Ab
  - a control(C) line containing goat anti-mouse Ab which should be bound to the conjugated monoclonal Ab regardless of the presence of hCG

9.3.3 Statement indicating

- the presence of and characterizing any catalytic or non-reactive ingredient (such as preservatives, buffers, stabilizers, etc.) for safe and effective use e.g. protein matrix with 0.1% sodium azide
- that device contains other ingredients which might influence measurement
- appropriate warnings and/or precautions for users (may be indicated in separated heading in package insert)
  - particular instructions about hazardous chemicals, handling [US: 16 CFR part 1500] e.g. " For In Vitro Diagnostic Use" or "For in vitro use"
  - any other limiting statements, self-testing declaration e.g. "For self-testing use", etc.

9.3.4 **Reagent preparation** or complete directions or adequate instructions for preparation e.g. for reconstitution, mixing, dilution, etc.

9.3.5 **sterile packaging**, radiation emitting products e.g. **"Sterile"** for sterile product (Ca: "Sterile" for product sold in sterile condition)

9.3.6 **Storage & handling** conditions/instructions(opened/unopened)

The adequate stability information (e.g. temp., light, humidity, other related factors) and shelf life to protect product stability and ensure safe handling should be declared basing on reliable, meaningful, and specific test method (or upon component having shortest projected useful life or

stability of individual reagent). Any special/ particular storage conditions (and/or handling conditions applicable to the device) should be as follows.

- unopened state for both device & individual reagents; or unopened IVD or its components(reagents, Q.C. materials, calibrators, etc.) e.g.
  - storage temp. interval e.g. 2 °C to 8 °C, 2…8 °C, ≤ -20°C, - 20 °C or below, etc.
  - other conditions/pertinent factors e.g. light, humidity, store in the dark, store desiccated, protect from freeze, etc.
- opened state/ opened IVD or its components (if differ from unopened)
  - storage conditions and shelf life following the first opening
  - storage conditions and stability with the performances of products need further manipulation (e.g. reconstituted/mixed reagents before use & with storage instructions stated in original container)

9.3.7 a **means to assure** reagent standard of identity, strength, quality, purity at time of use

- expiration date (opened/unopened based on stability of individual reagent)
- information regarding possible deterioration of reagent or observable indication of an alteration of the product[physical, biological, or chemical indications of instability/deterioration] e.g. indicators of reagent: turbidity, precipitate, color change, beyond its appropriate standards; instructions for a simple method that user can determine the meeting of appropriate standard (Au: a form of user control)

9.3.8 net quantity of **reagent contents of package** or other terms in

- weight or volume/numerical count/any combination (size, net wt., length, volume, length, volume/no. of units of device)
- reflecting package contents e.g. max. no. of tests be performed with stated contents (statement of no. of tests must consistence wt. instructions for use & amount of materials provided, for > single determination)

9.3.9 **Lot/control no.** of reagents to trace its identity

9.3.10 **Measurement of results**

9.3.11 **Follow-up action** required

9.3.12 **Name & place/add. of business** of manufacturer, packer, or distributor

9.3.13 **Kit identification** (if applicable)/ Identifier/catalogue number

9.4 For (in vitro diagnostic) instruments: Operation Manual/ User Manual/ Operating instructions for proper & safe operation, maintenance, basic trouble shooting

9.4.1 Name of instruments

9.4.1 Additional materials

9.4.1 Use or function

9.4.1 Installation procedure & special requirements (Au: not in specific heading of "instrument")

9.4.1 Principles of operation

9.4.1 Performance characteristics & specifications

9.4.1 Operating instructions/test procedure

9.4.1 Calibration procedures including materials and/or equipment to be used (GHTF: to ensure proper operation & safety during intended life)

9.4.1 Operational precautions (/Possible errors) & limitations

9.4.1 Reading and explanation of results

9.4.1 Hazards

9.4.1 Follow-up action (self-testing products)

9.4.1 Internal Q.C., accuracy

9.4.1 Date of issue of instructions for use

9.4.1 Bibliography

9.5 Warnings (operating warnings) and restriction/precautionary statements for users (USA: in "Warnings or precautions") e.g.

9.5.1 appropriate warnings and precautions or statement of warnings and/or restrictions or precautions for users & any other (contra-indications or) limitation/limiting statements e.g.

- "Do not use the kit or any kit component past the indicated exp. date"
- "Bring all reagents or components to room temperature before use"
- The procedures should be followed precisely for accurate results

9.5.2 Possible side effects/ any **"undesirable side effects"** (GHTF**)** caused by IVD use

9.5.3 Caution statements e.g. CAUTION: "The device contains material of human or animal origin and should be handled as a potential carrier and transmitter of disease." (for biological hazards)

9.5.4 Hazard statements e.g.

- HAZARD: "The device may transmit [infectious agent] and should be handled with extreme caution. No known test method can offer complete assurance that products derived from human blood will not transmit infectious agents." (USA: HAZARD by the product as stated in 16 CFR part 1500)
- "handle all reagents as though capable of transmitting infection"

9.5.5 For reusable IVD

Indicate precautions for the appropriate processes for reusable device e.g. proper processes to allow reuse including cleaning, disinfection, packaging, re-sterilization or decontamination, and any restriction on the number of reuses (all should comply to the Essential Principles of Safety and Performance of medical devices)

9.5.6 For sterile products e.g.

- statement indicate any special microbiological state or state of cleanliness; or sterile device indication/marking
- necessary instructions in event of damage to the protective of sterile packaging & appropriate description for re-sterilization/ decontamination methods

9.5.7 Indication/markings in case intended e.g.

- "for single-use only" (if applicable) [Th: in visible clear red color]
- be used by single individual and manufactured as written prescription or pattern e.g. "it is custom-made"

9.5.8 other **limiting statements** appropriate to intended use

9.6 Test procedure/description of procedure to be followed/"particular operating instructions" (EU) e.g.

9.6.1 For the **test method** or "Testing Procedure"

- description of required/necessary amounts of reagents, samples, and controls; incubation schedules, proper temperatures, wavelengths used for measurement, other relevant environmental conditions and times required for specific steps, etc. (CA, US, GHTF)
- performance/turnaround time (CA)
- calibration information/details of calibration: (CA, US)
  - identify reference materials (US, GHTF)
  - describe reference sample preparation, controls, use of blanks, standard curve preparation; indication maximum & minimum levels of detection or calibration range (highest & lowest value)(CA, US, GHTF)
- statement describes
  - stability of final reaction product/material to be measured (CA, US)
  - time within to be measured to assure accurate result (US)
- details of kinds of Quality Control (Q.C.) procedures & materials required (e.g. indicate need for +ve & -ve control, satisfactory limits of performance, etc.)

9.6.2 For the **individual reagents** (may in separated section in package insert)

- complete instructions for preparing use-dilutions or mixing
- test volumes & directions for use of individual reagents

9.6.3 Pretreatment

- details of procedures/ handling before the device can be used e.g. reconstitution, incubation, dilution, instrument checks, etc.

- further treatment/ handling needed before IVD can be used (e.g. sterilization, final assembly, calibration, reagents prep. and/or control materials, etc.) (some specify in reagent preparation)

9.6.4 Information needed to verify

- whether IVD is properly installed & can operate correctly & safely
- nature & frequency of preventive & regular maintenance, any Q.C., replacement of consumable components, and calibration needed

10. Test results */* (also should include trouble shooting information)

10.1 calculation principles/mathematical approach

10.2 explain **procedure for calculating** value of the unknown/test sample

10.2.1 expressed value in no. of significant figures

10.2.2 adequate description of expected results for the test providing other than quantitative results

10.3 explanation for each component of **formula** used for calculation; sample calculation, step-by-step, explaining the answer

10.4 Assay procedure and reading with explanation of results (calculations and interpretation of results)

10.4.1 criteria for acceptance/rejection

10.2.3 whether further testing is required e.g. duplicate tests if reactive initial result obtained

10.4.2 indicate the significance of test results obtained

10.4.3 +ve/-ve result must be clearly defined with cutoff levels

10.4.4 for qualitative result: explanation of expected results

10.4.5 for visual results: need high quality photograph or results reproduction

10.4.6 maximum time for interpreting results or how long the results are stable, particularly for –ve results, which may become +ve over time

10.4.7 possible errors

10.4.8 Sources of possible errors (AU, US)

10.5 Precautions/**measurements needed** in event of changes in the (analytical) performance/ malfunction, of IVD

10.6 Information appropriate for users on [ghtf: contact tel. no., if appropriate]

10.6.1 details of kinds of Quality Control procedures (internal Q.C.) including specific validation procedure & materials required (e.g. indicate need for +ve & -ve control, satisfactory limits of performance, etc.)

10.6.2 traceability of device calibration

11. Limitations of the procedure/method and information about the use of available reference measurement procedures and materials by the user (test limitations & all known contraindications)

11.1 any known extrinsic factors/ interferences/interfering substances affect results if not cited in previous part of package insert (may be in separated section in package insert)

11.1.1 discusses/lists of any foods, medications, or other possible interfering substances would affect test results/assay performance

- what substances should be avoided & for how long prior to testing [prescription/OTC drugs (e.g. pain relievers, oral contraceptives, antibiotics, and other commonly used medications); elevated levels of chemical analysts (e.g. caffeine, ascorbic acid); elevated levels of biological analysts (e.g. glucose, protein, albumin, bilirubin, lipids (triglycerides), hemoglobin, anticoagulants, etc.]

11.1.2 various patient and clinical factors may affect marker levels:

- certain health conditions e.g. trophoblastic disease, some non- trophoblastic neoplasm, ovarian cyst or ectopic pregnancy

11.2 indication that results should only be used in conjunction with other data

11.3 factors be considered when interpreting test results

11.4 state need for any further procedure/**follow-up action**/ handling/ additional test if obtaining certain results for more specific/more sensitive further testing

11.5 explain the meaning of false-positive and false-negative test result**s** & cite possible sources & implications of false result**s**

11.5.1 **False-positives** (+ve result when pregnancy does not exist)

- exclusions of self-testing
- unreliable results for false +ve (e.g. in patients with ovarian cysts or ectopic pregnancy, etc.)

11.5.2 **False-negatives** (-ve result when pregnancy exists)

- Interferences
- unreliable results for false-negative (e.g. with refrigerated urine, use of waxed cups, soap residue, etc.)

11.6 **Contraindications:** any (specific) contraindications for use (if applicable) (USA) e.g. “use of this device is contraindicated in recent influenza vaccine recipients…” when considerable cross-reactivity can be expected in recent influenza vaccine recipients, etc.

12. Expected values/Reference intervals for the quantities being determined include reference population (e.g. capable of detecting pregnancy by the 1st day of the missed period and no sooner)

12.1 state range of expected values (based on study in various populations)

12.2 indicate how range(s) of expected values was established (and population study)

12.3 literature references (as appropriate)

13. Disposal

13.1 installing sufficient information (complying with waste disposal requirements) for appropriate decontamination and disposal procedures of used/expired kit and/or reagents (AU, CA, EU, GHTF)

13.2 Precautions/special protective measures against special, unusual risks related to use or disposal of

13.2.1 IVD or its accessories e.g. lancets

13.2.2 any consumables used with it (e.g. batteries or reagents, etc.)

13.2.3 any potentially infectious substances of human/animal origin

14. Performance characteristics [Ca: may also be in "warnings and precautions" in package insert]

14.1 (Specific) Analytical Performance characteristics [ghtf: "performance intended and undesirable side effects"] e.g.

14.1.1 Analytical Sensitivity (lower/minimum detection limit), specificity (cross-reactivity, etc.), accuracy (trueness and precision; or method comparison), sample comparability, repeatability, reproducibility, predictive values, stability, earliest clinical detection in comparison with tests of reference e.g. accuracy of IVD determined by laboratory studies and in hand of OTC users

$$\% \text{ result accuracy (sh.not} > 99\% \text{ accurate)} = \frac{(\text{true } +ve) + (\text{true } -ve)}{\text{tot. no. of samples tested}}$$

(NB)

- accuracy is based on test efficiency & 100% accurate be avoided
- the source of reference material that the standards or test are calibrated against (1^{st} IRP, 2^{nd} IS, 3^{rd} IS) for hCG (should be stated in the submission only)

14.1.2 limits of detection by manufacturer and measurement range

14.1.3 statement summarizes data basing on specific performance characteristics

14.2 Diagnostic Performance characteristics/(Specific) test Performance characteristics (summary data from clinical trials)?

14.2.1 degree of accuracy claimed

14.2.2 a sentence relative to the sensitivity of the test (how early pregnancy can be detected)

15. Name and address of manufacturer, importer, distributor

15.1 name/trade name & address of manufacturer & (phone no. and/or fax no. and/or website address)(postal address)

15.2 name & address of importer/authorized representative in importing state

15.3 name & address (place) of (business/sponsor) of the manufacturer (manufacturer, packer) (and/or importer)

15.4 name & address (place) of authorized representative/distributor

16. Revision date (date of issue or any/latest revision of instructions for use)

17. Bibliography (pertinent references keyed to text/pertinent up-to date references for cited information in the text & other related reference**)**

18. Specifications for self-testing devices/device sold to general public

18.1 Information on device labeling [AUS,GHTF: format, content, location proper to IVD and intended use]

18.1.1 Comprehensibility (read, understand, remember, locate, keep)

- be obvious and clear enough to read and intended to last for the life of the device, except device is too small to display all information
- on IVD itself; or if full labeling of each unit is not practicable, placing on the packaging and/or in the instructions for use to eliminate "technical" or incomprehensible language
- be visible by intended user under normal conditions of sale; or be set out on; or be easily legible (permanent and prominent manner) through the outside of the containers/wrapper/package containing device (labeling on retailed package) [to make an informed choice & to easily permit device identification for post market activities e.g. recall]
- be simple, concise, easy to be readily understood and applied by lay user
  - be simplified and the text with informal subheadings e.g. "the analyte being measured" instead of "intended use"
  - contain clear/liberal use of illustrations and drawings, bold print/other methods to highlight warnings & precautions, color coding of reagent containers (whenever practicable)
- content in other language must correspond with that in Thai

18.1.2 Utility (benefits, contraindications, directions, precautions, side effects, storage)

- should be targeted to the anticipated user population
- information for user on action to be taken for +ve, -ve, or indeterminate result; and on possibility of false +ve & -ve
- should be sufficient for the user to interpret result properly & to take appropriate follow up action
- the fact must be clearly stated
- including statement clearly directing the user to not make any decision without 1st consulting medical professional/practitioner
- procedures presented be readily understood by the lay person (may use symbols, diagrams and charts)

18.1.3 Design quality (organized, attractive, print size, spacing, tone, un/helpful)

- in legible format
- in format most likely to be understood by expected user
- text must be readable

- given certain distance & lighting intensity, but not indicate minimum font size and color used
- in legible print

- print size of content in other language should not be bigger than in Thai

18.1.4 Official language

- shall be (translated) in official language especially (e.g. health professional and a variety of ways for self-services) due to absence of "learned intermediary" in safe and effective use
- information needed in all official languages of each country by manufacturer
  - outer package label [Ca: English & French; AU: English]
  - "Warnings & Contraindications" [Ca: Eng. or French, min.]
  - "Directions for use" [Ca: Eng. or French, min.]

☺ for device sold at a self-service display (some devices are exempted but be readily available in other official language by company at a self-service display as purchaser's request, if it's not self-testing)

18.2 any requirements for appropriate/special training needed before adapting treatment for disease monitoring after using self-test device [Ca: English & French (as min.) at the time of purchase]

18.3 test marketing of the device labeling in some cases

18.4 include simple method for user to reasonably verify product's performance in meeting design specification at the time of use

18.5 Performances specifications (a form of user control)

18.5.1 Analytical performance be comparable to professional in clinical settings

18.5.2 performance should not be affected by anticipated variation in user technique

18.6 should not pose any undue infective risk to the user/wider community

18.7 member states' transpositions of directive require label translation into national languages

19. Using symbol (drawings & diagrams)

19.1 substantial differences between labeling in USA & EU

19.1.1 Text explanation/words with harmonized symbols

- concern about possible inability of end-user to symbol understanding → product unsafe use

19.1.2 Symbols and color used must be described in package insert [US: few laypeople familiar with their meanings]

19.1.3 drawings and diagrams are highly recommended in areas which no standard exist

19.1.4 Encouragement of internationally recognized symbols should not compromise device safety by a lacking of patient/user understanding

- need explanation with device if the meaning is not obvious to device user

19.2 If device contains dangerous material or is considered to be dangerous, relevant danger symbols must be indicated on its label and its details must be in package insert/ instructions for use

20. Requirements of most countries need information to be labeled on both outside (or pack insert) & immediate containers/wrappers, or be easily legible through the outside containers/wrappers. However, there is some following flexibility if there are any limitations.

20.1 Exemption for immediate containers labeling (20.1.2 & 20.1.3 are all generally required to be labeled on immediate containers/wrappers**)**

20.1.1 in cases of where it is not applicable

- If the information on immediate containers will interfere with the readability of the test, such details may be indicated on the outside containers/ wrapper
- too small immediate containers or insufficient space

20.1.2 following information are still required on immediate containers

- product name (proprietary & established)
- intended use/purpose
- batch code or lot/control no. (to determine complete manufacturing history of products)
- name and place of business (manufacturer, packer, or distributor/sponsor)
- contents
- storage and handling information/instructions
- " For In Vitro Diagnostic Use" and a statement of warnings and/or precautions or any other limiting statement
- identifier/catalogue number
- specific operating instructions (where applicable)
- **For reagents**
  - o established name (common/usual name) (Ca: IVD & reagent name)
  - o quantity, concentration, or proportion of all active/each reactive ingredient reagent (in standard IU); and source and a measure of its activity (for biological materials) (Ca: in "contents")
  - o warnings and precautions (infectivity warnings to IVD nature)
  - o (recommended) storage instructions (conditions)
  - o instructions for manipulation e.g. mixing or reconstitution & its storage
  - o means to assure that product meet std. (e.g. expiration date)
- name and address of the manufacturer
- cautionary symbols
- indication of microbiological state (when applicable)
- Thai FDA License number (if required)

20.1.3 following information can be only within outer container labeling (exempted for immediate containers)

- intended use/purpose
- **For reagents**
  - means to assure that product meet std. e.g.
    - ☞ observable indication of reagent alteration
    - ☞ instructions for simple method to determine that reagent meets standard
  - net quantity of reagent contents in the package

20.2 **Exemption for outer package labeling** in cases of

20.2.1 **too small outer package** containing devices

- directions for use (can be in package insert but need referring statement outside the package for information in package insert)

20.3 **Exemption for pack insert labeling** in case of [Ca: information depend on safety & complexity of test]

20.3.1 **multiple-purpose instrument** for diagnostic: indicate only

- established name (not specific diagnostic procedure/systems)
- intended use
- instruments
- name and place of business
- date of issue or latest revision of labeling (manufacturer, packer, distributor)

20.3.2 **reagent** used **as replacement** in diagnostic system: information to

- identify reagent adequately
- describe its proper use in the system

20.4 following information are required on outer package labeling or pack insert labeling [EU: use "instruction for use" (do not separate "reagent & instrument), not state "pack insert"; Ca: "pack insert" is essential]

20.4.1 product name (proprietary & established)

20.4.2 intended use/purpose

20.4.3 summary and explanation of the test

20.4.4 principles of the procedure [EU: instructions (in heading "methodology")]

20.4.5 batch code or lot/control no.

20.4.6 contents

20.4.7 composition

20.4.8 name and address of manufacturer (& authorized representative)

20.4.9 for reagents (Ca & Au insert use "directions for use")

- common name [& quantity, concentration, proportion or activity of each reactive ingredient (all) reagent and source and a measure of its activity (for biological materials), if necessary] (See 8.1.2)
- warnings and precautions (cautions or warnings), " For In Vitro Diagnostic Use" statement, and any other limiting statements proper to intended use
- adequate directions for reconstitution, mixing, dilution, etc.
- appropriate storage & handling instructions (EU outer: storage & handling info..; EU instructions: storage & shelf life after 1st opening; Ca: insert use "components" & "storage instructions"; Au: "recommended storage conditions")
- statements of purification & treatment required for use e.g. "sterile"
- physical, biological, or chemical indications of instability/ deterioration
- expiry date

20.4.10 For instruments [EU instructions & Ca insert: "additional special equipment/ instruments/software"; Ca insert use "directions for use"]

- name, model
- brief description of "Use or function"
- Installation procedure & requirements
- Principles of operation
- Performance characteristics & specifications
- Operating instructions
- Calibration procedures including materials and/or equipment to be used
- Operational procedure & limitations
- Hazards
- Service & maintenance information

20.4.11 specimen collection & preparation (& handling) for analysis [Ca insert use "directions for use"; Ca insert use "directions for use"]

- specimen description, acceptance & rejection criteria
- special precautions/preparations
- additives (& preservatives) to maintain specimen integrity
- known interfering substances
- specimen storage, handling, shipping instructions

20.4.12 procedures to improve precision & accuracy [EU: instructions use only "procedures"; Ca: insert use "test procedure" under "directions for use"]

- a list of all materials provided/not provided
- description of the amounts of reagents, and parameters

- final reaction stability & time restriction on accurate measurements
- calibration, identifying, listing, preparation for ref. mat., samples, blanks
- Q.C. procedures & materials

20.4.13 explain procedure for calculating (Au: pack insert use “interpretation of results”; EU: instructions use “reading & interpretation of results”; Ca: insert use “results, interpretation of results”)

20.4.14 limitations of the procedure (EU: & possible errors) [Ca insert under “directions for use”; EU: instructions (in heading of “methodology”;)]

20.4.15 expected values [Ca insert under “directions for use”]

20.4.16 (safe) disposal [Ca insert under “directions for use”; Au: in “pack insert”]

20.4.17 specific contra-indications

20.4.18 specific performance characteristics

20.4.19 follow-up action [Au: in “pack insert”; EU: “instructions..”]

20.4.20 indication of microbiological state

20.4.21 Identifier/catalogue no.

20.4.22 Bibliography

20.4.23 name & place (add.) of business (manufacturer, packer, or distributor, or sponsor)

20.4.24 date of issue of instructions for use/date of revision

21. Other information

21.1 Thai FDA License number (if required)

21.2 other information on label as prescribed by the Minister

21.3 incorrect labeling lead to regulatory, criminal, or civil liability

APPENDIX F

The 2nd Draft Labeling Guideline of Home-Use IVD

Guideline for labeling of Home-use in vitro diagnostic (IVD) test kit in Thailand

I. Introduction

The labeling and language requirements are the essential elements needed for the consumers to use device safely and properly particularly the home-use device. In some device, the training and knowledge of the potential users are involved to achieve the intended benefits. Therefore, their risk-benefits information and instructions for use are necessitated for lay users to operate, interpret and manipulation the device; to know how to be careful in its utilization; to cooperate with the prevention, treatment, or diagnosis of an illness. However, the home-use devices those are popular for the lay consumers and are in the trend of their progressive used are the home-use in vitro diagnostic (IVD) test kits (7, 8).

In Thailand, the home pregnancy test kit (HPT) is the most simple and popular test kit among home-use devices. It's comfortable to test and less complicated product. Therefore, the product property might not interfere the lay users' understanding in labeling reading with product utilization. Moreover, their trend in diagnosis replacement has become increasingly significant as the growing number of marketed HPT. The ability to clearly communicate important product information becomes increasing challenge. Consequently, this guideline was devised to include both IVD reagents and instruments but the highlight will be on the IVD reagents. The home pregnancy test kit (HPT) was selected to be the model labeling in this study for more practicality in implementation of this guideline.

For the general characteristics of contents to be labeled in Home-use IVDs, the content must accompany each device and it should be proper to IVD with its intended use. Moreover, the information should be enough for the lay user to use the device with proper and safety method as well as capable to understand the result reading. The required information is needed to be labeled on both outside and immediate containers/wrappers, as well as in the package insert of the home-use in vitro diagnostic (IVD) test kits. However, it could have some flexibility if there are any limitations which might be further specified in details. The HPT product information would be most of the examples in this guideline to facilitate its implementation for the stakeholders.

II. Purposes of this guideline

1. to better serve/provide consumers and general public health by the availability of meaningful, reliable, useful, and adequately labeled IVD

2. to assist prospective manufacturers, producers, and marketers of home-use in vitro diagnostic (IVD) test kit in proper labeling

3. to assist Thai Food and Drug Administration (Thai FDA) rendering consistent decisions based on reliable, reproducible and standardized commercial tests

III. Definitions

1. Home-use in vitro diagnostic (IVD) test kit or IVD for self-testing refer to reagents, instruments, and systems intended for use in the diagnosis of disease or other conditions, including a determination of the state of health, in order to cure, mitigate, treat, or prevent disease or its sequelae. These products are intended for use in the collection, preparation, and examination of specimens taken from the human body (USFDA) in the home or similar environments by a lay person who will relate the result of the test to him- or herself (EN 376:2001) e.g. home-use pregnancy test kit, blood glucose monitoring test kit, etc.

2. Home-use Pregnancy Test Kit refers to the reagent, reagent product, calibrator, control material or kit) for the qualitative detection/measurement of HCG in human urine (GHTF: 2005).

3. Kit: set of components (reagents and/or other materials) packaged together (EN 375:2001)

4. label:

4.1 written, printed or graphic information provided upon the device itself, on the packaging of each unit/multiple device (GHTF: 2005) , or

4.2 written, printed or graphic information placed on a container (EN 375:2001).

5. labeling/information supplied by manufacturer was defined as written, printed or graphic matter related to identification, technical description, and use of IVD that affixed to IVD (immediate container) or any of its containers or wrappers (outer label), or accompanying IVD (package insert) [ISO 13485 and GHTF]

6. the inner label (the label of immediate container/primary container) refers to

6.1 any image, design, symbol or statement displayed on the medical device itself or its container (33), or

6.2 the label of packaging which protects the contents from contamination and/or other effects of the external environments (EN 375:2001) e.g. sealed vial, ampoule/bottle, or a sealed plastic bag containing test strip, etc.

7. the outer label (the label of outer container/sales packaging) refers to

7.1 any image, design, symbol or statement displayed on its package (33), or

7.2 the label on material used in the packaging of the immediate container(s) of IVD reagent(s) consisting of a single entity or an assembly of different or identical components (EN 375:2001)

8. "accompany document/product insertion" or "package leaflet or directions for use" or "procedure/operating/user Instructions" or "Instructions for use" refer to

8.1 The paper or any other material on which information about the medical device is displayed by; and image, design, symbol or statement, inserted in the container or package of the medical device, including the manual of instruction for use (33), or

8.2 Procedures recommended for achieving optimum performance of device, including warnings and precautions, contraindications, and possible side effects (90), or

8.3 Information supplied by the manufacturer with an IVD reagent concerning the safe and proper use of the IVD reagent (EN 376:2001).

9. lay person:

9.1 individual that doesn't have formal training in a specific field or discipline (ISO 18113-1)

9.2 individual who does not have specific medical education (EN 375:2001)

IV. **Labeling Requirements for the information on inner label/immediate containers and outer label/sales packaging label**

The details in this part are usually the consumers' buying decision information and they should be illustrated on the outer label and foil (if possible). Generally, some of these details would be also specified in the package leaflet for more emphasis on their importance and clearer explanation to the lay consumers. However, the manufacturers usually indicate the contents with short detail on the inner label (foil). This might be due to their consumptions of smaller space than the other information, and their necessities for consumers' decisions in product purchasing.

The following information in 1 is required to be indicated on the inner label/immediate containers and outer label/sales packaging label. However, the exemptions of some information could be allowed for the limitations as stated in 2. The details of such requirements and their exceptions would be as follows.

1. The following details are all required to be labeled on outer and inner label

1.1 product name (proprietary and established name) e.g. Lady Preg Strip, Home Pregnancy Test kit

1.2 batch code/lot number/control number/serial number for proper action to trace its identity, safety issues of the product, and recall the devices with attachable components.

1.2.1 batch code/lot number for single-use disposable devices/reagents

Example: Lot/ lot no. 10 Sep. 2004, or 100904, or 10/9/04; or 10/9/47 (Thai)

1.2.2 serial number for electrical powered medical devices

1.3 manufacturing date (may be included in batch code or serial number)

Example: in English: mfg. 10 Sep. 2004, or 100904, or 10/9/04; or in Thai: 10/9/47

1.4 name and place of manufacturer and distributor/sponsor

1.5 means to assure that product meet the required standard (particularly on devices supplied sterile, single-use or disposable devices or reagents)

1.5.1 the expiry date (the last day of the month indicated). It is based upon the stated storage instructions and should be presented in day/month/year or at least in year and month (month/year). Example: “Expiry/Expiration date/Use before date/Exp. or exp. date: 10 Sep. 2006, or 100906, or 10/9/06

1.5.2 statement of any visual indication of reagent alteration

1.5.3 instructions for simple method to determine that reagent meets standard

1.6 Statements of warnings and/or precautions or any other limiting statement e.g. “For In Vitro Diagnostic Use”, or in the lay term as “not to be swallowed”, etc.

1.7 intended use/purpose

1.8 contents/package

1.8.1 net quantity of contents e.g. number of test in 1 package [must be consistence with instructions for use and the amount of materials provided (for > single determination)

1.8.2 if contents are not readily apparent; indication of what the package contains, include size, net weight, length, volume or number of units of the device (metric designation be encouraged)

1.9 storage and handling information/instructions

1.10 indication of microbiological state (when applicable) e.g. “sterile”

1.11 Other information required for leaflet e.g. directions/instructions for use or specific operating instructions (if applicable)

1.12 Thai FDA License number (if required)

1.13 For **reagents:** the additional information will be as following

1.13.1 established name (common/usual name)

1.13.2 quantity, concentration, or proportion of all active ingredient reagent (in standard IU); and source and a measure of its activity (for biological materials)

1.13.3 net quantity of reagent contents in the package

2. Exemption for inner labeling will be in cases of

2.1 the information on immediate containers might interfere with the test, or

2.2 the immediate containers it’s too small or insufficient space.

In cases of where it is not applicable to be labeled on the immediate containers which are packed within the outer container from which they are removed for use, the exempted details to be indicated only on the outside containers/wrapper (outer label) would be 1.5.2 to 1.11.

3. Exemption for outer package labeling will be in cases of

3.1 Being easily legible through the outside containers/wrappers of the home-use in vitro diagnostic (IVD) test kits.

3.2 Too small outer package containing devices or space does not permit; the information of “directions for use” could be exempted from outer label. However, they must be appeared in the

package leaflet and the referring statement is needed on the outer label (outside the package) for such information in the package insert.

V. Labeling Requirements for the information in the package leaflet

The necessary contents for the lay consumers to effectively product utilization are generally indicated in the package leaflet because of much detail to be labeled for users' clearer understanding. However, it will be perfect if these contents could be labeled on both outer and inner label as well as in product insertion. The details needed to be on outer and inner label, would be the short contents or concise statements linking to more details in the package leaflet of the following issues. Moreover, the consumer' education information was also required to be specified in the product insertion for more knowledge to the users about the product. They were not directly involved with the product utilization but some of them would be useful for their further information and in the process of product information traceability.

1. The following details are all required to be labeled in the package leaflet

1.1 Device/IVD name (Product name) [Thai: with device category and type**]**

1.1.1 established name (common or usual name) e.g. Pregnancy Test

1.1.2 proprietary name (trade name) e.g. Lady Preg Strip

1.2 Use/purpose/intended purpose/ indications for use/or benefits

1.2.1 nature of intended use

(1) screening: to test for the presence/absence of hidden blood in stool, etc.

(2) monitoring: to check for changes in blood glucose (sugar level), etc.

(3) diagnostic: to predict ovulation, to indicate pregnancy, etc.

1.2.2 type of test/procedure (qualitative, or quantitative detection)

1.2.3 concise claim of **clinical utility** (specific disorder, condition, risk factor of interest for which the test is intended, or the analyte to be measured) e.g. early detection of HCG (a glycoprotein hormone secreted by placenta developing shortly after fertilization)

1.2.4 type of specimen(s) required (e.g. serum, plasma, urine, etc.)

1.2.5 who should use the test (clearly identify population characteristics of the user)

1.2.6 the conditions for its use: indicate if

(1) "the device is for home use"/"For Home Use" or "For self-testing use"

(2) any special indication for use statement e.g. requirements for special facilities/any particular training

Example: "To early/rapidly indicate pregnancy by home-use visual qualitative detection of hCG (human Chrorionic Gonadotropin) hormone in human urine specimen"

1.3 Detailed description of the test

1.3.1 Device/kit identification and separate components with identifier/catalogue number or uniquely identify the device

1.3.2 Summary and explanation of the test (may be combined with test principle)

(1) short history of the methodology e.g.

"Clinically useful HPT were introduced since 1927. Presently, HPT available use monoclonal or polyclonal Ab in an enzyme-linked immunoassay format. It is used to detect hormone hCG in human urine. The hCG is a glycoprotein composed of alpha and beta subunit, which is produced by trophoblastic tissue, appears around the 8-9th day after ovulation where fertilization has occurred, or around the 4th day after conception. The hCG levels rise rapidly, doubling approximately every 2 days, and peak around 100,000-200,000 mIU/mL in the latter part of the 1st trimester of pregnancy. Such levels will be decreased since the 2nd trimester of pregnancy." [USFDA guidance for OTC hCG 510(k)s]

(2) type of antibody (Abs) and antigen (Ags) used in the test (synthetic peptide, monoclonal, recombinant, etc.) as well as purification methods

Example: "Sandwich dye conjugate immunoassay that employs a unique combination of monoclonal and polyclonal Abs to selective identity hCG in test samples"

1.3.3 Principle of the method/Scientific Test Principle

(1) Chemical, physical, physiological or biological principles of assay/test procedure**;** or technique(s) and reactions (immunochemical, biological, chemical, microbiological) used**;** or technology of the IVDD (e.g. ELISA, chromatographic, etc.) Example: "Immuno Chromatography Assay Technique"

(2) Simple explanation of how the test works e.g. Monoclonal Ab is highly sensitive to one specific site along the hCG molecule. The hCG in urine will be trapped by the anti hCG Ab that is bound to a solid surface. The other Ab in device that linked to an enzyme will react with the anti- hCG complex to cause a color change, produce a positive (+ve) result.

Example: "As the test sample diffuse through the absorbent test strip,

- labeled Ab-dye conjugate binds to the hCG in the specimen forming Ab-Ag complex. This complex binds to the anti-hCG Ab in the test (T) zone → pink-rose color band when hCG conc. >25 mIU/ ml.
- in the absence of hCG → no line in test zone
- unbound conjugate binds to reagent in control zone → pink-rose color band"

1.4 Directions For Use/User Instructions [Instructions for preparation and use/detailed description of procedure in using device] ("Adequate directions for use")

1.4.1 Components of kit/list of kit contents

(1) a list of all materials provided

- name of components e.g. reagents, supplies, instruments and equipment, etc.
- contents in terms of quantity (number, mass and/or volume or concentration) of each component and maximum number of tests be performed with stated contents of material provided
- instructions for use

Example: Kit components:

- o a specimen collection container/ urine tray (and dropper/plastic pipette)
- o a one step dipstick pregnancy test strip (Lady Preg Strip) or test device (Lady hCG Card); sealed in a foil pouch containing a desiccant bag
- o a product package insert (test instruction/instruction for use)

(2) a list of all materials (components and/or special instruments/equipment) required but **not provided**

- Materials e.g. distilled water, buffer solution, etc.
- Equipment e.g. appropriate disinfectants or apparatus for disinfection procedures, etc.

1.4.2 For a Reagent/Reagents: they should declare about the following items to ensure proper and safe operation of reagent

(1) reagent and/or device name (proprietary name or established name)

- reagent name + IVD name (label for reagent used within single kit)
- name of reagent should be sufficient (label for multipurpose reagent used with a number of kits)

(2) Composition of contents/reagents by nature, or "reagent description" and contents as amount(quantity) or concentration (proportion) in metric or in standard international units, or activity, etc. of

- each active/reactive ingredients
- reagent derived from biological materials (with sources and a measure of biological material activity)

Example: "the test strip consists of

- o a conjugate pad contains mouse monoclonal anti- hCG Ab [IgG (Ab)] dye-conjugated to Colloidal Gold (in protein matrix with 0.1 % sodium azide)
- o a nitrocellulose/ polyclonal Ab coated membrane strip contains
  - ☞ a test (T) line which is captured with rabbit anti-hCG Ab
  - ☞ a control(C) line containing goat anti-mouse Ab which should be bound to the conjugated monoclonal Ab regardless of the presence of hCG"

- any catalytic or non-reactive ingredient (the presence of and characterizing of preservatives, buffers, stabilizers, etc.) for safe and effective use e.g. “protein matrix with 0.1% sodium azide”

(3) Warnings and restriction/precautionary statements for users (may be indicated in separated heading in package insert)

- Particular instructions/caution statements about hazardous chemicals, handling, some safety precautions e.g. Statement indicating
  - “The device contains other ingredients which might influence measurement”
  - HAZARD: “The device may transmit [infectious agent] and should be handled with extreme caution. No known test method can offer complete assurance that products derived from human blood will not transmit infectious agents.” (USA) or “Handle all reagents as though capable of transmitting infection”
  - CAUTION: “The device contains material of human or animal origin and should be handled as a potential carrier and transmitter of disease.” (For biological hazards)
  - “This reagent contains Sodium Azide as a preservative and harmful if swallowed”
  - “If this solution comes in contact with eye, rinse immediately”
- appropriate statement of warnings and/or restrictions/precautions for users, and any other contra-indications or limiting statements appropriate to intended use e.g.
  - “Do not use the kit or any kit component past the indicated expiry date”
  - “Bring all reagents or components to room temperature before use”
  - “Do not open the foil pouch until you are ready for testing”
  - “Read the instruction thoroughly before using the test, and the procedures should be followed precisely for accurate results”
  - “For In Vitro Diagnostic Use” or “For in vitro use” (in the lay term as “not to be swallowed” or “not for internal use”, etc.)
- Possible side effects/any “undesirable side effects” caused by IVD use e.g. “Prolong result reading will lead to false positive result”, etc.
- For reusable IVD

Indicate precautions for the appropriate processes for reusable device e.g. proper processes to allow reuse including cleaning, disinfection, packaging, re-sterilization or decontamination, and any restriction on the number of reuses, etc.

- For sterile products
  - Statement indicate any special microbiological state or state of cleanliness; or sterile device indication/marking e.g. “Sterile” for sterile product or product sold in sterile condition (sterile packaging)

o Necessary instructions in event of damage to the protective of sterile packaging and appropriate description for re-sterilization/decontamination methods

o Indication/markings in case intended e.g. “for single-use only” (if applicable) [Thai: in visible clear red color] or “the test cannot be reused”

(4) Reagent preparation, or complete directions, or adequate instructions for preparation e.g. for reconstitution, mixing, dilution, statements of purification and treatment required for use, etc.

(5) Storage and handling conditions/instructions (opened/unopened)

The adequate stability information and shelf life to protect product stability and to ensure safe handling should be declared basing on reliable, meaningful, and specific test method (or upon component having shortest projected useful life or stability of individual reagent).

- Any special/particular storage conditions and/or handling conditions applicable to the device

- Unopened state for both device and individual reagents; or unopened IVD or its components (reagents, Q.C. materials, calibrators, etc.) e.g.

o Storage temperature interval e.g. 2 °C to 8 °C, 2…8 °C, ≤ -20°C, - 20 °C or below, etc.

o Other conditions/pertinent factors e.g. light, humidity, store in the dark, store desiccated, protect from freeze, etc.

- storage conditions and shelf life following the first opening of primary container

(6) Means to assure reagent standard of identity, strength, quality, purity at time of use; were the information regarding

- possible deterioration of reagent or observable indication of an alteration of the product (physical, biological, or chemical indications of instability/deterioration) e.g. indicators of reagent: turbidity, precipitate, color change, beyond its appropriate standards

- instructions for a simple method for user to determine the meeting of appropriate standard (e.g. a form of user control) and to reasonably verify product’s performance in meeting design specification at the time of use

1.4.3 For (in vitro diagnostic) instruments: Operation Manual/User Manual/ Operating instructions for proper and safe operation, maintenance, basic trouble shooting

(1) Name and model of instruments

(2) Additional materials

(3) Use or function or brief description

(4) Installation procedure and special requirements

(5) Principles of operation

(6) Performance characteristics and specifications

(7) Operating instructions

(8) Calibration procedures including materials and/or equipment to be used to ensure proper operation and safety during intended life

(9) Operational precautions (or possible errors) and limitations

(10) Hazards, and

(11) Service and maintenance information

1.4.4 Specimen **type**, **collection, handling, and preparation for analysis**, including help by illustrations and pictures in color coding

(1) description or type of specimen to be used with IVD, special conditions of collection, pre-treatment and storage conditions (if necessary)

Example: "Fresh urine specimen must be collected at any time of day (but best for 1st morning urine due to high hormone conc.); in a clean, dry container w/o preservative"

(2) criteria for acceptance/rejection of specimen samples

(3) special precautions and procedures regarding specimen collection as well as patient preparation (where necessary) for testing validity

Example:

- removal of particular matter by filtration; or
- urine sample exhibiting visible precipitates should be filtered, centrifuged, or allow to settle and clear aliquots obtained for testing, etc.

(4) recommended storage, handling, shipping instructions for protection and maintenance of specimen stability

Example: "If testing can not be performed directly, urine specimens should be kept cool below 25 °C for up to 24 hours; or may be refrigerated at 2-8 °C and stored up to 48 hours prior to assay (USA); and the urine sample must be brought to room temperature before use".

1.4.5 Test procedure/Operating Instructions (description of procedure to be followed**)**/particular operating instructions/**Procedure** (a step by step from specimen reception to result obtaining) e.g.

(1) For the **test method**

- description of required/necessary amounts of reagents, samples, and other parameters e.g. proper temperatures, and times required for specific steps, etc.
- performance/turnaround time
- calibration information/details of calibration:
  - identify reference materials

o describe reference sample preparation, controls, use of blanks, standard curve preparation; indication maximum and minimum levels of detection or calibration range (highest and lowest value)

- statement describes
  - o stability of final reaction of product/material to be measured
  - o time within to be measured to assure accurate result

(2) For the **individual reagents** (may in separated section in package insert)

- complete instructions for preparing use-dilutions or mixing
- test volumes and directions for use of individual reagents

(3) Pretreatment (may be specified in reagent preparation)

Example: Test method for test strip:

- fill a urine cup with specimen
- open the foil pouch at the notch and remove test strip (or each reaction device and place on a flat surface, with the openings facing upwards)
- dip the strip into urine in vertical position with the arrow pointing towards the urine, the specimen level should not lower than 150 ul or higher than the end of arrow indicated on the strip
- hold for 30-60 seconds and take the strip out of urine
- lay it flat on a clean, dry, non-absorbent plane surface

1.4.6 Test results or **result interpretation** (include trouble shooting information)

(1) calculation principles/mathematical approach

(2) explain procedure for calculating value of the unknown/test sample

- adequate description of expected results for the test providing other than quantitative results
- explaining the answer

(3) Assay procedure and reading with explanation of results (calculations and interpretation of results)

- criteria for acceptance/rejection

Example: rejection: if there is no visible band on control line

- whether further testing is required e.g. duplicate tests for reactive initial result

Example:

- o if the test is invalid, repeat testing with new strip is recommended
- o if the test is –ve, test again after 7 days of missing the period
- o if the test is +ve, see physician to confirm your pregnancy
- o if pregnancy is still suspected, retest using a first morning urine

- indicate the significance of test results obtained

Example: +ve: > 25 mIU/ml urine, - ve: < 25 mIU/ml urine

- positive or negative result must be clearly defined with cut-off levels

Example:

o pregnant: positive (+ve) result with 2 pink bands appeared (1 at the control line (C zone) and 1 at the test line (T zone)

o non- pregnant: negative (-ve) result with only 1 pink band appeared at the control line (C zone)

o the test line can be lighter or darker than the control line. Its intensity depends on hCG conc. in urine, but it's normally distinguishable lines.

- explanation of expected results (for qualitative result)
- need high quality photograph or results reproduction (for visual results)
- maximum time for interpreting results or how long the results are stable, particularly for negative (–ve) results, which may become positive (+ve) over time

Example: Do not read the result after more than 10-15 minutes

- possible errors (e.g. prolong reading, contamination, cross reactivity, etc.) and their sources

Example: Inconclusive: if there is only one band on test line (none on control line); or no distinct band visible both on test line and control line which might due to

o the test usually be invalid due to not following instruction

o store test kit under direct sunlight, or below 4°C

o before testing.: open foil pouch > 1 hr, or moistened/wet strip

o urine level higher than the end of arrow indicated on strip

o dip non-reactive end of strip in urine or dip in urine < 30 sec.

o must not read the result too fast (within 1-2 min.) or too late (after 15 min.) from recommendation

(4) Precautions/measurements needed in event of changes in the (analytical) performance/malfunction, of IVD (or should be in sticker on the outer label)

(5) Information appropriate for users to verify

- whether IVD is properly installed, can operate correctly and safely by citing the details of kinds of Quality Control procedures (internal Q.C.) including specific validation procedure and materials required (e.g. indicate need for +ve and -ve control, satisfactory limits of performance, etc.).

Example: The control determines if chemicals are working properly, an adequate amount of sample was added, and the proper procedure was followed

- nature and frequency of preventive and regular maintenance, any Q.C., replacement of consumable components, and calibration needed to the traceability of device calibration

1.5 Limitations of the procedure/method and information about the use of available reference measurement procedures and materials by the user (test limitations and all known contraindications)

1.5.1 any known extrinsic factors/ interferences/interfering substances affect results

(1) discusses/lists of any foods, medications, or other possible interfering substances ability to affect test results/assay performance (what substances should be avoided and for how long prior to testing to prevent the cross reactivity)

- prescription or over-the-counter (OTC) drugs (pain relievers, oral contraceptives, antibiotics, and other commonly used medications)

Example: "normally taking alcohol and some medicines (e.g. oral contraceptives, pain relievers, antibiotics, etc.) including other commonly used medications would not affect testing results, except some injections containing hCG hormone e.g. Pregnyl, Profasi, etc.; which cause elevated hCG level and false +ve result"

- elevated levels of chemical analysts (e.g. caffeine, ascorbic acid), and biological analysts (e.g. glucose, protein, albumin, bilirubin, lipids or triglycerides), hemoglobin, anticoagulants, etc.

(2) various patient with certain health conditions or clinical factors ability to affect marker levels e.g. trophoblastic disease, some non- trophoblastic neoplasm, etc. Example: "urine in certain health conditions e.g. miscarriage, given birth in last 8 months, ovarian cyst or ectopic pregnancy, etc., can cause a false or irregular result"

1.5.2 indication that results should only be used in conjunction with other data

1.5.3 factors be considered when interpreting test results e.g.

(1) time in reading result should be followed strictly as recommendation

(2) the user should be without colored-blinded

(3) the optimal light for reading

(4) be sure to read at the right end of strip

1.5.4 information for user on possibility of false-positive (+ve), false-negative (-ve), or indeterminate test results with such meaning explanation, about possible sources, and the implications of false results

(1) False-positives (e.g. +ve result when pregnancy does not exist)

The exclusions of self-testing to avoid the unreliable results for false +ve should be prohibited in patients with ovarian cysts or ectopic pregnancy, etc.

(2) False-negatives (e.g. -ve result when pregnancy exists)

The interferences which might cause the unreliable results or false negative (-ve) results are such as refrigerated urine, use of waxed cups, soap residue, etc.

Example "A false negative result may occur if the urine is too dilute or with a very early stage pregnancy. If pregnancy is still suspected, retest using 1st morning urine."

1.5.5 Contraindications or any (specific) contraindications for use (if applicable) e.g. “use of this device is contraindicated in recent influenza vaccine recipients…” when considerable cross-reactivity can be expected in recent influenza vaccine recipients, etc.

1.6 Follow-up action:

The information should be stated about the need for any further procedure/handling/additional test if obtaining certain results for more specific/more sensitive further testing, and the action to be taken for such cases.

Example: It should include statement clearly directing the user to

- **“Consult physician to confirm the pregnant and obtain appropriate advice as soon as possible for your health” or**
- **“not make any decision without 1st consulting medical professional/ practitioner”**

1.7 Expected values/Reference intervals for the quantities being determined including reference population

1.7.1 state range of expected values (based on study in various populations)

1.7.2 indicate how range(s) of expected values was established (& population study)

1.7.3 literature references (as appropriate)

Example:

- urine samples of healthy non- pregnant women and men show –ve results
- Levels of ≥20 mIU/ml hCG, may reach as early as 10 days after conception, approximately 3 days before expected period
- “Detect pregnancy by the 1st day of the missed period and no sooner, etc.”

1.8 Performance characteristics

1.8.1 (Specific) Analytical Performance characteristics (performance comparable to professional in clinical settings)

(1) Analytical sensitivity (lower/minimum detection limit),

- limits of detection by manufacturer and measurement range e.g. 20 or 25 mIU/mL

(2) specificity (cross-reactivity, etc.),

(3) accuracy (trueness and precision; or method comparison) e.g. accuracy of IVD determined by laboratory studies and in hand of OTC users

- statement summarizes data basing on specific performance characteristics

Formula in calculation of % result accuracy:

$$\%\ \text{result accuracy (should not} > 99\ \%\ \text{accurate)} = \frac{(\text{true +ve}) + (\text{true -ve})}{\text{Total number of samples tested}}$$

(NB)

o Accuracy is based on test efficiency and “100% accurate” should be avoided e.g. % result accuracy = 99 %

o The source of reference material that the standards or test are calibrated against (1st IRP, 2nd IS, 3rd IS) for hCG should be stated in the submission only

Example: It can detect concentration of 25 mIU/mL hCG, or more. The test has been standardized to World Health Organization Std: 1st IRP (International Reference Preparation) IRP75/537

1.8.2 Diagnostic Performance characteristics/(Specific) test Performance characteristics (summary data from clinical trials) (it should not be affected by anticipated variation in user technique & include simple method for user to reasonably verify product’s performance in meeting design specification at the time of use)

(1) degree of accuracy claimed e.g. 99 % accuracy

(2) a sentence relative to the clinical sensitivity of the test (how early pregnancy can be detected) e.g. can detect at the 1st day of the missed period

1.9 Disposal

1.9.1 Installing sufficient information for appropriate decontamination and disposal procedures of used/expired kit and/or reagents e.g. “Must be disposed in a safe way”

1.9.2 Precautions/special protective measures against special, unusual risks related to use or disposal of

(1) IVD or its accessories e.g. lancets

(2) any consumables used with it (e.g. batteries or reagents, etc.)

(3) any potentially infectious substances of human/animal origin

1.10 Name and address (with contact phone number and fax number as well as website address) (postal address) of

1.10.1 manufacturer

Example: “Manufactured by U.S. Consumer Health, 1234 E. Hunter Ave., Anaheim, CA 92807, U.S.A”

1.10.2 importer/authorized representative in importing state

Example: “Imported by Thailand Diagnostics, Co Ltd., 100 Ramkamhang road, Hua Mark, Bangkapi, Bangkok 10240”

1.10.3 authorized representative/distributor

Example: “Distributed by Thailand Health, Co Ltd., 3 Sukhumvit road, Klongton, Bangkok 10240”

1.11 Revision date (date of issue or any/latest revision of instructions for use) Example: Revised 14/1/2006

1.12 Bibliography (pertinent references keyed to text/pertinent up-to date references for cited information in the text and other related reference**)**

2. Exemption for pack insert labeling in case of [information depend on safety and complexity of test]

2.1 All required contents in leaflet labeling are already illustrated on the outer label.

2.2 multiple-purpose instrument for diagnostic: indicate only

2.1.1 established name (not specific diagnostic procedure/systems)

2.1.2 intended use

2.1.3 instruments

2.1.4 name and place of business

2.1.5 date of issue or latest revision of labeling (manufacturer, packer, distributor)

2.3 reagent used as replacement in diagnostic system: information to

2.2.1 identify reagent adequately

2.2.2 describe its proper use in the system

VI. Specifications for self-testing devices/device sold to general public

1. Availability and accessibility of labeling

The availability of IVD inner and outer label with package leaflet is the obligations of the entrepreneurs in accompanying each device and it should be proper to IVD with its intended use.

2. Document characteristics of Information in labeling [format, content, location should be proper to IVD and intended use]

It should be in full labeling of each unit of IVD to make an informed choice and to easily permit device identification for post market activities e.g. recall. However, the quality of such labeling will be as follows.

2.1 Utility (e.g. benefits, contraindications, directions, precautions, side effects, storage, etc.)

2.1.1 All information should be targeted to the anticipated user population.

2.1.2 The details should be sufficient for the lay user to use the device with proper and safety method, interpret result with capable to understand the result reading correctly, as well as to take appropriate follow-up action.

2.1.3 The fact of all information must be clearly stated.

2.1.4 The presented procedures should be readily understood by the lay person (may use symbols, diagrams and charts).

2.2 Design quality (e.g. print size, tone, spacing, organized, attractive, un/helpful)

2.2.1 Format

The information should be in legible format that is most likely to be understood by expected users. The format of labeling should be proper to IVD and its intended use as well as clearly written in a step by step especially in “directions for use”.

2.2.2 Print type and size

(1) The text must be readable in legible characters/prints with

- certain distance and lighting intensity
- proper font size and color used

(2) print size of content in other language should not be bigger than in Thai

(3) The prints of labeling should be in legible characters/prints with proper print sizes for all ages of the lay users.

2.2.3 Emphasis

The emphasis of labeling should be permanent and prominent manner by using the bold prints or other ways to highlight the headings or important information (e.g. instructions for use, warnings & precautions, test interpretation, etc.). Moreover, the color coding of reagent containers should be provided (whenever practicable).

2.2.4 Graphics

The information in labeling should contain clear/liberal use of different types of graphics such as drawings, illustrations, diagram, charts, color identification, internationally recognized symbols. Drawings and diagrams are highly recommended in areas which no standard exist. These graphics could promote the lay users' understanding and effective use of devices.

2.2.5 Using symbol

(1) Encouragement of internationally recognized symbols should not compromise device safety by a lacking of patient/user understanding.

(2) It is necessary for words with harmonized symbols in all places of labeling. Moreover, text explanation in package insert is also required to describe symbols and color used particularly in case the meaning is not obvious to device user, the "directions for use", test results, result interpretation, etc. This is to prevent the product unsafe use to the users due to

- **few lay people familiar with their meanings, and**
- **the concern about possible inability of end-user to symbol understanding.**

(3) If device contains dangerous material or is considered to be dangerous, relevant danger symbols must be indicated on its label and its details must be in leaflet.

2.3 Comprehensibility (read, understand, remember, locate, keep**)**

2.3.1 Language and translation

(1) The labeling must include the information (or the translation) in the official or national language of country selling the product due to the absence of "learned intermediary" in safe and effective use of the lay consumers.

(2) The information needed in all official languages by manufacturer e.g. the contents on the outer label, "Warnings and Contraindications", "Directions for use", etc.

(3) The content in other language should be corresponded with that in Thai.

2.3.2 Ease factors for lay users

(1) The information in labeling should be simple, concise, in terms easily to be readily understood and applied by the lay users at all stages. This is to reduce the risks in specimen and IVD handling, result interpretation, etc.

(2) The "technical" or incomprehensible language should be eliminated and the text should be simplified with informal subheadings e.g. "the analyte being measured" instead of "intended use".

2.3.3 Location

The location of labeling should be proper to IVD and its intended use. All information should be obvious and clear enough to read and intended to last for the life of the device (permanent and prominent manner). It must be visible by intended user under normal conditions of sale.

3. any other requirements for

3.1 appropriate/special training needed (at the time of purchase) before adapting treatment for disease monitoring after using self-test device

3.2 test marketing of the device labeling in some cases

APPENDIX G

The 1st Draft of HPT Labeling Prototype

ชุดทดสอบการตั้งครรภ์

เลดีเพร็กสตริป (Lady Preg Strip)

ใช้สำหรับ ตรวจปัสสาวะด้วยตนเองเพื่อให้ทราบในเบื้องต้นว่าตั้งครรภ์หรือไม่

การเก็บรักษา ในที่แห้งเย็น แผ่นทดสอบต้องอยู่ในซองฟอยล์ที่ปิดสนิท ห้ามแช่แข็ง

ข้อควรระวัง อ่านฉลากและเอกสารที่แนบมาในกล่องให้ละเอียดก่อนทดสอบ

ผู้ผลิต บ.ไทยแลนด์ไดแอก จำกัด 9 ถ.สุขุมวิท อ.ศรีราชา จ.ชลบุรี 20150 ☎ 0-38221260

ผู้จำหน่าย บ.ไทยแลนด์เฮลท์ จำกัด 3 ถ.สุขุมวิท คลองตัน กทม. 10110 ☎ 0-22601738

ความแม่นยำ 99 % **เลขที่ผลิต** 05213

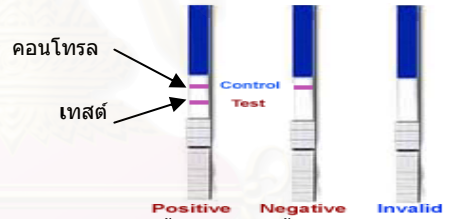
บรรจุ 1 ชุดทดสอบ/กล่อง **วันผลิต** ธ.ค. 48

เลขที่ใบอนุญาต ผ. 1/2549 **วันหมดอายุ** ส.ค. 50

วิธีใช้ เก็บปัสสาวะหลังดื่นนอนใส่ในถ้วยที่บรรจุมาในกล่องเพื่อทดสอบ ดังนี้ (ดูภาพที่ 1)

1. ฉีกซองฟอยล์ แล้วนำแผ่นทดสอบด้านที่มีหัวลูกศรชี้ลง ไปจุ่มในถ้วยปัสสาวะ 1 นาที
2. นำแผ่นทดสอบออกจากถ้วยปัสสาวะ แล้ววางพาดบนถ้วยหรือบนพื้นราบที่สะอาด แห้ง และไม่ดูดซับปัสสาวะ

ภาพที่ 1 การจุ่มแผ่นทดสอบลงในปัสสาวะไม่เกินขีดที่หัวลูกศรกำหนด



ตั้งครรภ์ ไม่ตั้งครรภ์ สรุปผลไม่ได้

ภาพที่ 2 ผลทดสอบการตั้งครรภ์

3. รอ 5 นาทีก่อนอ่านผลบนแผ่นทดสอบ แต่ไม่ควรเกิน 15 นาที (ดูภาพที่ 2)
   - ตั้งครรภ์ – พบแถบสีชมพู 2 แถบในตำแหน่งคอนโทรล และเทสต์
   - ไม่ตั้งครรภ์ – พบแถบสีชมพูแถบเดียวในตำแหน่ง โดยไม่พบที่ เทสต์
   - สรุปผลไม่ได้ – ไม่พบแถบสีใดๆเลย หรือพบบนตำแหน่งเทสต์ เพียงแห่งเดียว

ชุดทดสอบการตั้งครรภ์

เลดีเพร็กสตริป (Lady Preg Strip)

บรรจุ 1 ชุดทดสอบ เลขที่ผลิต 05213 วันผลิต ธ.ค. 2548

เลขที่ใบอนุญาต ผ. 2/2548 วันหมดอายุ ส.ค. 2550

ประโยชน์

เลดี้เพร็กสตริป เป็นแผ่นทดสอบที่ผู้บริโภคสามารถใช้ตรวจหาฮอร์โมนเอชซีจี(hCG)ในปัสสาวะของตนเองเพื่อดูว่าตั้งครรภ์หรือไม่

รายละเอียดเกี่ยวกับชุดทดสอบ

1. ความรู้เกี่ยวกับแถบทดสอบเลดี้เพร็กสตริป:

เลดีเพร็กสตริปสามารถตรวจการตั้งครรภ์โดยใช้เทคโนโลยีที่ทำให้เกิดสีในการบอกผลการตั้งครรภ์แก่ผู้บริโภค

เอชซีจี(hCG)เป็นฮอร์โมนที่มีส่วนประกอบของโปรตีนที่พบในปัสสาวะหญิงตั้งครรภ์ เป็นสารที่หลั่งจากรกที่เกิดหลังจากไข่ถูกผสมแล้วโดยสามารถตรวจพบได้ในปัสสาวะในวันแรกที่ที่ประจำเดือนขาดหายและจะเพิ่มปริมาณขึ้นอย่างรวดเร็วเป็นท่าตัวในทุก 2 วันของอายุการตั้งครรภ์ที่เพิ่มขึ้น โดยจะมีปริมาณสูงสุดในช่วงปลายของ 3 เดือนแรกของการตั้งครรภ์ คือประมาณอาทิตย์ที่ 8 – 11 ของการตั้งครรภ์

2. หลักการ:

เลดี้เพร็กสตริปเป็นชุดตรวจการตั้งครรภ์ที่ใช้หลักวิชาทางอิมมิวโนโลยี โดยการเคลื่อนของฮอร์โมนเอชซีจี(hCG)ผ่านเยื่อที่ใช้เป็นส่วนประกอบของแผ่นทดสอบ

แผ่นทดสอบนี้จะประกอบด้วย

1. แผ่นซับโพลีเอสเตอร์ที่มีส่วนผสมของแอนตีบอดี้ซึ่งย้อมด้วย คอลลอยดอลโกลด์ ซึ่งมีส่วนผสมของสารโซเดียมเอไซด์ 0.1 %

2. แผ่นเยื่อไนโตรเซลลูโลส มีส่วนผสมของแอนตี้บอดี้และแผ่นนี้แบ่งออกเป็น 2 ส่วน ได้แก่

2.1 บริเวณทดสอบ(เทสต์หรือทีไลน์) ซึ่งมีส่วนผสมของแอนตี้บอดี้ของสารเอชซีจี(hCG) ในกระต่าย

2.2 บริเวณควบคุม (คอนโทรลหรือซีไลน์) ซึ่งมีส่วนผสมของ แอนต้บอดี้ของสารเอชซีจี(hCG) ในแพะ

จำนวนที่บรรจุ 1 ชุดทดสอบต่อกล่อง

การเก็บรักษา

1. เก็บในฟอยล์ปิดสนิทที่อุณหภูมิห้อง (น้อยกว่า 25 องศาเซลเซียส) โดยจะมีอายุการใช้งานจนถึงวันหมดอายุที่ระบุไว้บนกล่องและบนฟอยล์

2. เก็บในที่แห้ง เย็น ห่างจากความร้อนและแสงแดด

3. ไม่ควรเก็บในที่ที่มีอากาศร้อนเกิน 30–45 องศาเซลเซียส

4. ห้ามแช่แข็ง

คำเตือนและข้อควรระวัง

1. อ่านฉลากและเอกสารกำกับให้ละเอียดก่อนทำการทดสอบ

2. ทำตามขั้นตอนที่แนะนำอย่างเคร่งครัด

3. ไม่เปิดฟอยล์ออกจนกว่าจะพร้อมทำการทดสอบ

4. ใช้กับการทดสอบภายนอกร่างกายเท่านั้น

5. แผ่นทดสอบนี้ประกอบด้วยสารโซเดียมเอไซด์ ซึ่งอาจทำปฏิกริยากับสารตะกั่วหรือทองแดง แล้วทำให้เกิดสารที่อาจทำให้มีการระเบิดเกิดขึ้นได้ ดังนั้นควรชะแถบทดสอบนี้ด้วยน้ำในปริมาณทีมากก่อนทิ้งแถบทดสอบดังกล่าว

ข้อจำกัดในการทดสอบ

1. ชุดทดสอบนี้ไม่สามารถนำกลับมาใช้ใหม่ได้อีก

2. ไม่ใช้ชุดทดสอบนี้ภายหลังวันหมดอายุที่ระบุไว้บนกล่องและฟอยล์

3. ผลการทดสอบจะแม่นยำมากขึ้นหากทดสอบอย่างเร็วสุด เมื่อ 1 สัปดาห์หลังจากประจำเดือนขาดหาย

4. ข้อควรหลีกเลี่ยงเพื่อป้องกันผลทดสอบผิดพลาดมีดังนี้

4.1 ผลบวกปลอม(ผลการทดสอบแสดงว่าตั้งครรภ์โดยที่ความคริงไม่ได้ตั้งครรภ์) จะพบในกรณีดังต่อไปนี้

(1) อาหาร ยา และสารที่อาจส่งผลต่อผลการทดสอบปกติการได้รับเครื่องดื่มที่ผสมแอลกอฮอร์และยาบางชนิด เช่น ยาคุมกำเนิด ยาแก้ปวด ยาปฏิชีวนะ (ยาฆ่าเชื้อ)หรือยาอื่นๆทั่วไป จะไม่มีผลต่อผลการทดสอบที่ได้ยกเว้น ยาฉีดที่มีส่วนผสมของฮอร์โมนhCG เช่น ยาเปอร์โกนอล (Pergonal), ยาโปรฟาซี (Profasi) ซึ่งจะไปเพิ่มระดับฮอร์โมน hCG และทำให้เกิดผลบวกปลอม

(2) ปัสสาวะของผู้ป่วยบางโรคจะมีระดับฮอร์โมนเอชซีจี (hCG) สูง จึงทำให้เกิดผลบวกปลอมได้ เช่น

- ซีสต์ในรังไข่ การตั้งครรภ์นอกมดลูก
- ผู้ที่ผ่านการแท้งบุตรหรือคลอดลูกมาแล้วยังไม่เกิน 8 สัปดาห์
- เนื้องอกต่อมลูกหมาก มะเร็งต่อมลูกหมาก และมะเร็งปอด

4.2 ผลลบปลอม(ผลการทดสอบแสดงว่าไม่ตั้งครรภ์โดยที่ความจริงตั้งครรภ์) จะพบได้ในกรณีต่อไปนี้

(1) ปัสสาวะขุ่นมีตะกอนเห็นได้ชัดเจน

(2) หญิงที่มีประจำเดือนมาไม่สม่ำเสมอ ควรทดสอบซ้ำอีกครั้งหลังจากประจำเดือนขาดหาย 1 อาทิตย์

(3) หญิงที่ตั้งครรภ์อ่อนๆ หรือกรณีทำการทดสอบก่อนวันแรกที่ประจำเดือนจะขาดหาย หรือกรณีทำการทดสอบในขณะที่ปัสสาวะมีปริมาณฮอร์โมนเอชซีจี(hCG)เจือจาง ดังนั้นในกรณีนี้ควรทำการทดสอบใหม่หลังจากทำการทดสอบครั้งแรกไปแล้ว 48 ชม. โดยใช้ปัสสาวะครั้งแรกหลังตื่นนอนในตอนเช้า

4.3 ผลไม่แน่ชัด มักพบในกรณีที่ทำการทดสอบโดยใช้ปัสสาวะที่แช่แย็นไว้ หรือใช้ภาชนะบรรจุปัสสาวะที่ปนเปื่อนขี้ผึ้งหรือสบู่ ซึ่งทำให้เกิดผลผิดพลาดได้

สิ่งที่บรรจุมาในกล่อง

1. ถ้วยใส่ปัสสาวะที่จะทำการทดสอบ

2. แผ่นทดสอบการตั้งครรภ์เลดี้เพร็กสตริปซึ่งบรรจุในฟอยล์ที่ปิดสนิทพร้อมซองใส่สารกันความชื้น

3. เอกสารกำกับระบุข้อแนะนำการใช้ชุดทดสอบ

การเก็บปัสสาวะ

1. ให้เก็บปัสสาวะใส่ในถ้วยที่แนบมาในกล่องโดยภาชนะบรรจุจะต้องสะอาดแห้งและไม่ใส่สารเคมีใดๆ

2. ปัสสาวะที่ใช้ในการทดสอบจะเก็บเวลาใดก็ได้ แต่ที่ดีที่สุดคือปัสสาวะที่เก็บในครั้งแรกหลังตื่นนอนในตอนเช้าเนื่องจากมีระดับฮอร์โมนเอชซีจี(hCG)สูง

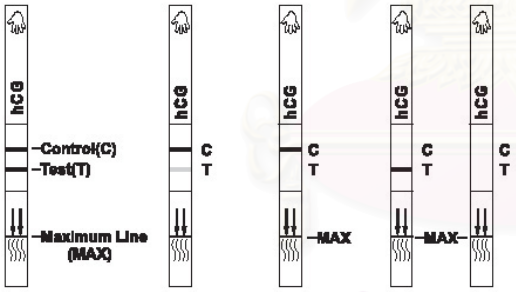
3. หากไม่สามารถทำการทดสอบได้ทันที ให้เก็บปัสสาวะไว้ในตู้เย็นที่อุณหภูมิ 2 – 8 องศาเซลเซียสไม่เกิน 48 ชม.และให้ตั้งปัสสาวะทิ้งไว้จนเท่าอุณหภูมิห้องก่อนทำการทดสอบ

4. หากปัสสาวะมีตะกอนจะต้องกรองเอาตะกอนออกก่อนทำการทดสอบ

วิธีการทดสอบ

1. ฉีกฟอยล์แล้วนำแผ่นทดสอบออกมา
2. จุ่มแถบทดสอบ(ด้านที่มีหัวลูกศรชี้ลง)ลงในถ้วยปัสสาวะไม่เกินขีดที่ โดยจับแผ่นทดสอบให้อยู่ในแนวตั้ง (ดูภาพที่ 1 ประกอบ)
3. จุ่มแถบทดสอบไว้นานประมาณ 30–60 วินาที หลังจากนั้นให้นำแถบทดสอบออกจากถ้วยปัสสาวะ
4. วางแผ่นทดสอบบนพื้นราบที่สะอาด แห้งและไม่ดูดซับปัสสาวะ
5. รอ 3-5 นาที ก่อนอ่านผลโดยขณะรอให้สังเกตสีที่เกิดขึ้นบนแถบทดสอบนั้น
6. อ่านผลการทดสอบภายหลังนำแถบทดสอบขึ้นมาจากปัสสาวะแล้วอย่างน้อย 3 นาที แต่ไม่ควรอ่านผลการทดสอบภายหลัง 15 นาที

ภาพที่ 1 การจุ่มแถบทดสอบลงในปัสสาวะไม่เกินขีดที่หัวลูกศรกำหนด



ตั้งครรภ์ ไม่ตั้งครรภ์ สรุปผลไม่ได้

ภาพที่ 2 การแสดงผลการทดสอบการตั้งครรภ์

ปัจจัยที่ช่วยให้การอ่านผลการทดสอบมีความถูกต้อง

1. การปฏิบัติตามคำแนะนำในการใช้อย่างเคร่งครัด
2. ผู้ใช้ชุดทดสอบต้องไม่มีภาวะตาบอดสี
3. มีแสงสว่างที่พอเพียงในการอ่านผลการทดสอบที่ได้
4. ต้องมั่นใจว่าอ่านผลการทดสอบที่ได้บนปลายที่ถูกต้องของแถบทดสอบ

วิธีการอ่านผลการทดสอบ (ดูภาพที่ 2 ประกอบ)

ผลการทดสอบที่อ่านได้จะปรากฏบนแถบการทดสอบดังนี้

1. **กรณีตั้งครรภ์**–จะพบแถบสีชมพู 2 แถบในตำแหน่งควบคุม (C:ซี) และตำแหน่งทดสอบ (T:ที)
2. **กรณีไม่ตั้งครรภ์**–จะพบแถบสีชมพูเพียงแถบเดียวในตำแหน่งควบคุม (C:ซี) และจะไม่พบแถบสีใดๆเลยในตำแหน่งทดสอบ (T:ที)
3. **กรณีที่สรุปผลไม่ได้-** ถ้าไม่ปรากฏแถบสีใดๆเลยบนแผ่นทดสอบหรือพบแถบสีบนตำแหน่งทดสอบ (T:ที) โดยไม่พบบนตำแหน่งควบคุม (C:ซี) แสดงว่าปริมาณปัสสาวะอาจไม่เพียงพอหรือแผ่นทดสอบเสื่อมสภาพหรือทดสอบผิดวิธีโดยอาจมีสาเหตุดังนี้

3.1 อาจมีการเก็บชุดทดสอบนี้ไว้ในที่ที่แสงแดดส่องถึงหรือไม่ปฏิบัติอย่างเคร่งครัดตามคำแนะนำ
3.2 เปิดฟอยล์ที่บรรจุแถบทดสอบไว้นานเกินกว่า 1 ชม. ก่อนทำการทดสอบ
3.3 แถบทดสอบเปียกหรือชื้น
3.4 จุ่มแถบทดสอบในปัสสาวะเกินขีดที่หัวลูกศรกำหนด
3.5 จุ่มแถบทดสอบผิดด้าน
3.6 จุ่มแถบทดสอบในปัสสาวะน้อยกว่า 30 วินาที

หากพบกรณีใดกรณีหนึ่งที่กล่าวมาข้างต้น ให้ทำการทดสอบใหม่ภายหลังจากการทดสอบครั้งแรกแล้ว 48 ชม. หากยังเกิดกรณีสรุปผลไม่ได้อีกให้ติดต่อบริษัทฯผู้จำหน่ายทันที

ข้อสังเกตเกี่ยวกับคุณภาพของแผ่นทดสอบ

การเกิดแถบสีชมพูบนแผ่นทดสอบที่ตำแหน่งควบคุม (C:ซี) เป็นตัวบ่งชี้ว่าแถบทดสอบอยู่ในสภาพที่เหมาะสม ปริมาณปัสสาวะที่ใช้เพียงพอและผู้ใช้ทำการทดสอบถูกวิธี

ประสิทธิภาพของชุดทดสอบ

1. ชุดทดสอบนี้ให้ผลลบในหญิงไม่ตั้งครรภ์ที่มีสุขภาพแข็งแรง และสามารถตรวจพบฮอร์โมนเอชซีจี(hCG)ในปัสสาวะหญิงตั้งครรภ์ได้ในปริมาณตั้งแต่ 25 mIU/ปัสสาวะ 1 ซีซี หรือตั้งแต่วันแรกที่ประจำเดือนขาดหายไป
2. จากการประเมินชุดทดสอบนี้เทียบกับสินค้าประเภทเดียวกันที่มีจำหน่ายในท้องตลาด ผลปรากฏว่าได้ผลสอดคล้องกัน

การกำจัดวัสดุที่ใช้แล้ว

"ระมัดระวังในการทิ้งวัสดุที่ใช้แล้วเพื่อป้องกันการติดเชื้อที่อาจเกิดขึ้นได้"

ท่านสามารถขอคำปรึกษาหรือข้อมูลเพิ่มเติมได้ที่
☎ 0-22601738-40

ผลิตโดย บริษัท ไทยแลนด์ ไดแอกนอสติกส์ จำกัด
เลขที่ 9 ถนนสุขุมวิท อำเภอบางละมุง
จังหวัดชลบุรี 20150 ☎ 0-38221260-5

จำหน่ายโดย บริษัท ไทยแลนด์ เฮลท์ จำกัด
เลขที่ 1234 ถนนสุขุมวิท เขตคลองตัน
กรุงเทพมหานคร 10110 ☎ 0-22601738-40

ฉบับ 2006/03/27

APPENDIX H

The 2nd Draft of HPT Labeling Prototype

ผู้ผลิต บ.ไทยแลนด์ไดแอก จำกัด 9 ถ.สุขุมวิท อ.ศรีราชา จ.ชลบุรี 20150 ☎ 0-38221260

ผู้จำหน่าย บ.ไทยแลนด์เฮลท์ จำกัด 3 ถ.สุขุมวิท คลองตัน กทม. 10110 ☎ 0-22601738

ชุดทดสอบการตั้งครรภ์

เลดีเพร็กสตริป

(Lady Preg Strip)

ใช้สำหรับ ตรวจปัสสาวะด้วยตนเองเพื่อให้ทราบในเบื้องต้นว่าตั้งครรภ์หรือไม่

การเก็บรักษา ในที่แห้งเย็น แผ่นทดสอบต้องอยู่ในซองที่ปิดสนิท ห้ามแช่ในช่องแข็ง

อ่านฉลากและเอกสารที่แนบมาในกล่องให้ละเอียดก่อนใช้

บรรจุ 1 ชุดทดสอบ
ความแม่นยำ 99 %
เลขที่ใบอนุญาต ผ. 1/2548

เลขที่ผลิต 05213
วันผลิต ธ.ค. 2548
วันหมดอายุ ส.ค. 2550

ชุดทดสอบการตั้งครรภ์ *เลดีเพร็กสตริป (Lady Preg Strip)*

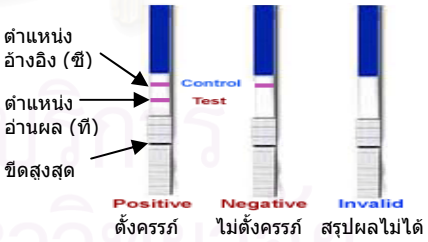
วิธีใช้

- จุ่มแผ่นทดสอบในปัสสาวะ 1 นาที
- นำขึ้นวางพาดบนถ้วย รอ 5 นาที ก่อนอ่านผล (ไม่ควรเกิน 15 นาที)

ภาพที่ 1 การจุ่มแผ่นทดสอบลงในปัสสาวะ (ไม่เกินขีดที่ปลายหัวลูกศรชี้)

วิธีอ่านผล

- ตั้งครรภ์ – พบแถบสีชมพู 2 แถบที่ "ซีและที"
- ไม่ตั้งครรภ์ – พบแถบสีชมพูแถบเดียวที่ "ซี"
- สรุปผลไม่ได้ – ไม่พบแถบสีใดๆหรือพบที่ "ที"



ภาพที่ 2 ผลทดสอบการตั้งครรภ์

ชุดทดสอบการตั้งครรภ์

เลดีเพร็กสตริป (Lady Preg Strip)

บรรจุ 1 ชุดทดสอบ เลขที่ผลิต 05213 วันผลิต ธ.ค. 2548

เลขที่ใบอนุญาต ผ. 1/2548 วันหมดอายุ ส.ค. 2550

ชุดทดสอบการตั้งครรภ์ เลดี้เพร็กสตริป

ประโยชน์
เลดี้เพร็กสตริปเป็นชุดทดสอบที่บุคคลทั่วไปสามารถใช้ตรวจหาฮอร์โมนเอชซีจี (hCG) ในปัสสาวะด้วยตนเองเพื่อให้ทราบในเบื้องต้นว่าตั้งครรภ์หรือไม่ โดยใช้หลักวิชาทางอิมมิวโนโลยี ทำให้เกิดแถบสีจากการเคลื่อนของฮอร์โมนเอชซีจี (hCG) ผ่านเยื่อที่ใช้เป็นส่วนประกอบของแผ่นทดสอบ ซึ่งสามารถอ่านผลได้ด้วยตาเปล่า

สิ่งที่บรรจุมาในกล่อง (1 ชุดทดสอบ)
1. ถ้วยเก็บปัสสาวะ
2. ซองฟอยล์ที่ปิดสนิทบรรจุแผ่นทดสอบการตั้งครรภ์เลดี้เพร็กสตริปจำนวน 1 แผ่นทดสอบพร้อมสารกันความชื้น
3. เอกสารแนะนำการใช้ชุดทดสอบ

การเก็บรักษาชุดทดสอบเลดี้เพร็กสตริป
1. แผ่นทดสอบจะต้องอยู่ในซองฟอยล์ที่ปิดสนิท
2. เก็บในที่แห้ง เย็น ห่างจากความร้อนและแสงแดด หรือเก็บที่อุณหภูมิห้อง (น้อยกว่า 25 องศาเซลเซียส) โดยไม่ควรเก็บในสภาพที่ร้อนเกิน 30–45 องศาเซลเซียส
3. ห้ามแช่แข็ง

คำเตือนและข้อควรระวัง
1. ใช้กับการทดสอบภายนอกร่างกายเท่านั้น
2. อ่านฉลากและเอกสารแนะนำการใช้ให้ละเอียดก่อนทดสอบและทำตามขั้นตอนที่แนะนำอย่างเคร่งครัด
3. ไม่เปิดซองฟอยล์ออกจนกว่าจะพร้อมทำการทดสอบ
4. การเกิดแถบสีชมพูบนแผ่นทดสอบที่ตำแหน่งควบคุม (C:ซี) เป็นตัวบ่งชี้ว่าแผ่นทดสอบอยู่ในสภาพเหมาะสม ปริมาณปัสสาวะที่ใช้เพียงพอและทดสอบถูกวิธี
5. ปัจจัยที่ทำให้อ่านผลได้อย่างถูกต้อง
5.1 ผู้ใช้ชุดทดสอบต้องไม่มีภาวะตาบอดสี
5.2 มีแสงสว่างพอเพียงในการอ่านผลการทดสอบที่ได้
5.3 ต้องมั่นใจว่า อ่านผลการทดสอบที่ได้บนปลายที่ถูกต้องของแผ่นทดสอบ
6. ผลการทดสอบจะแม่นยำมากขึ้น หากทดสอบหลังจากประจำเดือนขาดเกิน 1 สัปดาห์
7. แผ่นทดสอบนี้มีส่วนผสมของสารโซเดียมเอไซด์ซึ่งอาจทำปฏิกิริยากับสารตะกั่วหรือทองแดงแล้วเกิดการระเบิดขึ้นได้ ดังนั้นควรแช่แผ่นทดสอบนี้ในน้ำก่อนทิ้ง

ข้อห้ามใช้
1. ไม่ใช้ชุดทดสอบนี้ภายหลังวันหมดอายุที่ระบุไว้บนกล่อง
2. ชุดทดสอบนี้ไม่สามารถนำกลับมาใช้ใหม่ได้อีก

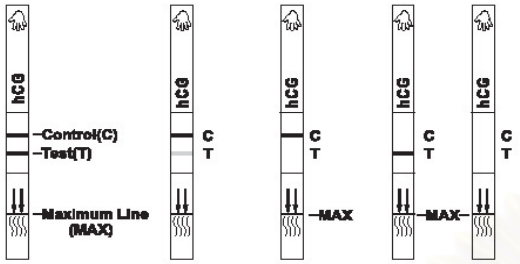
วิธีการใช้ชุดทดสอบ
1. **การเก็บปัสสาวะ**
1.1 ให้เก็บปัสสาวะใส่ในถ้วยที่บรรจุมาในกล่อง โดยถ้วยดังกล่าวจะต้องสะอาด แห้งและไม่มีสารเคมีใดๆ
1.2 ปัสสาวะที่ใช้ในการทดสอบจะเก็บเวลาใดก็ได้ แต่ดีที่สุดคือปัสสาวะครั้งแรกหลังตื่นนอนในตอนเช้าเนื่องจากมีระดับฮอร์โมนเอชซีจี (hCG) สูง

2. **วิธีการทดสอบ**
2.1 ฉีกซองฟอยล์ แล้วนำแผ่นทดสอบออกมา
2.2 จับแผ่นทดสอบให้อยู่ในแนวตั้ง แล้วจุ่มด้านที่มีหัวลูกศรชี้ลงไปในถ้วยปัสสาวะนานประมาณ 1 นาที โดยให้ระดับน้ำปัสสาวะไม่เกินขีดสูงสุด (Max Line)(ดูภาพที่ 1)
2.3 ให้นำแผ่นทดสอบออกจากถ้วยปัสสาวะ แล้ววางบนพื้นราบที่สะอาด แห้งและไม่ดูดซับปัสสาวะ
2.4 รอ 5 นาทีก่อนอ่านผลการทดสอบ โดยขณะที่รอให้สังเกตแถบสีที่เกิดขึ้นบนแผ่นทดสอบนั้น แต่ไม่ควรอ่านผลดังกล่าวเกิน 15 นาที

ภาพที่ 1 การจุ่มแผ่นทดสอบลงในปัสสาวะไม่เกินขีดที่หัวลูกศรกำหนด

3. **วิธีอ่านผลบนแผ่นทดสอบ** (ดูภาพที่ 2)
3.1 **กรณีตั้งครรภ์** – จะพบแถบสีชมพูซึ่งอาจเข้มหรือจาง 2 แถบในตำแหน่งควบคุม(C:ซี)และตำแหน่งทดสอบ(T:ที)
3.2 **กรณีไม่ตั้งครรภ์** – จะพบแถบสีชมพูเพียงแถบเดียวในตำแหน่งควบคุม(C:ซี) และจะไม่พบแถบสีใดๆเลยในตำแหน่งทดสอบ(T:ที)
3.3 **กรณีสรุปผลไม่ได้** – จะไม่ปรากฏแถบสีใดๆเลยบนแผ่นทดสอบหรือพบแถบสีบนตำแหน่งทดสอบ(T:ที) โดยไม่พบบนตำแหน่งควบคุม(C:ซี) ซึ่งอาจเนื่องจาก
(1) มีการเก็บชุดทดสอบนี้ไว้ในที่ที่แสงแดดส่องถึง
(2) ไม่ปฏิบัติตามคำแนะนำอย่างเคร่งครัด
(3) เปิดซองฟอยล์ที่บรรจุแผ่นทดสอบไว้นานเกินกว่า 1 ชั่วโมง ก่อนทำการทดสอบ
(4) แผ่นทดสอบเปียกหรือชื้น
(5) จุ่มแผ่นทดสอบในปัสสาวะเกินขีดสูงสุดที่หัวลูกศรกำหนด (Max Line) (ดูภาพที่ 1)
(6) จุ่มปลายแผ่นทดสอบผิดด้าน
(7) จุ่มแผ่นทดสอบในปัสสาวะน้อยกว่า 1 นาที

ถ้าพบกรณีใดกรณีหนึ่งที่กล่าวมาข้างต้น ให้ทำการทดสอบอีกครั้งด้วยชุดทดสอบชุดใหม่ภายหลังจากการทดสอบครั้งแรกไปแล้ว 48 ชั่วโมง หากยังเกิดกรณีสรุปผลไม่ได้อีก ให้ติดต่อบริษัทฯผู้จำหน่ายทันที



ตั้งครรภ์ ไม่ตั้งครรภ์ สรุปผลไม่ได้

ภาพที่ 2 ผลทดสอบการตั้งครรภ์

ข้อควรรู้เพิ่มเติม

1. **ความรู้เกี่ยวกับฮอร์โมนเอชซีจี** (hCG)
เอชซีจี (hCG) เป็นฮอร์โมนที่หลั่งจากรกหลังจากไข่เกิดการปฏิสนธิ ดังนั้นจึงสามารถตรวจพบเอชซีจี (hCG) ในปัสสาวะของหญิงตั้งครรภ์ได้ตั้งแต่วันแรกที่ประจำเดือนขาดและจะเพิ่มปริมาณขึ้นอย่างรวดเร็วเป็นเท่าตัวในทุก 2 วันของอายุครรภ์ โดยจะมีปริมาณสูงสุดในช่วงปลายเดือนที่ 3 หรือประมาณสัปดาห์ที่ 8–11 ของการตั้งครรภ์

2. **แผ่นทดสอบเลดี้เพร็กสตริปมีส่วนประกอบดังนี้**
2.1 แผ่นซับโพลีเอสเตอร์ที่มีแอนติบอดี้ซึ่งย้อมด้วยสีชมพูแดงของคอลลอยดอลโกลด์และมีสารโซเดียมเอไซด์ 0.1%
2.2 แผ่นไนโตรเซลลูโลส แบ่งออกเป็น 2 ส่วน ได้แก่
(1) บริเวณตำแหน่งทดสอบ (เทสต์ไลน์หรือT) มีส่วนผสมของแอนติ้บอดี้ต่อเอชซีจี (hCG) ในกระต่าย
(2) บริเวณตำแหน่งควบคุม (คอนโทรลหรือซีไลน์) มีส่วนผสมของ แอนติ้บอดี้ต่อเอชซีจี (hCG) ในแพะ

3. **ข้อจำกัดในการทดสอบ**
ข้อควรหลีกเลี่ยงเพื่อป้องกันผลการทดสอบที่ผิดพลาดดังนี้
3.1 **ผลบวกปลอม** (ผลการทดสอบแสดงว่าตั้งครรภ์ โดยที่ความจริงไม่ได้ตั้งครรภ์) จะพบในกรณีดังต่อไปนี้
(1) ได้รับยาฉีดที่มีส่วนผสมของฮอร์โมนเอชซีจี (hCG) เช่น ยาเปอร์โกนอล (Pergonal), ยาโปรฟาซี (Profasi) ซึ่งจะไปเพิ่มระดับฮอร์โมนเอชซีจี (hCG) ทั้งนี้เครื่องดื่มที่ผสมแอลกอฮอล์ อาหารและยาทั่วๆไป จะไม่กระทบต่อผลการทดสอบที่ได้
(2) ปัสสาวะของผู้ป่วยในบางสภาวะ จะมีระดับฮอร์โมนเอชซีจี (hCG) สูง เช่น เนื้องอกในรังไข่ การตั้งครรภ์นอกมดลูก ผู้ที่ผ่านการคลอดหรือแท้งบุตรมาแล้วยังไม่เกิน 8 สัปดาห์โดยเฉพาะการแท้งครรภ์ไข่ปลาอุก

3.2 **ผลลบปลอม** (ผลการทดสอบแสดงว่าไม่ตั้งครรภ์ โดยที่ ความจริงตั้งครรภ์) จะพบได้ในกรณีต่อไปนี้
(1) ปัสสาวะขุ่นมีตะกอนเห็นได้ชัดเจน
(2) ทดสอบในหญิงที่ประจำเดือนมาไม่สม่ำเสมอ ทดสอบก่อนวันแรกที่ประจำเดือนจะขาด หรือทดสอบในขณะที่ปัสสาวะมีปริมาณฮอร์โมนเอชซีจี (hCG) เจือจาง เช่น ในหญิงที่ตั้งครรภ์อ่อนๆ จึงควรทดสอบซ้ำหลังจากตรวจครั้งแรกไปแล้ว 1 สัปดาห์ โดยใช้ปัสสาวะครั้งแรกหลังตื่นนอนในตอนเช้า

3.3 **ผลไม่แน่ชัด** มักพบในกรณีใช้ปัสสาวะที่แช่เย็นไว้หรือใช้ภาชนะบรรจุปัสสาวะที่ปนเปื้อนขี้ผึ้งหรือสบู่

4. **ประสิทธิภาพชุดทดสอบ**
ชุดทดสอบนี้ให้ผลลบในหญิงไม่ตั้งครรภ์หรือชายที่มีสุขภาพแข็งแรง และให้ผลบวกในหญิงตั้งครรภ์ที่มีปริมาณฮอร์โมนเอชซีจี (hCG) มากกว่า 25 mIU/ปัสสาวะ 1 ซีซีหรือตั้งแต่วันแรกที่ประจำเดือนขาด

5. **การกำจัดวัสดุที่ใช้แล้ว**
"ระมัดระวังในการทิ้งวัสดุที่ใช้แล้วเพื่อป้องกันการติดเชื้อที่อาจเกิดขึ้นได้**"**

ท่านสามารถขอคำปรึกษาหรือข้อมูลเพิ่มเติมได้ที่
☎ 0-22601738-40

ผลิตโดย บริษัท ไทยแลนด์ ไดแอกนอสติกส์ จำกัด
เลขที่ 9 ถนนสุขุมวิท อำเภอศรีราชา จังหวัดชลบุรี 20150
☎ 0-38221260-5
จำหน่ายโดย บริษัท ไทยแลนด์ เฮลท์ จำกัด
เลขที่ 1234 ถนนสุขุมวิท เขตคลองตัน กรุงเทพมหานคร 10110 ☎ 0-22601738-40

ฉบับ 2006/03/29 lay

APPENDIX I

The 3rd Draft of HPT Labeling Prototype

ชุดทดสอบการตั้งครรภ์

เลดีเพร็กสตริป (Lady Preg Strip)

บรรจุ 1 ชุดทดสอบ เลขที่ผลิต 05213 วันผลิต ธ.ค. 2548

เลขที่ใบอนุญาต ผ. 2/2548 วันหมดอายุ ส.ค. 2550

ชุดทดสอบการตั้งครรภ์ เลดี้เพร็กสตริป (Lady Pregstrip)

ประโยชน์
ใช้ตรวจปัสสาวะด้วยตนเองเพื่อให้ทราบในเบื้องต้นว่าตั้งครรภ์หรือไม่ โดยอ่านผลได้ด้วยตาเปล่าจากแถบสีบนแผ่นทดสอบ

หลักการของชุดทดสอบ
แถบสีเกิดจากจากฮอร์โมนเอชซีจีในปัสสาวะ จับกับแอนติบอดีต่อเอชซีจีบนแผ่นทดสอบ

สิ่งที่บรรจุในกล่อง (1 ชุดทดสอบ)
1. ถ้วยเก็บปัสสาวะ จำนวน 1 ถ้วย
2. ซองปิดสนิทที่ภายในบรรจุแผ่นทดสอบจำนวน 1 แผ่นและสารกันความชื้น
3. เอกสารแนะนำการใช้

การเก็บรักษาเมื่อยังไม่ได้เปิดใช้
1. เก็บในที่แห้ง เย็น ห่างจากความร้อนและแสงแดด
2. ห้ามเก็บในช่องแช่แข็งของตู้เย็น

คำเตือนและข้อควรระวัง
1. ไม่ใช้ชุดทดสอบหลังวันหมดอายุที่ระบุบนกล่อง
2. อ่านฉลากกล่องและเอกสารนี้ให้ละเอียดก่อนใช้
3. ไม่เปิดซองจนกว่าพร้อมทดสอบ
4. ทำตามคำแนะนำอย่างเคร่งครัด

การเก็บปัสสาวะ
1. ใส่ในถ้วยที่ให้มา ที่สะอาด แห้ง และไม่ปนเปื้อนสารใดๆ
2. เก็บเวลาใดก็ได้ แต่ดีที่สุดถ้าเก็บหลังตื่นนอนในตอนเช้า

วิธีทดสอบ
1. ฉีกซอง แล้วนำแผ่นทดสอบออกมา
2. จับแผ่นทดสอบให้อยู่ในแนวตั้ง
3. นำด้านที่มีหัวลูกศรชี้ลงจุ่มไปในปัสสาวะ
4. จุ่มนาน 1 นาที โดยจุ่มไม่เกินขีดสูงสุดที่ปลายหัวลูกศรชี้ (ดูภาพที่ 1)
5. นำแผ่นทดสอบขึ้นวางพาดในแนวนอนบนถ้วย หรือบนที่แห้งที่ไม่ดูดซับความชื้น
6. รอ 5 นาทีจึงอ่านผล แต่ไม่ควรเกิน 15 นาที

ภาพที่ 1 การจุ่มแผ่นทดสอบในปัสสาวะ

ภาพที่ 2 ผลทดสอบการตั้งครรภ์

วิธีอ่านผลบนแผ่นทดสอบ (ดูภาพที่ 2)
1. **ตั้งครรภ์:** พบแถบสีชมพูเข้มหรือจาง 2 แถบที่ตำแหน่งอ้างอิง (ซี) และตำแหน่งอ่านผล (ที)
2. **ไม่ตั้งครรภ์:** พบแถบสีชมพูเพียง 1 แถบที่ตำแหน่งอ้างอิง (ซี)
3. **สรุปผลไม่ได้:** ไม่พบแถบสีชมพูที่ใดๆ หรือพบ 1 แถบที่ตำแหน่งอ่านผล (ที)

ข้อควรปฏิบัติเพิ่มเติม
1. ปรึกษาแพทย์ ถ้าผลปรากฏว่าตั้งครรภ์ หรือมีอาการคล้ายคนตั้งครรภ์
2. กรณีสรุปผลไม่ได้ ให้ทดสอบด้วยชุดทดสอบชุดใหม่ตามคำแนะนำอย่างเคร่งครัด หรือติดต่อผู้จำหน่ายทันที

ข้อจำกัดในการทดสอบ
1. ชุดทดสอบนี้ใช้ภายนอกร่างกายเท่านั้น
2. ผู้อ่านผลต้องไม่มีภาวะตาบอดสี
3. มีแสงสว่างเพียงพอขณะอ่านผล
4. มั่นใจว่าอ่านผลที่ได้บนปลายที่ถูกต้องของแผ่นทดสอบ

ข้อห้ามในการทดสอบ
สภาวะที่อาจทำให้เกิดผลผิดพลาด มีดังนี้
1. **ผลบวกปลอม** คือ ผลปรากฏว่าตั้งครรภ์ แต่ความจริงไม่ได้ตั้งครรภ์ พบในกรณี
   1.1 มีเนื้องอกหรือซีสต์ (cyst) ในรังไข่
   1.2 ตั้งครรภ์นอกมดลูก
   1.3 คลอดหรือแท้งบุตรมาไม่เกิน 2 เดือน
   1.4 ได้รับยาฉีดที่มีฮอร์โมนเอชซีจี
   หมายเหตุ อาหาร เครื่องดื่มที่มีแอลกอฮอล์ และยาอื่นๆ เช่น ยาแก้ปวด ยาคุมกำเนิด ฯลฯ ไม่กระทบต่อผลที่ได้
2. **ผลลบปลอม** คือ ผลปรากฏว่าไม่ตั้งครรภ์ แต่ความจริงตั้งครรภ์ พบในกรณี
   2.1 ปัสสาวะขุ่น มีตะกอน
   2.2 ทดสอบก่อนถึงวันที่ประจำเดือนไม่มาตามกำหนด หรือในผู้ตั้งครรภ์อ่อนๆ หรือผู้มีประจำเดือนมาไม่สม่ำเสมอ จึงควรทดสอบซ้ำหลังจากนั้น 1 สัปดาห์
3. **ผลไม่ชัดเจน** มักพบในกรณีเก็บปัสสาวะในถ้วยที่ปนเปื้อนขี้ผึ้งหรือสบู่

ข้อควรรู้เพิ่มเติม
1. **ความรู้เกี่ยวกับเอชซีจี (hCG)**
เป็นฮอร์โมนที่หลั่งจากรกภายหลังไข่ถูกผสมแล้ว โดยปริมาณจะเพิ่มอย่างรวดเร็วเป็นเท่าตัวในทุก 2 วันของอายุครรภ์ และจะสูงสุดในสัปดาห์ที่ 8–11 ของการตั้งครรภ์
2. **ส่วนประกอบแผ่นทดสอบ**
   2.1 แอนติบอดีต่อฮอร์โมน เอชซีจี ซึ่งย้อมด้วยสีชมพูแดง
   2.2 สารโซเดียมเอไซด์ 0.1 %
3. **ประสิทธิภาพชุดทดสอบ**
   3.1 ถ้าพบแถบสีชมพูที่ตำแหน่งอ้างอิง (ซี) แสดงว่า ทดสอบถูกวิธี
   3.2 แม่นยำ 99 % โดยผลจะแม่นยำมากที่สุด หากทดสอบหลังจากประจำเดือนขาดเกิน 1 สัปดาห์
   3.3 ให้ผลบวกในผู้ตั้งครรภ์ที่มีเอชซีจีมากกว่า 25 mIU/ปัสสาวะ 1 ซีซี และให้ผลลบในผู้ที่ไม่ตั้งครรภ์ที่มีสุขภาพแข็งแรง

ท่านสามารถขอคำปรึกษาหรือขอข้อมูลเพิ่มเติมได้ที่

ผู้ผลิต บ.ไทยแลนด์ไดแอก จำกัด
เลขที่ 9 ถ.สุขุมวิท อ.ศรีราชา จ.ชลบุรี
☎ 0-38221260-5

ผู้จำหน่าย บ. ไทยแลนด์เฮลท์ จำกัด
เลขที่ 3 ถ.สุขุมวิท คลองตัน กทม.
☎ 0-22601738

ฉบับ 24x/08/2549

APPENDIX J

The 4th or Final Draft of HPT Labeling Prototype

ชุดทดสอบการตั้งครรภ์

เลดีเพร็กสตริป (Lady Preg Strip)

บรรจุ 1 ชุดทดสอบ เลขที่ผลิต 05213 วันผลิต ธ.ค. 2548

เลขที่ใบอนุญาต ผ. 2/2548 วันหมดอายุ ส.ค. 2550

ชุดทดสอบการตั้งครรภ์ เลดี้เพร็กสตริป (Lady Pregstrip)

ประโยชน์

ใช้ตรวจปัสสาวะเพื่อให้ทราบว่าตั้งครรภ์หรือไม่ โดยอ่านผลได้ด้วยตาเปล่าจากแถบสีที่เกิดขึ้นบนแผ่นทดสอบ

หลักการของชุดทดสอบ

แถบสีเกิดจากฮอร์โมนเอชซีจีในปัสสาวะจับกับแอนติบอดีต่อเอชซีจีบนแผ่นทดสอบ

สิ่งที่บรรจุในกล่อง (1 ชุดทดสอบ)

1. ถ้วยเก็บปัสสาวะ จำนวน 1 ถ้วย
2. ซองปิดสนิทที่ภายในบรรจุแผ่นทดสอบ จำนวน 1 แผ่นและสารกันความชื้น
3. เอกสารแนะนำการใช้

การเก็บรักษาเมื่อยังไม่ได้เปิดใช้

1. เก็บในที่แห้ง เย็น ห่างจากความร้อนและแสงแดด
2. ห้ามเก็บในช่องแช่แข็งของตู้เย็น

คำเตือนและข้อควรระวัง

1. อ่านฉลากกล่องและเอกสารนี้ให้ละเอียดก่อนใช้
2. ทำตามคำแนะนำอย่างเคร่งครัด
3. ไม่ใช้ชุดทดสอบหลังวันหมดอายุ
4. ไม่เปิดซองจนกว่าพร้อมจะทดสอบ
5. แผ่นทดสอบต้องไม่เปียกชื้นก่อนใช้
6. ผู้อ่านผลต้องไม่มีภาวะตาบอดสี
7. มีแสงสว่างเพียงพอขณะอ่านผล
8. มั่นใจว่าอ่านผลที่ได้บนปลายที่ถูกต้องของแผ่นทดสอบ
9. ใช้สำหรับภายนอกร่างกายเท่านั้น

การเก็บปัสสาวะ

1. เก็บเวลาใดก็ได้ แต่เก็บหลังตื่นนอนในตอนเช้าจะดีที่สุด
2. เก็บใส่ในถ้วยที่ให้มา
3. ถ้วยต้องสะอาด แห้ง และไม่ปนเปื้อนขี้ผึ้งหรือสบู่ เพราะจะทำให้ผลที่ได้ไม่ชัดเจน

วิธีใช้

1. ฉีกซอง แล้วนำแผ่นทดสอบออกมา
2. จับแผ่นทดสอบให้อยู่ในแนวตั้ง
3. นำด้านที่มีหัวลูกศรชี้ลง จุ่มไปในปัสสาวะ
4. จุ่มนาน 1 นาที โดยจุ่มไม่เกินขีดสูงสุดที่ปลายหัวลูกศรชี้ (ดูภาพที่ 1)
5. นำแผ่นทดสอบขึ้นวางพาดในแนวนอนบนถ้วยหรือบนที่แห้งที่ไม่ดูดซับความชื้น
6. รอ 5 นาทีจึงอ่านผลแต่ไม่ควรเกิน 15 นาที เพราะอาจทำให้ผลที่ได้ผิดพลาด

ภาพที่ 1 การจุ่มแผ่นทดสอบลงในปัสสาวะ

วิธีอ่านผลบนแผ่นทดสอบ (ดูภาพที่ 2)

1. ตั้งครรภ์: พบแถบสีชมพูเข้มหรือจาง 2 แถบที่ตำแหน่งอ้างอิง (ซี) และตำแหน่งอ่านผล (ที)
2. ไม่ตั้งครรภ์: พบแถบสีชมพูเพียง 1 แถบที่ตำแหน่งอ้างอิง (ซี)
3. สรุปผลไม่ได้: ไม่พบแถบสีชมพูที่ใดๆหรือพบ 1 แถบที่ตำแหน่งอ่านผล (ที)

ภาพที่ 2 ผลทดสอบการตั้งครรภ์

ข้อควรปฏิบัติเพิ่มเติมภายหลังอ่านผล

1. กรณีตั้งครรภ์: ควรปรึกษาแพทย์
2. กรณีไม่ตั้งครรภ์แต่มีอาการคล้ายตั้งครรภ์: ให้ทดสอบซ้ำหลังจากทดสอบครั้งแรกไปแล้ว 1 สัปดาห์
3. กรณีสรุปผลไม่ได้: ให้ทดสอบด้วยชุดทดสอบชุดใหม่ตามคำแนะนำอย่างเคร่งครัด หรือติดต่อผู้จำหน่ายทันที

ข้อห้ามและข้อจำกัดในการใช้ซึ่งอาจทำให้ผลที่ได้ผิดพลาด

1. ข้อห้ามใช้

ห้ามใช้ในผู้ที่มีสภาพร่างกายดังต่อไปนี้ เพราะสามารถให้ผลผิดพลาดได้ โดยผลที่ได้อาจแสดงว่าตั้งครรภ์ แต่ความจริงไม่ได้ตั้งครรภ์

- มีเนื้องอกหรือซีสต์ (cyst) ในรังไข่
- ตั้งครรภ์นอกมดลูก
- คลอดบุตรหรือแท้งมาไม่เกิน 2 เดือน
- ได้รับยาฉีดที่มีฮอร์โมนเอชซีจี

2. ข้อจำกัดในการใช้

การใช้ชุดทดสอบในกรณีต่อไปนี้สามารถให้ผลผิดพลาดได้ เพราะผลที่ได้อาจแสดงว่าไม่ตั้งครรภ์ แต่ความจริงตั้งครรภ์

- กรณีปัสสาวะขุ่น มีตะกอนเห็นได้ชัด
- ทดสอบในผู้มีประจำเดือนมาไม่สม่ำเสมอ
- ทดสอบก่อนถึงวันที่ประจำเดือนไม่มาตามกำหนด

ข้อควรรู้เพิ่มเติม

1. ความรู้เกี่ยวกับเอชซีจี (hCG)

เป็นฮอร์โมนที่หลั่งจากรกภายหลังไข่ถูกผสมแล้ว โดยจะเพิ่มปริมาณอย่างรวดเร็วเป็นเท่าตัวในทุก 2 วันของอายุครรภ์ และจะสูงสุดในสัปดาห์ที่ 8–11 ของการตั้งครรภ์

2. ส่วนประกอบของแผ่นทดสอบ

- แอนติบอดีต่อเอชซีจีซึ่งย้อมสีชมพูแดง
- สารโซเดียมเอไซด์ 0.1 %

3. ประสิทธิภาพชุดทดสอบ

- แม่นยำ 99 % โดยผลจะแม่นยำมากที่สุด หากทดสอบหลังจากประจำเดือนขาดเกิน 1 สัปดาห์
- ให้ผลตั้งครรภ์ในผู้ตั้งครรภ์ที่มีเอชซีจีมากกว่า 25 mIU/ปัสสาวะ 1 ซีซี และให้ผลไม่ตั้งครรภ์ในคนทั่วไปที่แข็งแรง
- ถ้าพบแถบสีชมพูที่ตำแหน่งอ้างอิง (ซี) แสดงว่า แผ่นทดสอบมีคุณภาพ ทดสอบถูกวิธีและปัสสาวะเพียงพอ
- ผู้ได้รับยาอื่นๆ เช่น ยาแก้ปวด ยาเม็ดคุมกำเนิดฯลฯ สุราหรือเครื่องดื่มที่มีแอลกอฮอล์สามารถใช้ชุดทดสอบนี้ได้

ปรึกษาหรือขอข้อมูลเพิ่มเติมได้จากเภสัชกรประจำร้านขายยาหรือ

ผู้ผลิต บ.ไทยแลนด์ไดแอก จำกัด
เลขที่ 9 ถ.สุขุมวิท อ.ศรีราชา จ.ชลบุรี
☎ 0-38221260-5

ผู้จำหน่าย บ. ไทยแลนด์เฮลท์ จำกัด
เลขที่ 3 ถ.สุขุมวิท คลองตัน กทม.
☎ 0-22601738

ฉบับ 11/10/2549

APPENDIX K

Experts' Validation on HPT Labeling Prototype

The validation by experts were conducted for 2 rounds on HPT Labeling Prototype as following

1. The first round

1.1. The experts were composed of following 7 persons

1.1.1. one expert in Thai language

1.1.2. one expert in language from Royal Institute

1.1.3. one physician specialized in obstetrics and gynaecology from government hospital,

1.1.4. one faculty member (medical technologist) of the government academic hospital

1.1.5. one medical technologist from private sector who had experience in HPT product manufacturing and marketing, and

1.1.6. two pharmacists as authorized regulators (1 in Pre-marketing and 1 in Post-marketing Control Sector) from Medical Device Control Division of Thai FDA.

1.2. The perceptions and suggestions of the above experts could be summarized as

1.2.1. Design quality

(1) The print sizes

They were perceived by almost experts as small but still able to read. Some of them suggested that they should be designed to be in more proper size and looked interesting to be read. Furthermore, the prints should not be too emphasized due to eye disturbance. The highlighted ones should be only for the main titles e.g. benefits, use instructions, etc.

(2) The line length and line spacing

They were expressed by almost experts as too long sentence and too small space.

(3) Information organization

Many experts expressed that the information organization in formulated HPT labeling has some problematic issues. One medical professional expert specified that storage and warnings as well as precautions should be at the end of the package insert. However, the expert in Thai language had the opposite opinion and suggested for the revived in some information sequences for less confusion and easier to be read. Her recommended statement was as

"The new orders and grouping of such contents should be respectively as benefits and details of product; content and its component per pack; storage, warning or precautions, and factors helping in achieving the correct result interpretation; urine collection, test method, and result reading. The part of urine collection, test method, and result reading have to be in continuing presentation and rearrange to be easier to be read. These details are the most important part to be emphasized and indicated in highlighted location. Moreover, this part must not be after the part of the limitation in testing."

1.2.2. Utility/contents

(1) Amount of information

All experts with medical professionals expressed as enough information in provided labeling and did not mention any comments about this issue. The expert in Thai language also had the same perception but she gave much valuable opinion in such aspect. She specified as **"It should not have too much information because the lay consumers might want to know only what this product is, its principle and benefits, and how to use it as well as its warning or precautions. Some details are not necessary to be labelled because the lay users might not feel like to read all topics. If any information is still needed to be specified, it should be summarized or partly deleted or indicated only the most important one. For example, the limitation in testing is not necessary to be cited in HPT labeling. Oppositely, if it needed to be indicated it should be in shorter and more concise explanation, or be less emphasized. Otherwise, the consumers might feel no confidence in using such product".** This suggestion could also reflect the need of lay consumer due to her unfamiliarity in medical knowledge.

The above opinion was consistent with the finding of Patricia A. Kingsley on medical device labeling in patients' and caregivers' needs that there was disagreement to the length and depth of information that was ideal. It was found that a few wanted everything to know with complete with statistical information from the clinical trial. On the other hand, most participants wanted just the basic information in condensed with plain English, and predigested information that focused on the most important issues. Participants agreed that scientific information might be useful but could be available through the customer assistance number rather than in the basic patient labeling (51).

(2) The usefulness of Information

All of experts expressed as much valuable of HPT labeling.

1.2.3. Comprehensibility (difficulty level of information finding, reading, comprehension, and memorization); could be summarized as follows:

(1) Information finding and reading

More than half of experts specified for hard to find the information; or some easy and some hard in the information locating in such labeling.

(2) Information comprehension and memorization

Most experts expressed as hard to remember labeling information whereas nearly half of them specified as some easy and some hard in understanding and memorizing such details. The incomprehensibility details specified by the experts were as the product description, technical information, some part of test method (e.g. maximum dipping level of urine test strip, waiting time before result reading should not be indicated in range), and proposed information of "retest with other test kit" to be added in the inconclusive result for clearer understanding.

(3) The language used in some contents should be somewhat revised.

1.3. General Perceptions

1.3.1. The needed information for HPT labeling

An expert in Thai language expressed that the possible error was not important for the lay consumer. However, the other experts thought that all contents in such labeling was necessary.

1.3.2. The most attractiveness before and after reading the HPT labeling

(1) before reading

Almost experts expressed their most impressions as the drawing of test method and result reading whereas only an expert in Thai language revealed as the HPT product trade name.

(2) after reading

The result in this aspect was also the same as before reading the HPT leaflet. All experts in medical professionals had nearly the same expressions in their most impressions as the issue about drawing of test method and result reading whereas one expert specified as the specimen collection, test method, and its result interpretation and the other one cited as result reading. On the other hand, the expert in Thai language specified her most impression as HPT storage instruction.

1.3.3. Some suggestions from the experts

(1) Image

An expert in medical professional from Thai FDA expressed positively that the package insert gave clear and enough information in details. Whereas the expert in Thai language negatively specified that the product looked uninteresting and difficult to use.

(2) Recommendation to the manufacturer

Two experts in medical professional proposed that the print type and size should be improved to be more readable and not too much emphasized due to eye disturbance. The examples of highlighted information are as benefits/intended use, test method, etc. The other expert specified that the details about the product disposal in such leaflet could not communicate how to dispose such HPT. However, the one with Thai language expertise advised that the information should be somewhat taken out to reduce the confusion to the lay consumers.

From all of the above results, it was clearly demonstrated that the opinions of experts in different specialties had somewhat dissimilar perceptions in their realization. In actually, the medical professionals are usually the ones who develop and improve the health product labeling whereas the lay people are generally the users. The Thai language specialist in this study could be represented for the lay people due to their less medical knowledge. Therefore, the consumer testing was needed in the development of health product labeling Moreover; it should be more emphasized to better serve the lay users to achieve their most benefits in product utilization from the provided package insert. The 1st draft of HPT labeling prototype (Appendix E) was revised as the above recommendations to obtain the 2nd draft for further reviewed by the other group of experts in the 2nd round.

2. The second round

2.1. The experts were composed of the following 7 persons:

2.1.1. one linguistic expert from Language Institute of the government university, and 1 expert from Royal Institute of Thailand,

2.1.2. two medical technologists from private sector who involve in IVD product registration and marketing,

2.1.3. a faculty member (medical technologist) of the government academic hospital

2.1.4. two pharmacists as authorized regulators (1 in Pre-marketing and 1 in Post-marketing control sector) from Medical Device Control Division of Thai FDA

2.2. The perceptions and suggestions of the above experts on the revised HPT labeling prototype could be summarized as follows:

2.3.1. Design quality

(1) The print sizes and line spacing

All experts expressed for suitable print sizes and line spacing except one cited as too large and one from Royal Thai Institute specified as too little print size. Moreover, both of them expressed as too small line spacing.

(2) Printing quality

All experts specified as proper printing quality. However one of them recommended for improving this aspect of the product name in the package insert.

(3) Information organization

One medical professional expert cited as improper sequence of contents and 3 specified as somewhat proper. Moreover, they suggested that

- Some sequences should be changed e.g. contraindications and test limitations should be indicated directly after result reading for facilitating the correct result interpretation,
- Test principle should be indicated after the benefits/intended use or in the part of some further knowledge, and
- Test performance was already proper to be cited at the end of package insert.

2.3.2. Utility/contents

(1) Amount of information

All experts except one medical professional expressed for enough information. The amount of “1 piece” of cup for urine collection, were suggested to be added in the HPT leaflet.

(2) The usefulness of Information

All of experts expressed as much valuable of HPT labeling.

2.3.3. Comprehensibility (difficulty level of information finding, reading, comprehension, and memorization)

Some incomprehensibility details indicated and commented by the experts were as

(1) the rationale of "retesting within 48 hours after obtaining the inconclusive result" from the 1st test and the information about "the coating with hCG antibody to goat at the control line of test strip",

(2) the knowledge about hCG hormone,

(3) False-positive result,

(4) Internal quality control, and

(5) The details under title "Disposable of used materials".

2.3. General perceptions

2.3.1. The needed information for HPT labeling

All experts specified that all proposed information were the details necessary for the HPT labeling. However, one expert proposed for the additional information about "Physician's consultation for result confirmation and further suggestion" in the package leaflet.

2.3.2. The most attractiveness before and after reading the HPT labeling

Some experts expressed their most attractiveness as the drawing of test method and result reading whereas 1 specified for the details in such leaflet (e.g. test method, result reading, etc.).

(1) Before reading

Almost experts expressed their most attractiveness as the drawing of test method and result reading. The rests were specified as directions for use and result reading, simple language (easy to understand), information presentation, and proper print size.

(2) After reading

There were varieties of most attractiveness after information reading. They were the clear drawing of test method with result interpretation, the text of test method, result reading, complete information, and obvious information heading with accompanied drawings.

2.3.3. Some suggestions from the experts

(1) Image

One expert expressed her feeling about the image of packaging as reliable labeling.

(2) Recommendation to the manufacturer

The email address of responsible manufacturer was suggested by an expert.

Note: The other perceptions that were not specified in this part because they were all accepted by the experts.

The 1st and 2nd draft of HPT labeling was improved by the researcher as recommendations of the above experts to obtain the 3rd draft (see Appendix I) for further tested by the lay consumers except the email address due to the concern of some possible confusing to the lay users.

APPENDIX L

Labeling Image and Proposed Opinions of Lay Users (Phase III)

1. The details in labeling image of lay users proposed to manufacturer were illustrated as following:

1.1. Positive image in

1.1.1. Labeling (2nd round): look nice and interesting; ease more understanding, large prints

1.1.2. Packaging or outer label

1.1.2.1. 1st round: like, beautiful, nice picture could well communicate to the product benefits specific for women

1.1.2.2. 2nd round: beautiful [5], colour (natural looking, plain and attractive colour, beautiful pink give free feeling and relax) [5], big package, the picture of a lady on the outer label (like it, natural colour, nice picture could well communicate to the product benefits specific for women, beautiful, interesting and could well communicate to the product benefits),

1.1.3. Good impressive images and several interesting issues with varieties of reasons. The examples of their explanations were as follows

1.1.3.1. 1st round: contents (like details in leaflet),

1.1.3.2. 2nd round: contents (like details on the outer label); clear, complete, easy to understand information, its benefits (know whether pregnant or not), Thai FDA license number

1.1.4. Texts provided with drawings

1.1.4.1. 1st round: glad to have the opportunity to use this product

1.1.4.2. 2nd round: could ease more understanding, easy to buy and storage

1.2. Negative image

1.2.1. Drawing in the 1st round should be clearer and easier to result interpretation.

1.2.2. Picture on outer label in the 1st round can't communicate and picture of women during testing or handling the test strip was proposed.

1.2.3. Packaging should have

1.2.3.1. 1st round: smaller size of packaging, brighter package colour, more attractive colour

1.2.3.2. 2nd round: package with smooth and shiny surfaced

1.2.4. Package leaflet should

1.2.4.1. 1st round: be colour paper, both side printing for more attractive.

1.2.4.2. 2nd round: have fewer details.

1.2.5. Outer label should have clearer prints and in darker colour (2nd round).

2. Proposed Opinions of Lay Users to the Manufacturer

No.	Aspects of details needed & recommendations	no. lay
1.	**Design quality**	
1.1.	**Print face**	1
(1)	unclear & small print size should be improved e.g. dipping drawing, manufacturer., control & test band, etc. [0,1]	(1)
1.2.	**printing quality** e.g. color	**3**
(1)	leaflet should be clearer printed [1,0]	(1)
(2)	should improve for clearer & more distinction of outer label e.g. darker color, clearer drawing [0,1]	(1)
(3)	color & prints on outer label should be more highlighted/darker [0,1]	(1)
1.3.	**lines spacing**	**1**
(1)	each heading should have 1 free line spacing to ease the reading [1,0]	(1)
1.4.	**labeling format/design**	**3**
(1)	color paper with both side printing of leaflet for more interesting [1,0]	(1)
(2)	should be more beautiful [1,0]	(1)
(3)	trade name at the beginning of leaflet should be longitudinal enlarged to cover all 4 columns, up to the right hand side of the 1st line of leaflet. [0,1]	(1)
1.5.	**Drawings**	**8**
(1)	beautiful picture of a lady on outer label caused good image [0,1]	(1)
(2)	comments & suggestions	
	• unclear drawing [1,0]	(1)
	• should be clearer & easier to interpret [1,0]	(1)
	• need text to explain drawing [1,0]	(1)
	• picture on outer label can't communicate to product use [1,0]	(1)
	• unclear drawing on outer label as in leaflet due to black color [1,0]	(1)
	• color of strip drawing should be the same as the provided one [0,1]	(1)
	• too pale of dipping drawing [0,1]	(1)
1.6.	**Interesting due to packaging**	**8**
	• like packaging [1,0] because drawing of test method ease understanding [0,1]	(2)
	• quite nice package & like lady picture on outer label [1,0]	(1)
	• beautiful package but it should be glazed [0,1]	(1)
	• nice & look interesting [0,1]	(1)
	• beautiful and provided with drawing at the back side of outer label, big packaging [0,1]	(1)
	• interesting due to the picture of a lady can communicate to the specific use for women, attractive color of outer label [0,1]	(1)
	• its attractiveness, natural looking in packaging [0,1] caused good image	(1)
1.7.	**suggestions about packaging**	**13**
(1)	the picture of a nice lady was found to serve most lay participants because it could well communicate to product benefits and not link to the baby. Moreover, most of the lay users had no willing to be pregnant and didn't want anyone to know. [1,0]	(1)
(2)	the picture on the outer label should be added for more interesting e.g. drawing of women during testing or handling the test strip [1,0]	(1)
(3)	outer label should be more colourful because it's too pale [1,0] e.g. on the outer label background [1,0], brighter [1,0], nicer colour, and [1,0] darker pink colour [0,1]	(5)
(4)	should be in smaller size [3,0] e.g. about half smaller for easy to keep and less embarrassment [1,0]; too big package (it should be longer but smaller	(5)

No.	Aspects of details needed & recommendations	no. lay
	than this to ease in product handling) [0,1]	
(5)	the colour of packaging should be nicer and can encourage the product utilization (beautiful packaging could well attract the customer for better merchandise especially when presenting together with the other brands) [0,1]	(1)
	Total (before 21, after 16)	**37**
2.	**Utility/contents**	
2.1	**amount or content/pack:** should have 2 strips in 1 pack [0,1]	**1**
2.2	**contraindications**	**5**
(1)	clear citing who are contradict to use HPT e.g. after alcohol [1,0]	(1)
(2)	should be separated from error [1,0]	(1)
(3)	"Contraindications & limitations" should be cited in concise information but coverage all needed details [1,0]	(1)
(4)	the contents in the remark [NB]	
	• cause misunderstanding for "situation proper to use the test", then better citing about "situation or who can use this test" instead of "….no effect on testing result" [1,0]	(1)
	• "contraindications number 1" should be separated in the other number because it could mislead and be hard to notice [1,0]	(1)
2.3	**possible error/false result:** too much details make confusion [1,0]	**1**
2.4	**result interpretation/reading**	**2**
(1)	no "T" & "C" in actual product as explanation in the leaflet [0,1]	(1)
(2)	should be improved [0,1]	(1)
2.5	**expiry date:** should be in main part of outer label [1,0]	**1**
2.6	**lot number:** useful to the entrepreneur, not the lay users. [1,0]	**1**
2.7	**manufacturer:**	**2**
(1)	should be in the main part of the outer label [1,0]	(1)
(2)	unclear print size should be improved [1,0]	(1)
2.8.	**Disposal** of used test kit was not necessary to be indicated due to its generally known by the lay users [1,0]	**1**
2.9.	**The uninterested terms** for the lay users might be hCG, medicinal names (Pergonal, Profasi), etc. [1,0]	**1**
2.10.	**details on the outer label & in leaflet**	**3**
(1)	details on outer label caused good image but too many details in leaflet [0,1]	(1)
(2)	like details in leaflet [1,0]	(1)
(3)	To let us know whether pregnant or not, caused good image [0,1]	(1)
2.11.	**product price**	**2**
(1)	is needed for comparing to cost in consulting with physician [0,1]	(1)
(2)	should be indicated as drug to check for the reasonable price [0,1]	(1)
	Total (before 13, after 7)	**20**
3.	**Comprehensibility**	
3.1.	Thai labeling is very much necessary to the lay consumers due to their unknown in English [1,0]	(1)
3.2.	be glad to use and get the negative (-ve) result [1,0]	(1)
3.3.	"easy to find information" need colorful format, interesting drawings, user intention to read and observe [0,1]	(1)
3.4.	it eased more understanding caused good image [0,1]	(1)
	Total (before 2, after 2)	**4**
4.	**Test strip** is too small and hard to handle [0,1] (before 0, after 1)	**1**
5.	**No comment** because I like this labeling [0,1] (before 0, after 1)	**1**
	Overall total	**63**

[NB] [1, 0] = comments in the 1st round; [0,1] = comments in the 2nd round

APPENDIX M

Further Details of HPT Labeling Prototype from Individual Interview

1. Amount/pack:

1.1. too small prints on outer label and on the box side made it hard to find (1,0)

1.2. incorrect answering as “3 test” was due to the wrong implication from the real product as leaflet, test strip, urine container (0,1)

1.3. answer as details in labeling

2. Intended use: right answer was due to clear prints and easy to understand after reading (1,0)

3. Precautions: wrong answer was due to answering as

3.1. “further action” after result reading (1,0)

3.2. "contraindications” (1,0)

4. Contraindications:

4.1. contraindications finding: content hard to understand (1,0)

4.2. wrong answering as limitations (3) (1,0)

4.3. wrong answering because unable to understand their details (1,0)

4.4. wrong answering as "positive (+ve) result" (1,0)

5. Component: wrong answer due to the replying as

5.1. "strip component" (3) (1,0)

5.2. headings of all contents in leaflet (1,0)

6. Urine collection should be indicated in more distinct way (0,1)

7. Reading time is wrong due to answer as “1 minute instead of 5 minute” (2) (1,0)

8. Result reading:

8.1. positive result: answer the same as positive (-ve) result (1,0)

8.2. invalid result: don't know whether "unsure" & "invalid" are the same? (1,0)

9. Expiry date: too small prints on outer label and placing on the box side made it hard to find (should be on the main part) (1,0)

10. Manufacturer/importer:

10.1. too small prints on outer label & place on the box side made it hard to find (1,0)

10.2. on outer label should be improved to be more larger prints (0,1)

11. Distributor finding: too small prints on outer label & place on the box side made it hard to find (1,0)

12. False positive (+ve)/negative (- ve) result is

12.1. hard to find so it should be more distinct by larger print (1,0)

12.2. wrong answer so they should stress which one true or false for easier to understand (0,1)

12.3. wrong answer due to (0,1)

12.3.1. can't understand content in "contraindications"

12.3.2. answer as "no" due to "99% accurate" & all information is given, how can it could be wrong?

12.3.3. imply from accuracy 99 %

13. Source for further information is

13.1. hard finding on outer label (0,1)

13.2. wrong answer due to replying as

13.2.1. leaflet (2) (1,0)

13.2.2. outer label & leaflet (1,0)

13.2.3. lady magazine (1,0)

13.2.4. drugstore (1,0)

13.3. “can’t find & no answer” (1,0)

13.4. "in pregnancy test kit" (1,0)

13.5. "in box" (1,0)

14. Urine situation for testing:

14.1. “1st morning urine” is wrong due to can't find & don't know (3) (1,0)

14.2. “before going to bed” (1,0)

14.2.1. answer is wrong due to can't find & don't know

14.2.2. hard to find due to the need to interpret "test any time" before answering

14.3. “after alcohol drinking” answer is wrong due to ability to find details but hard in interpretation (1,0)

14.4. miscarriage is (1,0)

14.4.1. right answer is due to understand well

14.4.2. hard to find because of its unclear explanation and it needs reading, trying to understand (1,0)

14.5. “Ectopic pregnancy”

14.5.1. right answer but not well understanding (1,0)

14.5.2. hard finding because of its unclear explanation, and it needs reading, trying to understand (1,0)

14.6. “Ovarian cyst”: hard to find because of its unclear explanation and it needs reading, trying to understand (1,0)

14.7. “drug with hCG hormone”

14.7.1. wrong answering due to “can't find don't know” (2) (1,0)

14.7.2. hard finding because of its unclear explanation, and it needs reading, trying to understand (1,0)

14.8. “contraceptive”: wrong answering due to “can't find and don't know” (2) (1,0) (0,1)

14.9. “pain killer” answer is wrong due to “can't find and don't know” (0,1)

Note: the number in ( ) showed the amount of answer: (1, 0) = 1st round, (0, 1) = 2nd round

BIOGRAPHY

NAME: Sumalee Pornkitprasarn

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EDUCATION DATA:

1973: Saint Joseph's Convent School (High school Education)
1977: Mahidol University (B.Sc.)
1980: University of Santo Thomas (B.S. Pharm)
1990: Thammasart University (B.S. Law)
1994: Mahidol University (M.P.H.) (Public Health Administration)

WORKING EXPERIENCES:

1. Drug Control Division, Thai Food and Drug Administration (1980 – 1989)
2. Medical Device Control Division, Thai FDA (1989 - present)
3. Guest lecturer, Culalongkorn University and Mahidol University (1994 – present)

TRAINING EXPERIENCES:

1. Pharmaceutical Technology, Ghent University, Belgium (1984)
2. Good Manufacturing Practices (GMP), Upjohn Laboratory, UBC FARCHIM S.A., Belgium (1984)
3. Technique in Pharmaceutical Inspection, Ministry of Health, Belgium (1985)
4. Health Consumer and Behavior Science Research, The Robert Gordon University, U.K. (1997)
5. Lead Auditor ISO 9000, QMI Quest (1998)
6. ISO 13485/13488 Quality System of Medical Device (2000)
7. Sampling Technique and Statistical Control (2000)
8. EU Medical Directive and their Implementation (2001)
9. ISO 9000..2000 Introduction and Documentation (2001)
10. Application to Global Harmonization of Medical Device Regulations, Therapeutic Government Administration (TGA), Australia (2003)

RESEARCH WORK:

1. Deterioration of Condoms under the Use with Additional Lubricants
2. Survey of Public Opinions about the Magnetic Products for Consumer Health
3. Situation analysis of Central Sterile Supplied Department of Hospital under the Ministry of Public Health in Thailand
4. The Situation and Performance of HBsAg and Anti-HCV Test Kits in Thailand
5. Data Base and System Development for Monitoring Imported Diagnostic Reagents

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RESEARCH INTERESTS:

Her research interests focusing in various issues on consumer protection and related regulations were expected to contribute back to consumers and to all healthcare stakeholders to achieve the ultimate benefits on the quality of life to Thai people and to attain the sustainable health system development in Thailand.