FACTORS AFFECTING COMMUNITY PHARMACY CUSTOMER'S DECISION TO USE PERSONAL HEALTH RECORD VIA SMART PHONES

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ปัจจัยที่ส่งผลต่อการตัดสินใจใช้ข้อมูลสุขภาพส่วนบุคคลผ่านสมาร์ทโฟนของผู้ใช้บริการร้านยา

นางสาวกัลยา ลลิตพาณิชย์

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Field of Study	Social and Administrative Pharmacy
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กัลยา ลลิตพาณิชย์ : ปัจจัยที่ส่งผลต่อการตัดสินใจใช้ข้อมูลสุขภาพส่วนบุคคลผ่านสมาร์ทโฟนของผู้ใช้บริการร้านยา (FACTORS AFFECTING COMMUNITY PHARMACY CUSTOMER'S DECISION TO USE PERSONAL HEALTH RECORD VIA SMART PHONES) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: ผศ. ภก. ดร.อนุชัย ธีระเรืองไชยศรี, 134 หน้า.

วัตถุประสงค์: เภสัชกรชุมชนควรสนับสนุนให้ผู้ป่วยมีส่วนร่วมในการดูแลสุขภาพและจัดการข้อมูลสุขภาพของตนเอง การดูแลสุขภาพตนเองช่วยป้องกันและควบคุมความรุนแรงของโรคเรื้อรัง การใช้โปรแกรมข้อมูลสุขภาพส่วนบุคคลผ่านสมาร์ทโฟนช่วยสนับสนุนให้ผู้ใช้ดูแลสุขภาพตนเองได้ดีขึ้น ในปัจจุบันยังไม่มีการใช้ข้อมูลสุขภาพส่วนบุคคลอย่างเป็นระบบในประเทศไทยจุดประสงค์ของงานวิจัยนี้คือ เพื่อศึกษาปัจจัยที่มีผลต่อการตัดสินใจใช้ข้อมูลสุขภาพส่วนบุคคลผ่านสมาร์ทโฟนโดยใช้ทฤษฎีรวมของการยอมรับและใช้เทคโนโลยี และศึกษาพฤติกรรมการใช้ของผู้ใช้บริการเภสัชกรรมชุมชน

วิธีดำเนินการวิจัย: ทำการวิจัยเชิงสังเกตและการวิจัยไปข้างหน้าตั้งแต่เดือนสิงหาคม 2557 ถึงเดือนกุมภาพันธ์ 2559 ณ ร้านยาในกรุงเทพมหานคร ทำในกลุ่มตัวอย่างลูกค้าร้านยา 72 คน ผู้เข้าร่วมวิจัยจะได้รับความรู้เกี่ยวกับข้อมูลสุขภาพส่วนบุคคลและการสาธิตวิธีการใช้โปรแกรมไมโครซอฟท์เฮลท์วอล์ท จากนั้นจึงทำแบบสอบถามก่อนใช้งาน ผู้เข้าร่วมวิจัยแต่ละคนจะได้ใช้โปรแกรมเป็นเวลา 1 เดือน โดยจะมีระบบการเตือนและติดตามการใช้งานทางโทรศัพท์หรืออีเมล์สัปดาห์ละครั้ง มีการส่งคู่มือการใช้งานให้ทางอีเมล์ หลังจากครบ 1 เดือน ผู้เข้าร่วมวิจัยทำแบบสอบถามหลังใช้งานและให้สัมภาษณ์ทางโทรศัพท์ ข้อมูลวิเคราะห์โดยใช้สถิติการวิเคราะห์ความถดถอยแบบโลจิสติก เอกสารที่เกี่ยวข้องในโครงการวิจัยทั้งหมดได้รับการรับรองจากคณะกรรมการจริยธรรมวิจัยในคนกลุ่มสหสถาบัน ชุดที่ 1 จุฬาลงกรณ์มหาวิทยาลัย

ผลการวิจัย: ปัจจัยหลักที่มีผลต่อการตัดสินใจใช้ข้อมูลสุขภาพส่วนบุคคลอย่างมีนัยสำคัญคือ อิทธิพลของคนรอบข้าง ($p = 0.00$) และความคาดหวังประโยชน์จากการใช้ ($p = 0.03$) ปัจจัยด้าน ความคาดหวังประโยชน์จากการใช้, ความคาดหวังความพยายามในการใช้, อิทธิพลของคนรอบข้าง, และความสมัครใจในการใช้ สามารถรวมกันอธิบายการตัดสินใจใช้ข้อมูลสุขภาพส่วนบุคคลได้ 60.0% ในกลุ่มผู้เข้าร่วมวิจัยที่ใช้ข้อมูลสุขภาพส่วนบุคคลทั้งหมด 26 คนใช้ฟังก์ชันเพื่อการควบคุมน้ำหนักมากที่สุด ความถี่ในการใช้งานเฉลี่ยสัปดาห์ละครั้ง เหตุผลหลักที่คนใช้ข้อมูลสุขภาพส่วนบุคคลน้อยในมุมมองของผู้เข้าร่วมวิจัยคือ เห็นว่าไม่สำคัญสำหรับผู้มีสุขภาพปกติ, มีภาระจากการบันทึกข้อมูล, ข้อมูลสุขภาพส่วนบุคคลยังไม่เป็นที่รู้จักในสังคม, และการใช้งานไม่สอดคล้องกับกิจวัตรประจำวัน

ผลสรุป: อิทธิพลของคนรอบข้างและความคาดหวังประโยชน์จากการใช้คือปัจจัยหลักที่มีผลต่อการตัดสินใจใช้ข้อมูลสุขภาพส่วนบุคคลของผู้ใช้บริการเภสัชกรรมชุมชนโดยใช้ทฤษฎีรวมของการยอมรับและใช้เทคโนโลยี ในการส่งเสริมการใช้ข้อมูลสุขภาพส่วนบุคคล บุคลากรทางการแพทย์ควรช่วยให้ความรู้, สอนการใช้, และให้คำแนะนำในการพัฒนาสุขภาพจากการดูข้อมูลที่บันทึกในข้อมูลสุขภาพส่วนบุคคล ควรมีการโฆษณาประชาสัมพันธ์ให้เป็นที่รู้จักมากขึ้น ทำให้ประชาชนตระหนักถึงความสำคัญและประโยชน์ข้อมูลสุขภาพส่วนบุคคล นอกจากนี้ โปรแกรมข้อมูลสุขภาพส่วนบุคคลควรพัฒนาให้ใช้งานง่าย สามารถถ่ายโอนข้อมูลได้อัตโนมัติ มีฟังก์ชั่นการใช้งานที่ตอบสนองความต้องการของผู้ใช้ สิ่งเหล่านี้จะช่วยสนับสนุนให้เกิดการใช้ข้อมูลสุขภาพส่วนบุคคลเพื่อเป็นเครื่องมือช่วยในการดูแลและพัฒนาสุขภาพของตนเองให้ดียิ่งขึ้น

ภาควิชา เภสัชศาสตร์สังคมและบริหาร ลายมือชื่อนิสิต .....

สาขาวิชา เภสัชศาสตร์สังคมและบริหาร ลายมือชื่อ อ.ที่ปรึกษาหลัก .....

ปีการศึกษา 2558

5576354633 : MAJOR SOCIAL AND ADMINISTRATIVE PHARMACY
KEYWORDS: PERSONAL HEALTH RECORD / HEALTH APPLICATION / SMARTPHONE / SELF-CARE / TECHNOLOGY ADOPTION BEHAVIOR

KANLAYA LALITAPHANIT: FACTORS AFFECTING COMMUNITY PHARMACY CUSTOMER'S DECISION TO USE PERSONAL HEALTH RECORD VIA SMART PHONES. ADVISOR: ASST. PROF. ANUCHAI THEERAROUNGCHAISRI, Ph.D., 134 pp.

Objectives: Community pharmacists should support patients to do self-care management. Self-care can help to prevent and control the severity of chronic diseases. Having a personal health record application on a smartphone can support individual to do self-care. At present, personal health record system has not been systematically implemented in Thailand yet. The aims of this research are to identify factors affecting customers' decision to use a personal health record on a smartphone based on the unified theory of acceptance and use of technology (UTAUT) theory and to investigate behavior of use.

Methods: An observational and prospective study design was conducted from August, 2014 to February, 2016 at drug store in Bangkok. A total of 72 customers were selected. All received an explanation about PHR and were shown how to use the Microsoft Health Vault application. A prior-use self-administered questionnaire was conducted. Participants were asked to use the PHR for a month. During that period, the reminder and follow up system was conducted weekly by phone and email. Manual guides also provided. After one month, they were asked to do a post questionnaire and participated telephone interview. The data analysis was performed using logistic regression and descriptive statistical analysis. All study-related documents were approved by the Ethics Review Committee for Research Involving Human Research Subjects, Health Science Group, Chulalongkorn University.

Results: The key factor significantly affecting intention to use PHR were social influence ($p = 0.00$) and performance expectancy ($p = 0.03$). The result showed that performance expectancy (PE), effort expectancy (EE), social influence (SI), and voluntariness (Vol) together explained 60.0% of the variances for the intention to use PHR (INT). Among 26 used participants, weight control function was most used. The average frequency of use was about once a week. The major reasons of less use PHR included unnecessary for healthy people, manual data entry burden, little well known to public, and not get along with daily lifestyle.

Conclusion: Social influence and performance expectancy were key factors influencing the intention to use PHR via a smartphone of customers based on the unified theory of acceptance and use of technology (UTAUT) theory. To enhance the intention to use PHR, health professionals should motivate and help patients to use PHR by educating how to use, give feedbacks how to improve health from health data recorded in PHR. Public promotion and social advertisement should be done to make PHR use much well-known. These will make people acknowledge the importance and advantages of PHR. Besides, PHR application should be developed to be easy to use such as automatically data transferring, include features and functions based on end-user's needs. These will encourage users to employ a PHR as a self-care tool to improve their health status.

Department: Social and Administrative Pharmacy Student's Signature .....
Field of Study: Social and Administrative Pharmacy Advisor's Signature .....
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CHAPTER I

INTRODUCTION

1.1 Brief Background

In 2008, the World Health Organization (WHO) reported about 63% of deaths were due to non-communicable diseases(1). The World Health Organization (WHO) has reported about 31% of adults are insufficiently active and about 3.2 million people have died each year because they have done insufficient physical activities. Moreover, treating chronic diseases leads to significantly increased healthcare expenditures(2). Lifestyle modification and self-care are important factors which help to prevent and control the severity of chronic diseases. Good medication adherence, self-care, and health behavior modification such as dietary control and exercise could help chronic patients to reduce risks of complications and improve their quality of life(3).

Now the lifestyle of people has been changed from the past. Most people use computer and internet for their way of life like to support their work, more convenient communication. Most people use mobile phone to communicate with others and provide more convenient to their lives such as shopping, financial management(4). The use of mobile phone in China and India has more than 70% of their populations(4). About 1.5 billion Chinese people use mobile phone(5). In 2013, the mobile phone users in Thailand are about 88.9 million people. Among this group, the number of people who use the smart phone is around 22 million people or about 25%. Moreover, the mobile internet users have increased from 24 million to 36.4 million people in year 2013. More than fifty million of new smart phones were shipped worldwide in the first quarter of 2010(4). About 29.7% of the US mobile phone market consists of smart phones and iPhone and BlackBerry are leading in the market share in 2012(4). These rapid growths of using smart phone and mobile internet have shown that most Thai people usually use smart phones and mobile internet in their daily life. For healthcare sciences, there is an idea to apply

information technology to help promote communication between healthcare providers and patients and improve quality of care. Nowadays, people have learned more education about healthcare. They are interested to get health information in order to maintain their health or select the suitable treatment. Patients are the owner of their health data. The law and regulation of many foreign countries set the privacy and security of the data, so patients have rights to control the access to the data and share the health data with trust people.

A personal health record (PHR) defined as "an electronic application through which individuals can access, manage and share their health information, and that of others for whom they are authorized, in a private, secure, and confidential environment anytime and anywhere, is co-controlled by both patient and health professionals. It is one of the advantageous tools available for healthcare management and self-care monitoring(6). Basically, the personal health record will contain the information about identification data, health problem, medication use record, past medical history, family history, progress note, physician consultation, physicians' orders, lab results, imaging and x-ray data, immunization record, and consent or authorization form. The health organizations of many countries are interested in provide the use of personal health record because they believe that PHR can help to increase the patients' participation to their health management. When patients can take care and monitor their health, their health outcomes will be improved and the overall healthcare costs will be decreased. In New York, the PHR use has increased from 11% in 2012 to 17% in 2013. The healthcare providers have increased the PHR provision from 50% in 2012 to 73% in 2013. The Center for Information Technology Leadership has recommended that the United States could save healthcare costs more than $21 billion a year if about 80% of patients have actively engaged in using PHR by year 2018(7). The National Health Service of England has tried to make all patients have their own PHR by 2015(8). However, personal health record widespread use hasn't been much success. There are many challenges and barriers to use it such as

- There isn't any standard format of health information in the personal health record because health data is quite complicated and variety.
- Most the design of PHR system and functions haven't concerned about the users' needs(8).
- The privacy, security, and confidentiality policy and regulations
- The difficulty of integrating PHR to the electronic health record (EHR)(9)
- The interoperability and technical challenges: The PHR system should have the standard technological infrastructure to exchange the health information with other health information systems and have trusted privacy and security protocols(10).
- The design and usability challenges: the PHR should be useful and have usability characteristics such as effectiveness, efficiency, enjoy ability, learn ability, memorablility, and safety.
- The correctness and completeness of health data entered(9)
- Using medical terminology will be difficult for patients to understand(9)
- The different understanding level of various people involved in PHR system
- Costs(10)

This brings the difficulty in managing, sharing, or integrating to other systems.

The Thai government has realized the importance to provide continuity of care and prevent more severe complications related to the chronic diseases like diabetes, hypertension. Therefore, the Ministry of Public Health has implemented the accredited community pharmacies in the universal coverage benefit scheme project. This project has goals to increase the access to care and stimulate other related health organization and people to take part in healthcare. About 100 accredited community pharmacies of this pilot project do many activities like screening patients' risk of having chronic diseases, medication use monitoring, home health care visit. These activities will help to increase communication between patients and

healthcare providers. Healthcare providers can educate patients to take care their health and prevent themselves form severe diseases. One of the primary healthcare services offered by community pharmacists is health promotion and prevention. Pharmacists should support patients to take part in health information management and self-care management to make healthcare services more effective.

1.2 Rational and Statement of the Problem

Although there are many health and fitness applications available to smartphone users that can facilitate self-care tools embedded in daily routine activities of individuals, few people have adopted and continuously use them. Since a personal health record application on smartphone is a new tool for supporting healthcare, there is limited medical research to have been conducted to date(6). The aim of this study is to understand factors affecting the decision to use a personal health record via a smartphone of community pharmacy customers. The study was conducted based on the unified theory of acceptance and use of technology (UTAUT) theory, which was formulated by Venkatesh. It is a behavioral theory developed from the technology acceptance model (TAM) and is widely used to study user acceptance of information technology. Therefore, this theory is suitable to use in this study to identify factors influencing the intention to use a personal health record via smartphone. The result from this study would benefit in encouraging personal health record use via smartphone in the future.

1.3 Purpose of the study

1. To explore factors affecting community pharmacy customer's decision to use personal health record via smart phones
2. To investigate community pharmacy customer's behavior of using personal health record via smart phones

1.4 Research Questions

1. Which factors affecting community pharmacy customer's decision to use personal health record via smart phones?
2. What are the characteristics of community pharmacy customer's behavior of using personal health record via smart phones?

1.5 Scope of the study

1. The Personal Health Record
    - Definition, types, and health information composition
    - Benefits of PHR to healthcare management
    - Personal health record in community pharmacy
2. The Health Vault (the mPHR application)
    - Features and functions
    - Instructions to use the apps
3. Mobile personal health record use behavior
    - Related health behavior theories

1.6 Expected Benefits

Understanding factors affecting community pharmacy customer's decision to use personal health record via smart phones and their use behavior will be benefit to proposed strategy to enhance personal health record use.

CHAPTER II

LITERATURE REVIEW

2.1 Health information evolution in Thailand

The health information evolution in Thailand can be divided in three ages. First age, patient data is documented in paper-based. The data is stored at the hospital like “physician centric”. The second age, people try to use information technology to help managing the healthcare system. The patient data is stored as the electronic medical records and personal health records. However, the healthcare sciences have attempted to use information technology to support the treatment more efficiently. The Ministry of Public Health has attempted to reform the health information system by integrating each health information systems of all healthcare providers, health organizations, and health insurance schemes together(11). They try to change the physician centric to the “patient centric” which treatment and dispensing is specific for each individual patient. The third age, people have tried to expand from the electronic health to the mobile health. The mobile devices are used to support health management.

2.2 Definitions of related health information systems

Electronic Medical Record (EMR) is defined as the electronic health information and notes created, recorded, and managed by healthcare provider. The data is used only within one organization for decision making to diagnosis, treatment, and monitoring patients to improve quality of care. EMR is more valuable than paper health record because health professional can track health data over time.

Electronic Health Record (EHR) is defined as the electronic health information that is collected from all healthcare providers that involve in that patient’s care. The health information is managed by healthcare professionals. All relevant healthcare providers can access and share the health information together in order to provide healthcare services. The EHR can support healthcare activities suchas evidence-based

decision support, quality management, and health outcomes reporting. It also enhance closer relationship between patients and physicians.

The Markle Foundation has defined the personal health record is “An electronic application through which individuals can access, manage and share their health information, and that of others for whom they are authorized, in a private, secure, and confidential environment(7, 12).”

The International Standards Organization (ISO) (2009) has defined the definition of an individual’s personal health record is “A repository of information considered by that individual to be relevant to their health, wellness, development and welfare, and for which that individual has primary control over the record’s content(9).”

The adapted definition from a NAHIT report (2009) of the personal health record is an individual’s electronic record of personal health information (PHI) that incorporates nationally suggested interoperability standards. It can be accessed and reviewed from multiple sources, and it is constantly organized, controlled, and disseminated by each individual patient(10).

The United States Joint Electronic Personal Health Record Task Force has defined PHRs as(13) “Electronic personal health record (PHR): a private [and] secure application through which an individual may access, manage, and share his or her health information. The PHR can include information that is entered by the consumer and/or data from other sources such as pharmacies, labs, and health care providers. The PHR may or may not include information from the electronic health record (EHR) that is maintained by the health care provider and is not synonymous with the EHR. PHR sponsors include vendors who may or may not charge a fee, health care organizations such as hospitals, health insurance companies, or employers.”

Personal Health Record (PHR) is the health information application that is recorded, managed, maintained, accessed, and controlled by individual patients. Users can share their information with people that are authorized in the privacy, security, and confidentiality conditions. It promotes patient-centric healthcare. The data of PHR is collected from both patients and healthcare professionals to provide

complete picture and accurate health record through the internet or the portable devices. The PHR can be categorized into three types;

1. Stand-alone PHR, the health data is recorded and managed by only patients and cannot be automatically shared or connected with other EHR systems of healthcare institutions(14).

2. Tethered PHR, the health data is collected from patients, healthcare professionals, and home health monitoring devices. The PHR system can only connects to the specific healthcare institution by being patient portal part of the EHR system, but not to other healthcare systems. The data can be easily transferred within PHR and EHR system's infrastructure(14).

3. Interconnected or integrated PHR, the PHR system can be integrated to other EMR, EHR systems and applications. It can collect data from multiple data repositories. It allows users to view and share their health information as documented with healthcare providers(14).

There are many kinds of platform for personal health record such as personal computer, notebooks, universal serial bus (USB) devices or mobile/smart phones platforms(9). The privacy and security regulations are also determined. The types of information in the PHR is same as the EHR which include demographic data and patient identification, insurance details, healthcare provider information, medical and procedure history, lab test results, diagnostic images, monitored health outcome, the healthcare plan recommendation, medication use lists, drug allergies, vital signs such as weight, blood glucose, blood pressure, etc. which patients especially who have chronic diseases can measure and record by themselves to monitor their health. Some kind of the PHR standard like the Continuity of Care Record (CCR) also provides the vital health information as the PHR. In addition, it contains physician appointment plan information and the health information of patients' families. It shows the current health state information of users(15-17).

<u>The interface of PHR application guideline</u>

One study has tried to develop the PHR application guideline by comparing the Microsoft Health Vault and the Google Health. The methods to collect the data of

the study are observation and the participants' comments. Since the perceived ease of use is the key factor to PHR use, the PHR application should:

- be easily visualized
- have user guide for entry their health information
- have space to add additional details about medication
- use easily understand language and avoid the technical terms
- provide various information entry methods and search functions
- provide confirmation button when editing the information
- the summary of profile data is provided in every pages of PHR
- provide the family member's profile data entry
- provide the drug interaction tool
- include the insurance information
- show the reference source of medical information to assure the data reliability
- integrate with the health records at the healthcare providers
- provide easily access and understand privacy agreements
- have various functions to support many kinds of diseases and patients

Good PHR should integrate and communicate with the electronic health record (EHR) system at the healthcare providers. It should consist of disease and medication knowledge part in order to educate the users(18). It should help improving the quality, safety of healthcare by supporting the coordinating between the healthcare providers and increasing awareness of patients and their families to their health. Moreover, it should have the appropriate privacy and security protection(8).

The benefits of the PHR should not only record and store the health information, but also have other functions such as disease and medication knowledge parts, provide some decision support tools to promote self-health

management and good health outcomes, prescription refills, communication channel with healthcare professionals or other patients(8).

Generally, the barriers of PHR adoption includes costs, standard interoperability and integration with other electronic health systems, poor quality system design, lack of national infrastructure, lack of top management support, inadequate motivation users to use, security and privacy requirement issues, and technology transfer protection policies of government(10, 19).

2.3 What is mobile PHR? Examples of mobile PHR

Mobile Personal Health Record is the health information application that allows user to record, manage, maintain, control, access, and share via the internet or the telecommunication equipment such as smart phones, cellular phones that can perform functions as computer.

The 2010 mHealth Summit of the Foundation for the National Institutes of Health (FNIH) has defined the mobile health as "The delivery of healthcare services via mobile communication devices(20)." The mobile health service is the electronic health services that have been applied on the mobile platform. It has three main components which are mobile devices, software platform, and the mobile health applications. The mobile health provides more flexible and portable than normal electronic health(5).

The International Organization for Standardization (ISO) has divided the personal health records into four categories. They are self-contained electronic health record maintained and controlled by the patients or consumers, self-contained electronic health record maintained by third party such as web service provider, component of integrated electronic health record maintained by healthcare provider and controlled at least partially by the patients or consumers, and component of integrated electronic health record maintained and controlled by the patients or consumers(4).

There is one research has tried to define the set of requirements for the efficient personal health record (PHR). First, the candidate PHR systems were searched and selected from well-known database websites. Second, the PHR

evaluation criteria were established. The candidate PHR systems should be free license and open source software, be web-based systems, and include basically functions to provide healthcare services. The PHR systems should have functions to record patient problem, diagnosis process, and treatment process. It should have functions to help patients to monitor their health status. It should also have communication management section to help patients talk to the healthcare professionals and doctor visits. The security and access control is quite important in the PHR systems. The last category is the intelligent factors such as additional education resources, data presentation and data export, interaction with other electronic health system or health applications. The architectural and technical of the PHR systems were considered according to whether the integrating to other health systems and data collected from single or multiple repositories. There are three types of personal health record systems which are standalone, tethered, and interconnected or integrated. The final step, the IT experts were used to evaluate the PHR systems according to the five categories requirement model. The results have been shown that the interconnected PHR system is superior to the tethered and the standalone(14).

One research has evaluated mobile personal health record (mPHR) applications among smart phone platforms (iOS, BlackBerry, and Android). The requiring external connectivity, content and data elements, number of possible records, functions and features (import and export data, upload images, print out data summary, user interface, easy to enter and view data), security, and marketing characteristics are compared among the standalone mPHR applications. The selected mPHRs should work on mobile platform as the primary mechanism, access health record without requiring internet connection, not web-based system, not specific to some diseases or patient groups, can be downloaded to analyze the content, and not cost more than $100 US to download or subscribe. The results have been shown that the iOS mPHRs have more data elements and features than Blackberry and Android. The major contents of the mPHRs have covered allergies, medications, problems and conditions, procedures, and labs while the least data elements that covered in the mPHRs are emergency contact, family history, and insurance. The

features that mostly lacked in the mPHRs are data import or export and image storage. For the market strategies to promote the mPHRs use, the vendors should target the specific users that match with functions n features of each mPHR applications and should avoid scare tactics. The effective personal health record should provide decision support and feedback functions such as medication interaction too(4).

Capzule PHR

It has user-friendly interface by showing the important emergency information such as age, height, weight, blood group, medication use, and allergies on the initial screen. Its functions include next thirty days appointment schedule link to Google Calendar, flowsheets of labalatory tests and self-monitoring of blood pressure, blood glucose, and weight and graph trends. Data can be exported via e-mail. Images and document files can be uploaded by computer or iPhone to be stored on the apps. Data elements include physician and insurance information. There is password protection to access the data(4).

Health n Family

It has function to support multiple users such as family members' health data record but it can't identify who is the primary user. The photo and images can be uploaded. The user interface is quite confusing and not appealing. Data editing can't be done at the summary page. There is link between the medical condition and the medication taken. Lab tests, procedures, and surgeries are allowed free text entry(4).

Cloud PHR

This PHR system use the Google Health account and have to connect internet to add or edit the information. The user interface is basic. The summary of health information page isn't available. Users can't select which parts of information to export. Google Health password is required every each time of access(4).

Express Well

The user interface is fairly simple because it allows users to edit data at the summary screen and each data element is differentiated by icons. Each data

elements are differentiated by icons. All data elements are free text entry. The four-digit passcode is required every each time to enter the application(4).

HealthNotes

Health conditions and surgeries data is recorded. Medication use is only selected from the pre-defined list with no free text entry option. It also provides neck and back pain assessment and social history includes alcohol intake, smoking, exercises. Features about data importing and password protection are not included. Summary of health data can be emailed(4).

motionPHR

Functions for supporting multiple users are only available in paid version. There is no data summary page. The initial screen provides emergency button to access emergency contact person without password protection. There are features about medication reminders, data importing, and prescription refill. Data elements include conditions, allergies, immunizations, and procedures(4).

Emergency

Major features and functions are provided to support use for emergency cases. Data elements only include basic health information such as conditions, providers or emergency contacts, medications, allergies, and personal information. Data input is easy. There is no data importing/exporting or password protection features. The dominant function of this application is Google Maps linking to show the nearest hospitals on GPS of the smart phones(4).

TheHealthRecord

The current or past health conditions are not recorded in the application. Data elements include medications, allergies, lab tests, and provider information. There are no data importing/exporting or password protection features. The test result expenditures are also included(4).

My Medical Pro

It has function to support multiple users. Health data can be exported and sent via email. Password protection is not available. Provider contact information can be imported from phonebook of mobile phone(4).

My family

Health data such as blood pressure, blood glucose, cholesterol, urine tests can be tracked in this application. Health data can be exported and sent via email. Check boxes features are provided for medical history input. Medical and insurance reimbursement can be stored in the application(4).

Stabilix PHR

User interface is easy. Drop downs feature is provided to create health profile instead of text entry. Reminders and charts features are provided only in paid version(4).

ZipHealth

User interface is well-designed. Required data elements are quite comprehensive except lack of emergency contact data. This application can sync between Google Health and Microsoft Health Vault. Terminology standard like SNOMED-CT is also provided to support integrating EHR system. Personal health sticky notes feature is provided for physician visit(4).

Health Care Management

It lacks of many required data element and features. Interoperability with other external health systems is not available. Data exporting and security module are not included(4).

MedRecordsToGo

User interface is simple. Manual data entry is required. Interoperability between datasets is not provided(4).

Dossia Health Manager

This application is mostly used to manage the officers' health data. It can integrate medical health records from many sources. Its function can support about patients' health plan change. The privacy and security of the data is determined. Moreover, users can evaluate the signs and symptoms, the cause of disease from the application.

Users' health information is collected in one secure place. Users can control and share their data to others.

MyChart

The Epic Systems Company has created MyChart application to support integrating of the electronic medical records automatically. The patients can view their lab result, physician appointment, re- medication, medicine billing payment. The functions of the system help patients to improve their health and save medical costs.

The Health Avatar CCR Plus

The Systems Biomedical Informatics Research Center in Korea has developed the mobile PHR application on the smartphones in 2010. Users can store, manage, and access their health information by logging in to the platform system. They can communicate with the healthcare providers to ask for the medications. The security and privacy regulations are well established for access, share, and exchange the data(21).

Health-DR

There is a PHR application on the android mobile platform called Health-DR. The users can access their health information at anytime, anywhere, and any place. They can share their health information with physicians, pharmacists, the insurance agents via their mobile phones without meeting face to face. The functions of the Health DR. application include view, save and record medical information and physical activities, update health reports, appointment alerts, prescription get alerts via SMS or email, insurance claims. This application also provides the data security by encryption and users have to create username and password for authentication. Health DR. supports the communication among patients, the healthcare professionals, and the insurance agents. The data is high reliable because the database is update every time that the system is log in. The system is quite user friendly too. The advantages of the Health DR. are easily access to the health data, faster communication between patients and doctors, and paper cost savings(22).

Google Health

The Google Company has developed the personal health record based on the internet called the Google Health ™ in 2006. It was an XML-based Continuity of Care Document (CCD) which collected health information from both patients and healthcare providers. First, it was used as live testing with 1600 patients at the

Cleveland clinic. Later the Google Company has announced to discontinue the Google Health ™ on January 1, 2012 after experiencing limited success. Registered patients could transfer and retrieve their data files to their computers, other PHR vendors, or their physicians for a year after its discontinuation announcement(10, 12).

The result of one study has shown about twenty-two reasons that cause the discontinuation of the Google Health ™. They were

1. It did not scale.
2. Adopters were limited to the tech savvy.
3. It was just a data repository and not much else so there were no incentives for patients or providers to use it. If the advantages of it were shown such as cost savings, avoidance in delays in care or unnecessary tests, these could facilitate more adoption.
4. The Google Health ™ did not provide any high engagement activities such as sharing information through social networking to have social discussion about achievement of desired outcomes. This could make users more enjoy.
5. No compensation for healthcare professionals to help patients to use it.
6. The health system in the United States has too many electronic medical record platforms already.
7. The difficulty of managing and directed data entry for patients.
8. Federal has not spent much money to promote electronic medical system use yet.
9. Some mainstreams of the electronic medical and health record system were not fully compatible with privacy policies of 1996 HIPAA regulations.
10. Congressional pressures were raised about patient information privacy issues.
11. The Google Health ™ focused on consumer-centric. It allowed patients to manage their own PHR, while others, like the Microsoft Health Vault ™ focused on the participations of healthcare providers, clinicians, and third party application developers. These third parties will assist patients to manage their PHR files.
12. The Google Health ™ project was discontinued and closed too early.
13. The Google Health ™ project was low return-on investment. It was not revenue product.

14. Many patients were unaware the Google Health ™ project because of little advertising and marketing strategic efforts.

15. Most healthcare providers in the United States did not share patient health information across institutions or allow patients to obtain their data easily.

16. Google did not do any pre-research before launching the Google Health ™ project. At that period of time, only about 17% of physicians have used advanced electronic health record systems.

17. Google did not invest to develop protocols, reform privacy legislative policy, and generate data flow through technological innovation.

18. There was no extensive third party application to work with Google so the Google Health ™ cannot run on other platforms such as smartphones.

19. The Google Health ™ did not include any trust model for poor privacy record or sensitive medical information for users.

20. There were no any customer service departments such as live-service models, human customer service departments, or real-time customer service departments.

21. The search and advertisement model may be too unsettling for patients to do with their PHRs.

22. The Google Health ™ did not support good encryption and decryption schemes for PHR use and distribution.

All possible reasons are categorized to six main problems. They are the no policy and legislation to support use, lack of trusted privacy regulations to manage sensitive health data, not well planned and implementation, marketing profit and financial problem, and not user friendly application(10).

MySafe-T.net system

It has been created to increase patient's compliance to screening tests and patients' lifestyles modification to improve their health. It collects five main types of information like demographic data, medical history, family history, lifestyles, and health habits. It also provides knowledge and specific recommendations according to patients' health profiles(9).

2.4 What is Microsoft Health Vault? and What are the features of mobile PHR?

Microsoft Health Vault

The Microsoft Company has created the Microsoft Health Solutions called Microsoft Health Vault. It launched on October 4, 2007. It is U.S.-centered and mainly be used and cooperated among U.S. hospitals, physicians, and pharmacies in 2010(12). It is standalone personal health record. It is the software to help users to manage and monitor their health data according to the patient centric concept. It can run on iPhone and Window phone platforms. Everyone can download and register without payment. Users can use the Microsoft Health Vault application by logging in with the Microsoft accounts through websites, computer software, or mobile apps. Users can add the health information in many ways such as recording by hand, uploading data. The health data is always up to date. The Health Vault can transfer data from more than 70 medical devices like blood pressure, blood glucose, weight scales, pedometers. This application uses the CCR standard interface of the PHR(15).

There are four main functions of the Microsoft Health Vault

1. Help organizing the users' health information: You can manage health information by yourselves. Users can track all medical records such as health history, conditions and illness, medications, allergies, lab results, images and x-ray, and fitness. Users can also track the health information of their family members like elderly and children.
2. Well-prepare necessary health information for physician visit or emergency: when users go to see the doctor, they can provide their health information to doctor by logging in the apps or printing out the information. Doctors will see overall health data, so they can make appropriate decisions for treatment. Users can access their health information at anytime and anywhere. This function is beneficial to emergency case too.

3. Users will see overall picture of their health data and patients will become the center of their health information: Users can store and collect all their health records include images. They can share data with trusted people. For chronic disease patients, they can transfer the measurement from medical devices to Health Vault. They don't need to record their readings in little book anymore. It will show trends of health condition which can help patients to monitor their health. It also motivates users to take care and improve their health.
4. Achieve fitness goal: Microsoft Health Vault provides functions for setting goals about weight control and doing exercises to get fit. The application provides visualizations to support them to see their change and progress. When users can achieve their set goal, the application allows them to post the success to their friends.

For the privacy concerns, users can determine who can access, view, record, use, and share their health information. Microsoft Health Vault will not transfer the data to any other applications or services without users' permission.

The reasons that the Microsoft Health Vault application is selected for this study are

- It can be freely downloaded on the internet.
- It provides many variety functions to support healthcare activities.
- It can connect with many medical devices.
- It was developed by the well-known computer hardware and software company like the Microsoft Company.
- There are many researches have conducted study about Microsoft Health Vault

2.5 The benefit of mobile PHR for healthcare

Chronic disease patients usually have to use medication for a long time or all of their life. They also take variety of medications. Most patients lack of knowledge about disease and suitable practices. Some use medications incorrectly. Some often buy medications from drug store without physician visit. Many patients don't adapt their bad health behavior to improve health condition. The main problem of providing healthcare services to chronic patients in community pharmacy setting is polypharmacy. It is very useful for healthcare provider to know complete health information because they will understand current health state of patients and cause of problem. Hence, they can provide healthcare more efficiently.

The PHR services support the communication between the patients and the healthcare professionals. Everyone can reach the vital and reliable health information in real time. The PHR services also help to increase the access to healthcare for people who live far from the healthcare providers(5).

For chronic disease patient's aspect, patient can have complete health information that can access and share to trust people anywhere and anytime. When people have an emergency illness or accident, they can go to treat at any healthcare providers. The healthcare professionals can get the important information such as medical records, procedure history, drug allergies, contact information. When physicians get the important information completely and in time, it helps to improve the quality of treatment, reduce medical errors save healthcare costs and time consuming(15).

The personal health record will help to activate patients to develop their knowledge, skill, and motivation to participate in their healthcare efficiently(9). It can support patients to evaluate and improve their health and well-being. They can manage their exercises, their blood pressure, the physician appointment, medication use reminders, etc. systematically. The health knowledge or guidance also helps patient gain more knowledge to take care their health(5, 20). When chronic disease patients have seen the progress of disease from the PHR, they will be stimulated to control their chronic disease and prevent complications. Personal health record

helps to promote self-health monitoring. The PHR can also increase patients participate in making decision about healthcare treatment. This will lead to better outcomes and cost saving(11). If patients can manage their health by themselves, they will have more confident to control the disease especially in chronic disease patients(18).

Moreover, personal health record can support the relatives of elderly, children, or disabled patients to manage health information(9).

Many functions of mobile personal health record support chronic disease patient to improve their health. They can record their chronic disease, medication use, drug allergies, current health state or health problems such as complications, family history, physician appointment, contacted physician or provider information. In part of self-health behavior, they can record measurements or transfer measurement from medical devices, record exercise and diet behavior. Patients can take complete health information with them anytime and anywhere. This provides convenience when patients go to any other healthcare providers both hospital and community pharmacy.

Many mobile personal health record applications provide the results of users' performance of controlling diet and physical activities. This will stimulate users to adapt their health behavior. When patient pays attention to their health information, they can manage and control the disease more efficiently.

2.6 Researches related to the electronic health system in foreign countries

Thai researcher has studied the effect of the personal health record booklet to the knowledge about disease, self-efficacy, and health behavior in Thai people who have risk of cardiovascular disease. The researcher has developed the personal health record booklet which contains three parts: health education, health record, and health behavior monitoring. The study has designed to do the quasi-experiment and compared between the experimental group and the control group. The result has shown that the personal health record booklet significantly improve the self-efficacy but not improve the health education or health behavior(23).

One of the most important thing to encourage people to use the mobile health application is the mobile PHR application should respond the users' needs. There is a research to study which kinds of the mobile PHR applications that the most popular engagement on the Apple iTunes mobile phone. The objectives or the benefit functions of the mobile health applications are separated into nine types. They are environment change to support good health behavior, promote the social support to improve health, goal setting to improve health, tracking the health progress, use recorded health information to plan treatment, self-health monitoring, show the success health management cases via the social media, compare to the others that have the same health condition and treatment, and other kinds of the mobile PHR application. The result has shown that the functions of the mobile PHR applications that the most popular engagement are self-health monitoring and tracking the health progress. Therefore, the developers should promote the self-health monitoring and tracking the health progress functions to persuade the mobile PHR use(24).

The electronic health record system in Taiwan, the National Health Insurance (NHI) will provide the universal coverage benefit scheme and support the overall access of healthcare services. The physicians can do the electronic signature to retrieve the patient information from the National Health Insurance at any time, so patients can visit any healthcare providers as they prefer. The benefit of this electronic health record system are maintaining all health data of the patients, saving costs of paper use and storage area, and getting reimbursement more convenient and faster. There is one study has used the Technology Acceptance Model and the Planned Behavior to explore the factors associated with the electronic health record use. Integrating between the Technology Acceptance Model (TAM) and the Theory of Planned Behavior (TPB) has been used to study the factors associated with the intention to use new technology and use behavior. The independent variables are perceived ease of use, perceived usefulness, computer self-efficacy, subjective norm, security and privacy, intention to use. The study has compared between the EHR adopter physicians and the non EHR adopter physicians. The results have shown that the intention to use EHR, perceived usefulness, and perceived ease of use are the

important factors to use EHR. The non EHR adopters have concerned about the privacy issues and the subjective norms. The barriers to implement the health information system are waste time, privacy and confidentiality issues, difficulty of integrating between new and old HIT system, lack of standard of electronic health applications, lack of technology skills and knowledge. Moreover, the high volume visit clinics have intended to use EHR than the low volume visit clinics. To promote the EHR use, the government should make the physicians realize the benefit of EHR and provide the EHR training program to the healthcare professionals(25).

There is one research in China has applied the Value Attitude Behavior model (VAB), the Theory of Planned Behavior (TPB), some age- related characteristic factors like perceived physical condition, resistance to change, technology anxiety, and self-actualization needs to explore the factors associate mobile health services use. The study has compared between the middle-aged users and the elderly users. The results have shown that the factors associated with the intention to use the mobile health services in the middle-aged users are perceived value, attitude, perceived behavioral control, and resistance to change. For the elderly users, perceived value, attitude, perceived behavioral control, technology anxiety, and self-actualization needs are the factors influence the intention to the mobile health services use. The most important factors influence the mobile health services use intention in both two groups are perceived value, attitude, perceived behavioral control. On the other hands, subjective norm and perceived physical condition have no significant effects to the behavioral intention. To promote the mobile health service use, the government should provide training program, the mobile health applications should be designed user friendly interface, easy to use, and compatible to users' daily lives(5).

In Europe, there is a research has shown the obstacles to implement the electronic health record. The barriers are the culture of organizations support health information exchange, the integration between different technology platforms and various database systems need standards of architecture and terminology, the legal requirement about privacy and security to have patient authentication, lack of investment in good electronic health record system development, lack of leadership

and vision to reform the healthcare processes of the decision makers, and difficult usability EHR system and lack of training and education(26).

One study has conducted the questionnaire to measure the self-efficacy of HIV patients to create, update, track their symptoms, and share health information with the healthcare providers. The research has compared the self-efficacy to use between the paper-based and computer-based personal health record. The result has shown that HIV patients have significant self-efficacy on the paper-based PHR more than the computer-based PHR. The lack of computer skills and low incomes are the main factors that the patients have preferred the paper-based PHR(27).

Ozok and friends have tried to evaluate the usefulness and usability of web-based personal health record called MySafe-T.net to improve health prevention. The study has explored both in patients' viewpoints and primary care providers' viewpoints. They have conducted direct observation, survey, and focus group interviews. The results shown that the patients feel easy to use the PHR. The health recommendations are useful for them. For primary care providers' opinions, the content of the PHR is useful and help patients to improve their health activation. In the future, the PHR system should be integrated to the electronic health record systems of hospitals, provide more health knowledge and recommendations, and emphasized on security system(9).

2.7 Theoretical framework related to mobile personal health record use behavior

There are many theories or models trying to predict or explain human behavior in different aspects. In information technology context, the general theoretical models that related to the information technology use are the Unified Theory of Acceptance and Use of Technology (UTAUT) model, the Technology Acceptance Model (TAM), the Theory of Planned Behavior (TPB), the Value Attitude Behavior model (VAB).

The Unified Theory of Acceptance and Use of Technology (UTAUT) model is developed from the Technology Acceptance Model (TAM). It is widely used to explain factors influence the intention to use and actual use of the information

system. The main four constructs are performance expectancy, effort expectancy, social influence, and facilitating conditions. Performance expectancy, effort expectancy, and social influence have influenced the intention to use(28), while facilitating conditions has directly influenced the actual use. Moreover, there are two additional constructs to moderate the effect of the four main key constructs to the independent variables. They are experiences and voluntariness. The Unified Theory of Acceptance and Use of Technology (UTAUT) model has been developed in USA and widely used in many fields like telecommunication, banking, entertainment, etc. This model is claimed that can be used to explain the intention to use information technology or technology acceptance about 60% while other previous models can only explain technology acceptance about 40%. In 2009, there is one research has applied the modified Unified Theory of Acceptance and Use of Technology (UTAUT) model to explore the factors influence the health information technology use of the community healthcare providers in Thailand. The researchers have designed to measure the performance expectancy, effort expectancy, social influence, voluntariness, experiences, facilitating conditions, basic IT knowledge, intention to use IT, and IT use. The results have shown that the performance expectancy, effort expectancy, social influence, and voluntariness influence the intention to use IT. While previous IT experience, facilitating conditions, and intention to use IT influence the actual IT use(11, 28, 29).

The UTAUT model integrated eight acceptance theories which included the Technology Acceptance Model (TAM), Innovation Diffusion Theory (IDT), Theory of Reasoned Action (TRA), the Theory of Planned Behavior (TPB), the motivational model (MM), a model combining the theory of Planned Behavior and Technology Acceptance Model (C-TPB-TAM), the model of PC utilization (MPCU), and Social Cognitive Theory (SCT)(28). In many longitudinal field studies, the UTAUT model explained about 70% of the variance in the intention to use technology and about 70% of the variance in the technology use which is greater than each the eight previous theories and its extensions(28). The model has been widely applied in variety researches of technology acceptance in both organizational and non-organizational settings. Generalizability of the model was tested by three methods.

First, it has been applied in new contexts such as new technologies, new user population, or new cultural settings. Second, the model has been applied by adding new constructs to expand endogenous theoretical mechanism. Third, the model has been applied by combining exogenous predictors for more understanding of user acceptance of technology. One paper has included three constructs which were hedonic motivation (pleasure and enjoyment from using technology), price value (user' cognitive tradeoff between perceived benefits of using technology and monetary costs), and habit (the extent to which individual performs the target behavior automatically because of learning) in the UTAUT model to expand the scope of generalizability of UTAUT model in consumer environment. The voluntariness was dropped out from the framework and a link between facilitating conditions and behavioral intention was added. The research framework also incorporated some individual differences such as age, gender, and experience as moderating factors on behavioral intention and technology use. Age and gender modified the relationship between performance expectancy and behavioral intention and the relationship between price value and behavioral intention. Age, gender, and experience modified the relationship between effort expectancy and behavioral intention, the relationship between social influence and behavioral intention, the relationship between hedonic motivation and behavioral intention, and the relationship between habit and behavioral intention and technology use. Age and experience modified the relationship between facilitating conditions and use behavior. The passage of chronological time like experience can form different levels of habit depending on their interaction and familiarity with target technology. Increasing habit and experience can make intention less important. Increasing experience can make hedonic motivation less important role determining technology use. The modified UTAUT model has been applied to study acceptance and use of mobile internet application on mobile device in consumer context. Mobile internet use in the study was voluntary decision. The two-stage self-reported online survey through a popular web portal was conducted in Hong Kong. All data on the predictors and intention to use mobile internet were collected at first stage online survey. After four months, the previous respondents at first stage were contacted to

collect their mobile internet use data. Final sample of the study was 1,512 customers. Data analysis was performed by using partial least squares (PLS). The research tested separate four models which were baseline UTAUT (direct effects only), baseline UTAUT (direct and moderate effects), modified UTAUT (direct effects only), modified UTAUT (direct and moderate effects). In baseline UTAUT model, the results showed that performance expectancy, effort expectancy, and social influence had significant effects on behavioral intention. Facilitating conditions and behavioral intention had significant effects on mobile internet use. When modifying the baseline UTAUT model or adding other constructs and some moderating factors in the model, the result showed the variance in behavioral intention was explained better (from 56% to 74%) and the variance in technology use was also explained better (from 40% to 52%) . Gender and age were significant moderators the effect of facilitating conditions on behavioral intention but experience was not. Besides the significant effects of main constructs of original UTAUT model, hedonic motivation and price value were critical determinants of behavioral intention to use mobile internet. Hedonic motivation was as important driver as perceived usefulness in consumer context. Price value should not be concerned between monetary value and perceived usefulness. Other types of vale for consumer such as hedonic, social value, and timeliness should be tradeoff too. Main constructs of UTAUT model, hedonic motivation, price value, and habit played important role on predicting continued use of technology(29).

Another research applied full the Unified Theory of Acceptance and Use of Technology (UTAUT) model to test factors influence acceptance and use of technology of students in their academic environment. The original UTAUT model focuses on user acceptance of new technology. This research model was applied to study from user's first perception at the time of training and how the perception changes when user has more experience in using that technology. An exploratory longitudinal study was conducted for a semester. The research model included performance expectancy, effort expectancy, social influence, and facilitating conditions. Self-efficacy, anxiety, and attitudes constructs were dropped out from the research model because they were found no direct effects on intention to use

technology. Moderators which were gender, age, experience, and voluntariness of use were also included in the research model. The research hypotheses were:

- Age and gender moderated the influence of performance expectancy on intention to use technology particularly for younger men.
- Age, gender, and experience moderated the influence of effort expectancy on intention to use technology particularly for younger women with little experience at early stage of adoption.
- Age, gender, voluntariness, and experience moderated the influence of social influence on intention to use technology particularly for older women with little experience at early stage of adoption in mandatory settings.
- Age and experience moderated the influence of facilitating conditions on technology use particularly for older worker with much experience about technology use.
- Facilitating conditions, computer self-efficacy, computer anxiety, and attitudes toward using technology did not significantly influence intention to use technology.
- Intention to use technology significantly positive influence technology use.

There were three times of data collections which were one week (T1; before technology use), four weeks (T2; after using technology for some time), and eight weeks (T3; after using technology for some time) after first introducing and training of technology use. Intention to use in T1 was used to predict actual use in T2 and intention to use in T2 was used to predict actual use in T3. Self-administered questionnaire was sent to student participants via email. Data analysis was performed by using linear regression. It showed performance expectancy, effort expectancy, social influence, and attitudes towards technology use were significant determinants of intention to use technology. Facilitating conditions was significant determinant of technology use. The moderators such as age, gender, and voluntariness of use moderated effects of main predictors on technology use except experience. The study suggested that training and knowledge resources provision and generating appropriate environment were important for introduce new technology use. The

task-related outcomes of using the technology were also emphasized to increase technology adoption(28).

There is one cross-sectional study in Canada has created the Electronic Medical Record Adoption Model (EMRAM) to explain the nurses' electronic patient record (EPR) acceptance and use and their satisfaction. The study has been conducted from October 2012 to March 2013. This model has been adapted from the modified Unified Theory of Acceptance and Use of Technology (UTAUT) model. The performance expectancy, effort expectancy, social influence, and facilitating conditions have been applied to explain actual EPR use and nurses' satisfaction. Nurses' satisfaction has been measured because all respondents in the study are mandate to use the EPR. Two independent variables which are compatibility of the electronic patient record to the nurses' practices and self-efficacy are added to the EMRAM model. The respondents were sampling by stratify according to different EPR adoption stages. The actual electronic patient record use was measured in terms of frequency of use and scope of functionalities used in the system. The self-reported questionnaires were used to collect the data. The items of the questionnaires were tested face validity, content validity, and construct validity. The Cronbach's alpha is measured to verify the internal consistency. The statistical that was used to analyze the data is Structural Equation Modeling (SEM) by AMOS version 19. The results have been shown that the performance expectancies have the strongest effect to actual EPR use. Facilitating conditions have strong effect to effort expectancies. Compatibilities of the electronic patient record to the nurses' practices have strong effect to performance expectancies. Compatibilities of the electronic patient record to the nurses' practices have increased actual EPR use by influencing the performance expectancies and effort expectancies. The self-efficacy and social influence constructs have not influence the actual EPR use. Moreover, age and nurses' level of education have relationship to the EPR use. To promote electronic patient record use, it is important to provide the EPR that are useful to the users and compatible with users' life styles(30).

The Technology Acceptance Model (TAM) is mostly used to study the factors influence users' acceptance to implementation new information technology(25). The

model consists of perceived usefulness (users' perception the information technology will help to improve their job performance.), perceived ease of use (users' perception of using information technology without any efforts), attitude towards the behavior, behavioral intention, and behavior. Many researchers have accepted the Technology Acceptance Model (TAM) is one of the best behavior theories to explain the new information technology use(31).

Ajzen said that the Theory of Planned Behavior (TPB) is used to explore the factors influence the humans' intention and behavior(25). It consists of behavioral beliefs (beliefs about the outcome of performing the behavior), normative beliefs (individual's perception of other people's beliefs whether they should or should not perform behavior), control beliefs (beliefs about things that facilitate or obstruct to perform behavior such as skill, capability, emotion, environment), attitude towards the behavior, perceived behavioral control (the person perceives difficulty in performing the behavior), subjective norm (whether the important people think the person should or should not perform the behavior), behavioral intention, and behavior(5, 31).

The Value Attitude Behavior model (VAB) has shown that perceived value and attitude influence human behavior. The perceived value also influences the attitude. Perceived value is the evaluation between the benefits and sacrifices to perform the behavior. The attitude is the individual's feeling good or bad to perform the behavior(5).

One study has explored the relationship between the health literacy and patients' PHR use decision. The health literacy is defined as the patients' capacity, knowledge, and skills to decide to use the PHR. The eHealth Literacy Scale (eHEALS) questionnaire has been used to measure the heath literacy. The study has not measured the actual PHR use. The result has indicated that patients who have high health literacy have designed to use the PHR(32).

There is one study has tried to review many technology adoption and use theories to study continue use of Cyber-infrastructure of scientists. The research has created ICT adoption process in three stages(33):

1. Pre-adoption stage which people have examined the technology and consider adopting.
2. Adoption stage which people have formed intention and use the technology.
3. Post-adoption stage which is related to continuance or abandon use.

At pre-adoption to adoption stage, they have defined adoption as users' initial acceptance of an object and studied many adoption theories. These theories focus on people's intention to engage in a certain behavior(33).

Theory of Reasoned Action (TRA) has explained that attitudes and social norms have significant influence the intention to adopt and use the ICT(33).

Theory of Planned Behavior (TPB) is developed from Theory of Reasoned Action (TRA) by adding Perceived Behavioral Control (PBC) to the model. It shows the relationship between attitudes, social norms, perceived behavioral control, and intention to adopt and use the ICT(33).

Technology Acceptance Model (TAM) is the theory that has explained the determinants of users' acceptance of computer technologies. The major factors that affect the intention to use technologies are Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). The limitations of this model include generality. It hasn't considered non-organizational setting and the moderating effects(33).

Enhanced Technology Acceptance Model has increased some factors such as subjective norm, voluntaries, experience, image, etc. to address the limitations of TAM(33).

Unified Theory of Acceptance and Use of Technology (UTAUT) has explained that performance expectancy, effort expectancy, and social influence affect intention to use. Facilitating conditions and intention to use affect the use behavior. The relationship between the predictors and dependent variable is moderated by individual difference such as gender, age, experience, and voluntaries. Including individual difference in the model as moderating factors is the advantage of this theory compared to other user adoption and acceptance of technology models(33).

Innovation Diffusion Theory (IDT) has tried to explain the diffusion of innovation via four elements. They are innovation, time, communication channels, and social systems. An individual's technology adoption is depended by his or her

perceptions about relative advantage, compatibility, complexity, trialability, and observability(33).

Social Cognitive Theory (SCT) has explained certain behavioral pattern of people based on observing and learning from others in the context of social interactions, experiences, and outside media influences. Outcome expectations and self-efficacy are the main constructs of this theory(33).

At post-adoption stage, this research has studied three theories to explain the changes in perceptions on computer technologies of people after using. First, the Expectation Confirmation Theory (ECT) has explained that user experience increasing during technology using period affects the continued or discontinued use of technology. Expectation, perceived performance, and expectancy confirmation influence satisfaction. Second, IS Continuance Model has explained that satisfaction is the main factor to influences the intention to continue use of technology. The last main construct that influences the continued or discontinued use of technology is habit. It can be defined as the extent to which people tend to perform the behavior automatically because of learning. In this study, the questions to measure habit have been deigned to ask both the frequency of repeating the behavior and the comprehensive of use various features of the technology system(33).

After reviewing all relevant theories about adoption and post-adoption, the researchers have synthesized the research framework for post-adoption behavior. The framework has consisted of three major components which are cognitive reaction (performance expectancy, effort expectancy, subjective norm, and facilitating conditions), affective reaction (satisfactions and positive emotions), and habit to predict for the intention to continue use of technology. The Data Observation Network for Earth (DataONE) is the set of cyber-infrastructure tools that has been use in this study. The tool can help researchers to discover, access, analyze, visualize, and share the data. The research design has been divided into two phases. First, they use qualitative method like interview and focus group to collect the factors related to the adoption and use to enrich the framework. Then, they use survey to examine the relationship between the constructs in the framework model(33).

One study had aimed to evaluate information technology (IT) post-adoption behavior of continuers and discontinuers based on extending the expectation-confirmation model. The conceptual framework of this study has identified factors and theory which influenced IT continuance behavior. The constructs included(34):

- Individual influence was defined as the extent to which people's belief of controlling over the elements of their dissonance.
- Expectation-confirmation theory was the expectation about the useful of the product before adoption and users will confirm or disconfirm whether their actual experiences of using it meet their expectations or not.
- Cognitive consonance was defined as the IT continued use conformed to users' belief, behavior, or environments.
- User satisfaction was defined as the positive feeling towards the IT system use.
- Social influence: According to Kelman who has proposed social influence theory in 1958(35). The theory has explained that an individual's beliefs, attitudes, and behavior are influenced by their others through three processes which are compliance, internalization, and identification. Compliance occurs when an individual is influenced by rewards or punishments, approval or disapproval. Internalization occurs when an individual is influenced by intrinsic rewards or personal values. Identification occurs when an individual is influenced to create or maintain satisfying or beneficial relationship with others. When users have no or little experience about system use at the initial stage of adoption, compliance-based social influence has strong effect on maintaining system use. When users accumulate more experiences of using the system, the effect of compliance-based social influence will decrease. Hence, two hypothesis of the study were(34):

1. As moderating effects, the internalization-based and identification-based social influences had stronger effects than compliance-based social influences at post-adoption stage.

2. The internalization-based and identification-based social influences had direct effects on continuance behavior.

Besides, social influence patterns are different across various groups. Social influence has significant effects in bottom-up group. It has limited effects in peer-level group and has no effects in top-down group(34).

When users confirm that the IT system use meets their expectation and the IT system conform to their behaviors and their environments (cognitive consonance), users will be satisfied to the IT system. Users usually continued use when they are satisfied the product. Besides, individual influence moderates the effect of the expectation confirmation construct to the cognitive consonance. Social influence moderates the effect of user satisfaction to the continuance behavior and has direct effect on continuance behavior. LISREL was performed to test both linear and moderating effects in the research model. Chi-square tests were performed to compare differences between continuers' intention and discontinuers' intention(34).

One research was conducted in Saudi Arabia in 2013. The new hybrid theoretical framework which collected both attitudes constructs and normative constructs was applied to identify factors affecting mobile internet application acceptance and use of consumers. The research framework was based on the Unified Theory of Acceptance and Use of Technology (UTAUT) model. The UTAUT model integrated eight acceptance theories which included the Technology Acceptance Model (TAM), Innovation Diffusion Theory (IDT), Theory of Reasoned Action (TRA), the Theory of Planned Behavior (TPB), the motivational model (MM), a model combining the theory of Planned Behavior and Technology Acceptance Model (C-TPB-TAM), the model of PC utilization (MPCU), and Social Cognitive Theory (SCT)(28, 29). From UTAUT model, performance expectancy, effort expectancy, social influence, and facilitating conditions are main predictors determining user adoption of information

technologies. The conceptual framework consisted of eight constructs which were Performance Expectancy (perceived utility of using mobile internet), Effort Expectancy (perceived difficulty of using mobile internet), Facilitating Conditions (users have necessary resources and knowledge to use mobile internet), Social Influences (referees' opinion on individual user behavior), Perceived Value (overall assessment of utility based on perception of received and given), Perceived Playfulness (the intrinsic motivation such as pleasure and enjoyment associated with mobile internet using), Attention Focus (concentration of user when using mobile internet), and Behavioral Intention (subjective probability that willing to engage in given behavior). Some good quality IT systems had failure because they lacked of user's acceptance. Hence user acceptance is crucial part to determine success or failure of information technology products. Data was collected from 238 citizens who were different in gender, ages, internet experience, use frequency, incomes, and educational graduate. The data collection tool was self-administered questionnaire. The structural equation modeling was performed to analyzed data. The analysis result showed performance expectancy, perceived playfulness, social influence, and facilitating conditions had significant effects on behavioral intention and ICT use(19).

Another research had studied about user acceptance of using Web site by applying the Technology Acceptance Model (TAM). The research framework hypothesized that the beliefs about the quality of Web site effects on perceived usefulness and perceived ease of use. Perceived usefulness and perceived ease of use affect preference for a Web site. Perceived usefulness, perceived ease of use, and preference for a Web site constructs effect on intention to reuse the Web site. Perceived ease of use effects on perceived usefulness. The Web site quality was measured by information quality, response time, and system accessibility. The sample included undergraduate students who are most active and influent internet users in the market. Web site use training session was available before actual use. Then all of them were given questionnaire. The result showed that the goodness of fit indicators model accounted for 64% of the variance in the intention to reuse the Web site. Perceived usefulness had stronger effect on intention to Web site reuse than perceived ease of use. Perceived ease of use had indirect effect on intention to

Web site reuse through significant effect on perceived usefulness. The quality of information had significant effect on perceived usefulness. Response time which referred to time spent on waiting to interact the Web site significantly affected user' beliefs about perceived ease of use and perceived usefulness. System accessibility had strong effect on perceived ease of use the Web site. From the data analysis, response time was the strongest predictor user' beliefs about using Web site because it significantly affected user' beliefs about both perceived ease of use and perceived usefulness. Hence, Web site developers should not only make Web page content informative and timely but also speedy design to increase user acceptance of Web site(36).

The demographic data also affect the PHR use such as gender, age, highest education level, incomes, frequency of smart phone use, etc.

2.8 Personal Health Record and other health applications use in healthy person and chronic disease patients

Although many health applications (apps) on smartphones are available, there are little implementation in health promotion practice. One of the goals of the Healthy People 2020 Health Communication and Information Technology is the increased use of mobile devices to improve health outcomes, health quality, and health equity. In 2012, nearly 30% of U.S. adults used health application on smartphone. Pew internet research suggested that about 32% of adults aged 30 to 49 used health application more often than adults aged 18 to 29 (28%) and adults aged 50 and older (20%). However, number of adults with all age groups increase use of health application annually. Available health applications usually cover healthy lifestyles, health fitness, disease management, and public health. For the medical apps that target user is health professional usually provide functions such as medical reference, medical alerts, general diagnosis, lab result and digital image delivery, patient monitoring and tracking, and continuing medical education. However, there was still little known about using health application for health promotion practice and health outcomes like support intervention to change health behavior. One research aimed to understand an overview of using health application on

smartphone for health promotion intervention in three aspects which were for healthcare, for consumer health behavior change, and for education(37).

In healthcare aspects, function to support real-time interactions between patients and their physicians would change episodic to continuous healthcare. Mobile health monitoring support health professionals to access and monitor patient health information in real time. They can send text messaging to feedbacks patients to motivate behavioral modification or send reminders to improve medication adherence or use patient health information for decision support in interventions. Refill data can show the effectiveness of medication adherence(37). The result from one randomized control trial study showed type-2 diabetes patients who used mobile health monitoring and received text reminders to take their diabetes medication improve their diabetes medication adherence when compared to the control group. Diabetes medication adherence can help to improve glycemic control(38). Another randomized control trial study, using pedometer to change health behavior about physical activity in 192 inactive women aged 25 to 69 for three months and followed up for six months after intervention. Participants could set weekly physical activity goal, recorded daily physical activity, and received message and videos feedback immediately. Total physical activity achievement was also reported daily and weekly(39). Other functions to improve healthcare were function for self-assessments or tracking symptoms, function for home therapeutic skill training such as relaxation(40). Other medical practices such as healthcare delivery to far distance, access to medical references in resource-limited area, care plan management, and chronic disease management could be implemented more efficiently by using mobile health application. Reducing operational costs and worker time savings from using mobile health application could provide cost-effective healthcare model(37).

In health behavior change of consumer aspects, consumers usually used health application to search for general health information. About 70% of chronic disease patients own and use cell phone so mobile self-monitoring function of health application on smartphone would be beneficial to their health management(41-43). Different aged group users also require different health

application function. Free Calorie Counter apps provides calorie listing for food consumption, water consumption, goal setting, physical activity, target weight goal, data presentation as graphs and charts for easy tracking. The Nexercise apps provides exercise progress tracking, medal and points reward for motivation, share information with friends. Free WebMD Baby apps provides children's health tracking, parent tips and information for emergency and illness(37).

In education aspects, some health and fitness applications on smartphone include functions like calorie tracking, meal planning, physical activity promotion like pedometer, or reduce weight gain to educate for healthy lifestyle and health behavior change(37). One research website has reported about one-fourth of apps are downloaded and used once. And about three-fourth of apps are dropped after about the tenth use.

Major requirements for choosing health apps include content quality of the apps, usability and technical concerns, regulation, and data security and privacy. Most health applications are not developed content quality from health professional input or based on medical practice guidelines or accepted health behavior change theory. Difficulty of use, poorly user interface design, run only on some specific platforms, and some technical problem to access health apps are barriers of adoption and use. Training how to use health apps is important to facilitate health apps use. Relevant governmental organization like the Food and Drug Administration (FDA) should regulate health apps to promote disease management.(37) The Office of the National Coordinator Chief Privacy Office has tried to address data security and privacy concerns by identify best practices to protect patient rights when health information in health apps is shared among providers. It should be notified in consent forms from patient before access health information(40).

The results of the study suggested the health applications (apps) on smartphones should include function that provide evidence based guidelines for chronic disease management, function to improve patient-physician interaction, and function to improve access to healthcare services from far distance(37).

Physical activity is important health behavior to prevent non-communicable diseases. Hardly physical activity engagement can lead to poor health outcome. Poor

health outcome can cause extended medical care costs(44). Older people tend to do physical activity less than younger people. Function of health application on mobile phone such as SMS intervention delivery can help promote health behaviors, including physical activity(44). New Zealand guidelines for regular physical activity recommends normal people should do moderate to vigorous physical activity at least 60 minutes each day. In 2013, there were more than 40,000 health apps available in the U.S. iTunes store health & fitness category(45). Three-arm, parallel, randomized control trial was conducted in one research in Auckland, New Zealand. First objective of the study was to see the effectiveness of using walking and running health apps to improve cardiorespiratory fitness in young people aged 14 -17, compared to usual physical activity behavior alone as control group. Another goal of the study was to compare effectiveness of physical activity intervention, self-efficacy, enjoyment, psychological need satisfaction (perceived competence, autonomy, and relatedness), usability, and acceptability of game-based story health apps and no game-based story health apps. Cardiorespiratory fitness outcomes were measured as time to complete the one mile run/walk test after eight weeks training program. Two representative health apps of the study were selected from top-40 most downloaded apps of the health and fitness category of the New Zealand i/tunes store(46). Two selective health apps include function to support self-regulatory behavior change like goal setting, self-monitoring, feedback on performance provision, and behavior goal review(47). The participants were encouraged to use the apps three times per week to do 35 minutes workouts to help their achievement of 5 kilometers run. Data collection was performed using self-reported questionnaire. Data analysis was performed by applying analysis of covariance (ANCOVA) regression model. The result showed health apps that can make user perceives of enjoyment, autonomy, competence, relatedness, and self-efficacy would have potential to change user's physical activity behavior(44).

Hypertension is one of chronic disease which requires medication adherence, achieving blood pressure control, and lifestyle modification to improve health outcomes. Self-management of chronic diseases model consists of four main components which are medications, lifestyle, monitoring, and health records. Mobile

health application can enhance patient self-care. It can allow patients to access disease information educational resources and their medical records. Some mobile PHR applications allow patients to edit their health records, request for appointment, referral, or prescription refills. When patients can see their health trends in mobile health applications, they can be motivational tools to patients to maintain their adherence to treatment, improve better patient-provider communication, and empower patients to engage in treatment decision-making(3). One automated interactive telecommunication system allows patient-provider communication weekly by phone to asked patients about self-measured blood pressure readings, medication regimen, adherence, or side effects(48). Green and colleagues from the United States has designed mobile health program for provide communication between pharmacists and hypertensive patients. Patients were asked to measure their blood pressure twice a week and send the readings to pharmacists via secure email. Pharmacists can make medication change according to approved protocol, laboratory tests, and schedule follow-up visits. Pharmacists contacted patients every two weeks until their blood pressure was controlled(49). However, the major issue of using eHealth systems to improve chronic disease management was user acceptance. The complexity of mobile health system and requirement of internet connectivity and electronic equipment, and affordability issues were concerned. From the results of one focus group research, hypertensive patients preferred mobile health applications which did not require high computer literacy. They also preferred the systems which provide real time feedback, blood pressure monitoring alerts such as automated messaging when measurements were abnormal, medication taken reminders to improve patient adherence, and one page summary of blood pressure readings report over the past 30 days and their averages(3).

In 2013, there were estimate 382 million people have diabetes(50). Most diabetes patients have serious complications because of low self-management skill, non-adherence to care regimen. Severe complications result in hospitalization and reducing quality of life. Self-monitoring of blood glucose is important for diabetes intervention. Predetermining the frequency and timing of self-monitoring blood glucose can significantly improve patient engagement in glycemic control. Mobile

health applications on smartphones can be used as self-management tool that are embedded into daily routine to facilitate self-monitoring and health behavior change for diabetes patients. One study has applied a mobile health application called “bant II” with type2 diabetes patients to facilitate self-management. The bant II focused on blood glucose self-monitoring and lifestyle behavior change. Users can plan self-monitoring blood glucose levels goal during the next seven days and set reminders. There were four phases in the research included(51):

- Phase 1: identifying the relevant behavior change theories such as social cognitive theory and barriers to use the apps and modeling process and outcomes
- Phase 2: determining sample size, recruitment, and implement the intervention
- Phase 3: evaluation outcomes and cost-effectiveness
- Phase 4: implementation and long term follow up

For blood glucose self-monitoring, some diabetes patients did not benefit from self-monitoring blood glucose because they cannot interpret blood glucose readings and cannot make daily self-management decision from the readings. Patients still needed physician visits and received feedback based on A1C measurements. Another barrier was manual data entry which can cause patients’ burden and data errors. Measurements should be automatically transferred from blood glucose meter to the bant II apps. The four main aspects to be addressed in order to gain benefit from self-monitoring blood glucose were frequency and timing to measure, patient education, measurements interpretation, and efficient data collection approaches(51).

For physical inactivity, doing physical activity can beneficial to diabetes control. Using mobile health applications can give ability of real-time self-monitoring of physical activity performance and tailored feedback provided to guide patients how to change their health behavior in positive way(51).

For dietary intake, food photography approach supported ability of capturing more accurate than recorded from user's memory recall of food consumption. User took photo of food consumption and sent to third party providers to interpretation. Meal photo capturing function was automatically associated with blood glucose measurement reminders. User who set blood sugar measuring goal was reminded to take blood sugar readings before meal thirty minutes or after meal two hours according to the set goal(51).

For weight management, weight loss in obese and diabetes patients can lower risk of cardiovascular disease and metabolic disease(52). The apps encouraged user to measure weight weekly through reminders and data can be transferred with some Bluetooth-enabled weight scales(51).

For incentivizing health behavior change, good diabetes patients who follow clinician recommendations like lifestyle modification and medication adherence strictly tends not to realize the immediate benefit to their action from using the apps and may see the positive effects only continue use for few years or decades. Tangible monetary-based rewards were shown to be significant incentives for health behavior change(53). The bant II apps also allowed users to accumulate points from participating in diabetes self-care activities. The points can be redeemed tangible gift cards such as grocery coupons. Game mechanism approaches can be used to motivate health behavior change(54). The result of study showed in the pilot test 12 diabetes patients from all 20 diabetes patients increased 49.6% in frequency of blood glucose measurement from using the bant II apps. The study supported the principles of user-centered design. The features of health and fitness apps should be based on users' needs such as type 2 diabetes patients(51).

Many pedometer apps on smartphones and wireless pedometers allow user to track physical activity and provide feedbacks to increase physical activity. However, most users discontinue use of these apps quickly. From the economic theory, increasing rewards or benefits of achieving physical activity goal will motivate individual to reach their physical activity goals(55). Based on theory of reasoned action, individual will perform the behavior if they evaluate it positively

and their other important people think they should perform it. Hence, charitable incentives can motivate health behavior change. One research aimed to test the effectiveness of wireless wearable pedometer with and without cash or donation to charity incentives to encourage for reaching weekly physical activity goals and increase physical activity levels over six months. The study also tried to determine the cost effectiveness and incremental cost when the incentives were added to improve physical activity, not only by using wireless pedometer applications. The four-armed randomized control trial has been conducted with convenient sample of 800 full-time employees in Singapore. Fitbit Zip wireless pedometer was selected because it is low cost, small size, low record step error, convenient data uploading from pedometer to smartphones or personal computer via Bluetooth, and motivation feedback provide on Fitbit website. Participants can set steps goal, track steps and distance, monitor weight and diet, share steps data on social network like Facebook or Twitter, and get motivation message. Participants in two incentive arms (cash or charity) can earn S$15 if they achieve 50,000 to 69,999 steps per week and earn S$30 if they achieve 70,000 or more steps per week. Maximum 20,000 steps for each day is set to prevent injuries from excessive steps. For donation group, they were rewarded with personal feedback on the donation they raised for charity. The results showed wearable technologies plus financial incentives can be used for propose strategy to increase physical activity. The study also suggested providing specific step goal will significantly affect on the effectiveness of pedometer-based physical activity intervention. To enhance physical activity, scalable, effective, and affordable health promotion strategies are needed(56).

The two most important of self-management are self-monitoring and feedback(57, 58). Some domains suggested only one self-report per week is sufficient for effective self-monitoring(59). One study aimed to identify user preferences for self-monitoring and self-management features of mobile health applications. Focus group was conducted in HIV patients to discuss about their preferences and concerns about feasibility, acceptability, and attractiveness of privacy, goal setting, feedback, motivational messaging, data capturing method,

and reminders features. The results showed preference features including medication adherence reminders, sharing data with healthcare providers, goal setting motivational messaging, problem solving, and real-time feedback. The privacy like password protection for some sensitive information was also concerned. They wanted to be able to select which data was shared, with whom, and how to share the data. These features made using mobile health applications be attractive and acceptable. Motivation message and goal reminders features were beneficial to medication adherence, stress management, sexual risk, and substance abuse. They did not want only simple data summary but they wanted to see highlight trends, patterns, and anomalies. It would help them to figure things out. The major burden of using mobile health application was data entry during inconvenient time. They felt more convenient to access data via smartphones than via computer or log into website. However, user preferences of various characteristics of population could be different(2).

In 2014 among more than one million apps on smartphones, there were 23,490 and 17,756 health and fitness apps available on Apple iTunes (iOS) and Google Play (Android), respectively. Most of available health and fitness apps focus on fitness and self-monitoring such as improve physical activity, weight goals, nutrition and diets, sleep, relaxation, healthcare information, and alternative medicine(60). Some health and fitness apps allow data synchronizing with other wireless wearable devices. One research was conducted to show health and fitness applications on smartphones could help users to reach their health and fitness goal by analyzing user's health summary data, plan individual user's goal, provide rapid reliable feedback when users cannot achieve their minimum goal, personalized coaching, and allow sharing health goal achievement on social media to motivate users in friendly competition to improve behavior change and well-being. The study also reviewed popular health and fitness apps to see valuable features, and recommendations and limitations of health and fitness apps in patients' views. First, key criteria were identified to selected representative health and fitness apps to be reviewed. The selective criteria included available on both iOS and Android platforms, can be used by general adults, have feature for specific measure and

intervention to improve user's health and fitness, highly rated by end-users, unique, user-friendly interface, reliable, innovative, cost to purchase (free trial version offering), number of users logging into the apps via Facebook, allow data synchronizing with other health and fitness apps or devices, support social networking, easy review of periodic data summary, alerts system when health and wellness is going off course, and expert consultation available. From the recommendation based on the social cognitive theory, the effective activity monitoring apps should include goal setting, self-monitoring, and individual tailored feedback features(6). Result of one study showed adults aged 50 and over who received goal setting and daily feedback via mobile device significantly increased their physical activity per week when compared to the control group(61). Another study compared self-monitoring weight management among overweight participants using smartphone apps, website, and paper diary. The results showed intervention adherence in smartphone apps (means 92 days) was significantly higher than website group (means 35 days) and paper diary group (means 29 days), respectively. Means weight reduction at six months were 4.6 kg, 2.9 kg, and 1.3 kg in smartphone apps, website, and paper diary group, respectively(62). One study applied the Persuasive Social network for Physical Activity model to measure step count and share performance data on social network compared to control group. The result was measured after intervention one week. Means steps was 6352 per day in social support feature group compared to 4202 means steps per day in control group(63). The US Centers for Disease Control and Prevention has identified lack of encouragement and support from family and friends is the major barrier for improving physical activity. Health and fitness applications include feature of sharing workout achievement on social networking may have persuasive power to overcome the barrier. Limitations of current applications on smartphones were smartphone and sufficient Wi-Fi requirement, no appropriate reviewed from health professionals, cannot use by users who have physical impairment or disabilities or retirement age adults, inconvenient to take smartphones during some extreme activities, technical problem, apps not be developed based on behavioral change theories, sensors of smartphones may not accurate as standalone sensor devices, no data synchronizing

with other health and fitness apps and devices, and actively engagement of user is required to get benefit. The future health and fitness applications should develop security and privacy to protect personal health data and incorporate game design to increase fun and improve user engagement and compliance to achieve goal. The future ideal apps may cover all major aspects of health and fitness so users do not need to use many various specific apps(6).

2.9 Architectural design and requirement functions of PHR systems or mobile applications for use as self-management tools

One research aimed to define clear set of requirements for efficient PHR system. The concept of PHR is patient-centric. The primary goal of the PHR system is to support patients to be able to manage and maintain their health information. It will empower patients to take part in their own self-health management and make decisions. Complete and accurate health summary will help clinicians make more accurate diagnoses, improve healthcare delivery, and reduce healthcare costs. This paper applied three research projects to create evaluation criteria for the PHR system which they were the p-medicine project, the eHealthMonitor project, and the EURECA project. The p-medicine project had concept to change the current medical practices to personalized medicines. The patient profiling was utilized to create personalized decision makings and patient-doctor interactions. The eHealthMonitor project was to provide basic personal eHealth services to support decision makings through website, mobile and remote access channels. Three key requirement functions of PHR system for this project were alerts, linked with external monitoring medical devices, and creating understandable summary of health information. The EURECA project was to develop semantic interoperability and seamless integration among EHR, PHR, and clinical trials systems. The standard terminology such as SNOMED CT, ICD-10, and LOINC were used for data importing and data exporting. The research had process to create PHR system evaluation criteria. First, the twenty-five candidate PHR systems were identified by both websites search and publications search. Second, the evaluation criteria were established(14). They were

- The free and open source software (FOSS) requirement: Users have free license to study, copy, and redistribute the software. Moreover, users can access the source code of the software to modify it according to their needs or to meet healthcare requirements(14).

- The web-based system requirement: There are many advantages of web-based PHR system. Users can access the system at anytime and anywhere only has internet connection and browser. Users do not need to download and install the system. It can promote m-Health because it can easily integrate with mobile communication devices(14).

- The functions of the PHR system should have eight quality properties for general software product which are functional suitability, performance efficiency, compatibility, usability, reliability, security standards, maintainability, and portability. An ideal PHR system should include five categories of requirement functions. The first category is Problem which includes recording of patient problem, diagnosis process, and treatment process. The second category is Self Health Monitoring which includes functions that can help patients to monitor their own health status such as blood pressure, diets. The third category is Communication Management which includes functions that can provide convenient communication between patients and their healthcare professionals such as appointment schedules and reminders, recording of healthcare providers' contact information, communication messaging services like prescription refill. The forth category is Security and Access Control which includes Authentication (verify the user that he is the person he claims to be), Authorization (verify that the authenticated user has the right to access the system that he requests), Audit (capturing all access events in the system), Delegation (the ability of user to transfer rights to access the system to other users such as healthcare professionals which is very useful for emergency situation or allergic reaction cases.), and Data Security (data exchange and data storing encrypted). The last category is Intelligence Factors which includes additional education resources module, data presentation, data exporting, system alerts, recommendation for abnormal cases to support decision making, integration with other EHR systems or health applications, clinical trials resources(14).

- Architectural and technical requirements: PHR system should be designed to support maintainability, expendability, and interoperability. There are three types of architectural design of PHR systems which are standalone, tethered, and interconnected PHR system(14).

After that, the IT experts used evaluation model to evaluate each PHR system whether they could achieve optimal functionality requirements. The result showed the interconnected architectural model is superior to the tethered and standalone PHR system. Six PHR systems that were reported highest number of users were NoMoreClipboard, eClinicalWorks, WebMD, HealthVault, Patient Fusion, and Dossia(14).

Another research aimed to understand barriers to the PHR system adoption and use. Only about seven million US adult patients have used PHR in 2011. The study applied three methods to find the results of the study. First, end-user evaluation was performed. Three specific consumer-centric PHR systems were chosen to be representative PHR systems which they were Google Health, Microsoft Health Vault, and WorldHealthRecord. These PHR systems were selected according to the following criteria such as containing variety of features and functions, easily access through internet connection, and available to public. About 18 end-users who were various in careers, age, technical and medical experiences were asked to do nine specific tasks that mimic routine activities engagement of end-users such as update data, upload images, data export to show to their doctors. Second method was interview patients and clinicians about useful of the PHR system and general viewpoints on electronic health data and PHR system. Third method was heuristic evaluation from five HCI experts. They gave feedbacks of their perceptions of the PHR systems about how the heuristic and actual system matched up. After data analysis, the challenges of PHR adoption and use were categorized to seven issues which were(64)

- Advanced computationally functionality: the balance between comprehensive amount of functions provision and simplicity to use was challenge for software developers

- Terminology: Specific medical jargon or advanced languages such as diseases were too complex for general patients to interpret or understand it. It would be harmful if patients misunderstand and enter data incorrectly. The PHR system should use basic language as possible. Function that provides ability for users to search with different synonym listing was preferable than directed data entry.
- Personalization: the user interface design of the PHR system had effects on users' preferences and responses to the system. It should be designed to look simplistic such as neutral color use or offering users to change color schemes or layouts of the system according to their personal preferences.
- Familiarity and comfort: Users usually select to use product that is developed by the trusted and familiar company. Google Health and Microsoft Health Vault were much well known than WorldHealthRecord so most users concerned about brand products. However, well-known brand was not always advantage. Some users were worried about their health data record on Google Health would be publicly searchable because Google is well-known as good search engine.
- Collaboration, communication, and integration: Tracking record update status was one of the most concerned features of PHR system for both patients and clinicians especially completed lab results and medical procedures status. Sharing and integration between PHR record system and official medical record system (EMR) among patients and all their relevant healthcare professionals would be promote collaboration and communication to provide efficient healthcare delivery. The PHR system should allow clinicians to access and record some specific medical information instead of patients to protect error data.

- Privacy, security, and trust: PHR systems should be designed to protect patient's sensitive health information according to the Federal Health Insurance Portability and Accountability Act of 1996 (HIPAA) policy. Users said that they felt less trust if the username and password for logging in to the PHR system can use with other provided services of the developed company. Some users feel more comfortable to record their private health data in downloadable PHR program than web-based PHR program. Some users believed that their sensitive data would be safer on paid PHR system service than free of charge PHR service. It was important to design PHR model to make users trust about privacy and security protection such as level of authorization access to information. However, clinicians were less concerned about the data security and privacy issues on online PHR system.
- Ensuring accurate data: Health data record of PHR system should be accurate which means to be both complete and without errors. Sharing health information system will aim to provide both patients and health professionals to trust and keep health record being accurate. Some health IT systems have medical error checking feature to avoiding medical errors such as automated drug dispensing.

The result of this research showed that major barriers to PHR system adoption and use were usability concerns and socio-cultural concerns that according to many users' needs. This would be beneficial to PHR designers and developers to address these issues to enhance PHR adoption and use(64).

One research listed 25 necessary end-user features for successful PHR system and used Microsoft Health Vault and Google Health applications which are two biggest PHR platforms to evaluate suitable framework for PHR. The inclusion characteristics for successful PHR implementation were(12):

1. Patients should have ability to view and access their whole medical information through PHR system.

2. Patient information should be up-to-date and health professionals can edit information in PHR system with patient's permission.

3. Medical information should be recorded in understandable language instead of medical terminology so both health professionals and patients can understand and record correctly.

4. Patients should have ability to edit their health information. This would be both advantage and disadvantage. Although doing so will empower patients to have more involvement in the system, information correctness may reduce.

5. Patients should not need much effort or exotic technology to access PHR system.

6. Patients should have rights to control access to their PHR system. Others should have consent from patients first when they want to access PHR system for a defined period of time. General secure functions were authentication, authorization.

7. A possibility process to access PHR system without authorization should exist especially in emergency cases.

8. Audit feature should be available for end-user to check who access to their PHR and what actions they perform.

9. PHR system could provide healthcare costs function for patients to manage and support interaction with insurance company to review their insurance claim status.

10. Most patients require health data exporting and printing out as paper so they could take it to see a doctor.

11. PHR system should include secure messaging feature such as email communication to healthcare professionals. It is not only more convenient and faster than telephone but it also increases access to healthcare. Some patients feel this communication form is less intimidating than face-to-face conversation.

12. Many patients were interested in PHR system which provides online prescription refills function.

13. Many patients were also interested in PHR system which provides automated appointment scheduling function.

14. Computer-based reminders feature such as email reminders especially about appointment and medical procedures should be provided on PHR system.

15. PHR system should provide notification when their medical record is changed via email.

16. Health educational resources which are relate to the patient's record is provided to help patient understand unknown medical vocabulary.

17. Inclusion social support groups function in PHR system will help to encourage patients to improve their health outcomes such as cancer patients.

18. PHR system should be able to integrate with monitoring devices such as glucometers and blood pressure cuffs.

19. Computer-based decision support function of PHR system could help to improve physician's performance.

20. PHR system should be able to provide document filing to support referral management.

21. Medicine information about drug interaction or side effect of medicines could be available in PHR system.

22. Address book: Contact information of relevant healthcare providers should be recorded in PHR system.

23. PHR system could provide quality of care of clinicians and healthcare providers so patients can compare and select efficient healthcare delivery.

24. PHR system should be localization.

25. Searching function to find required information should be available in PHR system.

After that the study evaluated both Microsoft Health Vault and Google Health whether they consisted of 25 characteristics of ideal PHR system. The evaluation was based on current accessible internet documents and researchers' experiences with these applications. The results showed that the characteristics which these two representative PHR system were not available or partially available were understandable language use, exist of possibility to access PHR system in emergency

cases, healthcare cost information capturing only through integration with insurance companies, securing messaging, educational relevant health information, social support groups, address book, quality comparison, localization, and searching. For functions like prescription refills, appointment scheduling, reminders, decision support, filing referral requests, medicine information were only available through integration with healthcare service providers(12).

In the first quarter of 2010, more than fifty million smartphones were shipped worldwide(65). From smartphone use survey, about 94% of physicians have used smartphones to communicate, manage personal and business workflows, and search for medical information. Many people have used smartphones to bank, shop, and manage personal health information so mPHR using can be increased in adoption rate. The mobility and instant accessibility of mPHR can allow users to have their health record wherever and whenever they want. Personal health record (PHR) is one tool to provide flexible access to health information and services according to patient's demand(66). One research evaluated standalone mobile PHR application on IOS, Blackberry, and Android platforms to identify data elements and application features included in most current mPHR. Main characteristics of the PHR application which were assessed were content, feature and function, security, and marketing tactics. Considering implement scare marketing tactics was considered by inclusions of scare tactic sentences, the apps features reviewing sentences, or specific target certain users wording. The inclusion criteria of the selected mPHR in the study were operating standalone on mobile platform, can access offline with no external connectivity requiring such as internet connection or Wi-fi services, cover wide range of health topics and not narrowly focused on a specific type of diseases, be downloaded and function properly without any technical glitches, and download or subscribe cost not more than $100 US. Three components of 19 selected mPHR applications were identified which were product characteristics, data elements, and application features. Ten product characteristics included mobile platform, price, number of maximum records, and offline accessibility. The data elements included illness conditions, procedures, medication use, healthcare providers, allergies, laboratory tests, immunizations, family history, emergency contact information, and

healthcare insurance information. Application features included security of data such as password protection, data import/export, images uploading, print out health data summary, and user interface and ease of data entering and searching. The resulted showed end-users can view and edit data recorded in all selected mPHRs applications from mobile devices. These mPHR apps have relative inexpensive cost and require single payment at first download or registration with no monthly fees. The common components of typical mPHR are allergies and medications. Many potential mPHR applications which provide medical decision support or healthcare delivery at a distance features were excluded from the study just because of internet connectivity requiring. The selected mPHRs applications on iOS platform included more comprehensive data elements when compared to Android and BlackBerry. Most selected mPHRs applications on iOS platform provided password protection features and require user password every each time of use. The selected mPHRs applications on BlackBerry platform were simple. Manual data entry was required and data importing feature was limited the potentials on selected mPHRs applications on BlackBerry and Android platforms. Major consideration of selected mPHRs applications on BlackBerry platform was software and network incompatibility. Many selected mPHRs applications on Android platform were developed by a single developer. Emergency contact, family history, and insurance were least covered content components among mPHRs. Data import/export and image storing were features which were lacked from most mPHRs. Capzule PHR, Health n Family, My Family, and My Medical Pro were on highest number 1 top ranked because they included coverage data elements. None of selected mPHRs had all required functions according to evaluation criteria. The top four mPHRs contain 13 from 14 required content functions omitting only emergency case feature. Seven mPHRs lack of basic security function like password protection. Ten mPHRs support multiple user profiles. Eight mPHRs used marketing strategy. For marketing tactics results, half of selected mPHR applications used scare tactics to persuade users to purchase the apps. In the future, new technology should be used to develop mPHRs to enhance patient empowerment features and propose marketing strategy to target specific population needs(4).

Patient engagement in health promotion and disease management is critical to improve healthcare quality and healthcare cost containment(67). About 80% of PHR adoption rate in the United States would assume to save healthcare cost estimate at $19 billion annually(68). Personal health records (PHRs) are patient-centric tool which provide patient's ability to manage their health data and take part in health management. At present, PHR system is often perceived in computer-based type. Among three types of PHR models (standalone, tethered, and integrated), only integrated PHR system has potential to promote healthcare delivery and patient's self-care. Integrated PHR system is patient health information system that can link and share information with electronic health record system (EHR) of healthcare provider. In 2006, an invitational roundtable discussion on topic "Personal Health Records and Electronic Health Records: Navigating the Intersection" was held by Kaiser Permanente Institute for Health Policy, the American Medical Informatics Association (AMIA), the Robert Wood Johnson Foundation (RWJF), and the Agency for Healthcare Research and Quality (AHRQ) to identify potential integrated PHR framework, barriers of implement potential integrated PHR, and action framework to facilitate integrated PHR in healthcare services(69).

For PHR model, standalone or free-standing PHRs are common paper-based, computer-based, or internet application enable. Creation and control by patient and requiring manual data entry can cause inaccuracy and incompleteness of health data. This makes health professionals do not trust this kind of data. Health information of integrated/interconnected/networked web-based PHR is collected from many sources such as EHR, pharmacy data, insurance claims, and patient. It provides patient-provider communication channel and eliminate manual reentry data. This model provides more complete and accurate health data, eliminate data duplicate, improve data quality, and enhance convenience. Institution-specific, web-based/tethered PHR are PHR that can connect to single EHR system of specific provider. Health information is controlled by healthcare provider and patient can access to the EHR system via web portals(4, 69).

For additional functions of advanced PHR include accessing medical record with capacity to record or edit health information or patient decision support, drug

interaction checking, health monitoring and tele-reporting from home, remote medical visits, patient education resources, secure patient-physician email, prevention reminders, claims and payment processing, appointment scheduling, prescription refilling, medical history questionnaire, laboratory tests retrieving, health insurance and benefits reviewing(69).

The major capabilities of integrated PHR's potentials were:

- Good quality, complete, depth, and accessible health information provided by patient do health monitoring at home and send to healthcare provider directly.
- Facile communication among patient, healthcare provider, and informal caregiver to provide interactive decision making tool.
- Access to health knowledge like best practice guideline, self-care content
- Portability: health information can be accessed anywhere and anytime with internet connection.
- Auto population: Insertion of reusable content automatically helps reduce redundant data entry and ensure accurate and comprehensive data.

These capabilities of integrated PHR can improve healthcare in many aspects. For example(69):

1. Providing patient health information at the point of care could save time of gathering patient health history of health professionals. Integrated PHR also provides patient-provider communication tool.
2. It creates innovation in care management such as capture self-management and home monitoring data, link to peer support group. This is very useful for chronic disease patient by reduce doctor visits, provide access to lab tests data, and improve continuity of care.
3. It helps empower patient to control their health information.by generating medical home model. Integrated PHR also provides health promotion and lifestyle modification knowledge to educate patient.

4. Offering opportunities to reduce healthcare costs and improve healthcare delivery such as reduce redundant transactions and tests, reduce time to gather patient health history, provide healthcare services at a distance.

There were many barriers for adoption integrated PHR system as following major topics such as(69):

1. Culture in healthcare system and incentives such as balancing patient and physician autonomy towards shared decision making, physician concern about responsibilities in new care process and use health information technology, lacks of incentives to physician to provide healthcare with using integrated PHR system, physician concern risk of incomplete and inaccurate patient reported information.

2. Patient confidence and trust issues in exchange personal health information such as preventing unauthorized access or mistaken identity, able to review who has had access to personal health information(69). In 2007, the Institute of Medicine has conducted national survey that only 1% of respondents were comfortable if researchers freely used their personal health information without their consent.

3. Lack of technical interoperability standards due to immaturity of data portability. Technical interoperability standards require data interchange standards (codification, data structure and format), minimum common core data set, healthcare terminologies, authentication process to protect unauthorized access of health information system, identification process, security standards, data integrity processes, privacy standards, certification to ensure compliance with data interchange standards.

4. Lack of Health Information Technology (HIT) infrastructure due to high budget allocation of data integration, no mediating structure to support health information exchange among relevant stakeholders, limitation of access to online services.

5. Equity and usability includes racial and socioeconomic disparity gap, health illiteracy, special needs for individual physical limitations, lack of financial resources.

6. Value realization (ROI): cost-benefit or willing to pay for implement integrated PHR has not justified in practice. Benefits such as patient satisfaction, patient engagement, communicate improvement were not easily to measure.

7. Uncertain market demand such as concern about who should pay and how much to pay.

To improve advanced integrated PHR system, relevant private and public sector organizations should discuss about integrated PHR system includes desired functionalities, model development and evaluation, effectiveness to all stakeholders, barriers of implementation, security and privacy protection, semantic interoperability, inform consent for authorized information exchange, needs of physical impairment person(69).

Patients need memory, organization, and planning skill to manage their medication use. Mobile health application could remind patient to take medication or refill prescription(70). About 52% of US smartphone owners have used smartphone to search for medical information. Nearly one in five smartphone users have downloaded mobile health application to do health management and nearly 10% of US adults have used mobile health application to promote their health. One study conducted systematic review of current available mobile applications to support medication self-management of patient. The mobile health applications in the study were concerned about platform, number of installation, review ratings, cost, recent update history, features and capabilities. The result of study showed among 424 eligible applications, which were highly varied in quality, content, and functionality. Most popular functions were medication reminders or alerts, medication history list creation, data exporting and sending email to third party such as healthcare provider, medication management for multiple users such as family members, respectively. Subset analysis was conducted with 26 top ten search results health applications. About 56.3% of user reviews gave positive or general comments. The most common complaint of available medication management applications included technical difficulties such as frequent crash or malfunction after upgrading and the absence of desired features include notification for alarms, expand visual images of medication, create medication taken history, data exporting and sending email to third party such as healthcare provider and family, poor user interface design, future prescription refill, illness and laboratory results record, registration and log in problem, data security concerns, and difficulty syncing with other devices.

Mobile medication management applications can provide features like medication taken reminders, prescription refills notification, medication use history creation could help patient take their medication safely and appropriately(70).

2.10 Personal Health Record adoption in community pharmacy settings

One research project was tried to promote PHR adoption of consumers in community pharmacy context. The guidance ADDIE model was created to be PHR adoption framework in community pharmacy settings. The model contained five phases which were analysis, design, development, implementation, and evaluation.(71) PHR can be innovative solution for fragmented communication and lacks of interoperability among electronic health record systems(72). From the national survey in 2012, only about 7-10% of Americans reported they have used a PHR. This indicated very small number of Americans has used PHR although medical and technology stakeholders have tried to push PHR adoption. Community pharmacists have important role impact on patients' health behaviors through health educational and intervention programs such as smoking cessation. Community pharmacists are assumed to be educators and PHR facilitators for providing healthcare services. The two major phases of the ADDIE project were educational materials development as tools for pharmacist-patient communication and implementation the program in community pharmacy setting. In analyze phase, workplace environment of community pharmacy was considered whether it was suitable for PHR adoption implementation or not. The administrative burdens were faced including training needs, increased tasks of community pharmacists, manpower needs, new technology costs. These burdens would bring difficult challenges for change community pharmacy setting to be practical for PHR implementation. In design phase, instructional and educational materials were designed to be clear and easy in order to change patient's health behavior. Instructional system design should determine end goal, create some intervention, and measurable outcomes. For successful of PHR adoption in community pharmacy, both patients and pharmacists needed to achieve in computer literacy. Both of them should be assessed basic computer skills at the initial of PHR use. In develop phase, educational materials and

pharmacy environment were properly arranged for PHR adoption. Both basic background knowledge about PHR and manual guide how to create PHR according to patient' needs or specific health condition were provided on the myPHR website. In implementation phase, the instructional materials were delivered to patients. In this study, the pilot test was conducted with pharmacy students on academic rotation. The students provided PHR implement program and patient-centered care in community pharmacy environment. The last evaluate phase evaluated the overall outcomes of PHR program implementation. The educational materials, patient learning, PHR adoption rate achievements, and effectiveness of communication with patient were analyzed. The ADDIE model was assumed to be accepted and used in all pharmacy communities in the near future. It needs reasonable timeframe about few years to transform the public's perception about using and maintaining PHR in a positive way(71).

CHAPTER III

METHODOLOGY

An observational study design was conducted to explore factors influencing the intention to use a personal health record via smartphone. A prospective study design was conducted to investigate community pharmacy customer's behavior of using personal health record via smart phones(31, 73). This research was conducted from August 2014 to February 2016 at two branches of Pharmax Pharmaceutical Center in Bangkok which are Praditmanutham branch and Chamchuri Square branch.

3.1 Identification and selection of applications

The Microsoft HealthVault application, developed by the Microsoft Company, was selected to be the representative of the personal health record applications available to download to a smartphone. There are comprehensive features and functions contained in this app as a self-care management tool such as a health information repository, self-monitoring, and goal setting(10).

3.2 Theoretical conceptual framework model creation

To identify the factors that affected community pharmacy customer's decision to use mobile personal health record from the previous researches. All relevant human behavior theories and models were studied and compared the similarity and difference of the constructs among these theories. Then, the independent variables and dependent variable were selected and clustered to formulate the conceptual framework of the study. The concepts, measurement, and data collection tool were designed. The response of questionnaire from participants was used to study factors affecting community pharmacy customer's decision to use mobile personal health record.

The Conceptual Framework

The Unified Theory of Acceptance and Use of Technology (UTAUT) model was applied to examine the factors affecting community pharmacy customer's decision to use mobile personal health record application because this model was developed

from many theories that were related to technology acceptance and adoption. It can address the limitations of the Technology Acceptance Model (TAM) by adding individual difference variables such as past experiences, voluntariness, etc. as the moderating variables to the model. It can also address generality problem. Moreover, some constructs in technology acceptance theories such as the Unified Theory of Acceptance and Use of Technology (UTAUT) model, the Theory of Planned Behavior (TPB), Innovation Diffusion Theory (IDT), etc. have similarity definition or meaning. It can be used to measure the same thing. For examples;

- Performance expectancy of the UTAUT model is related to perceived usefulness of the TAM. In the conceptual framework of the study, expected benefits is replaced performance expectancy construct because this variable will be measured both in pre- and post- adoption stages.
- Effort expectancy of the UTAUT model is related to perceived ease of use of the TAM.
- Social influence of the UTAUT model is related to subjective norm of the TPB(31, 33).
- Voluntariness is described as the extent to which individuals are free to choose to use or not use new information technology. It has an important effect on intention to use information system especially when users have no prior experience in the initial acceptance behavior. This is because it requires the extent of behavior modification(74). In voluntary environment, intention to use technology mainly depends on user's control while in mandatory environment, normative consideration or organizationally compulsory has much stronger effect on intention to use technology(75).

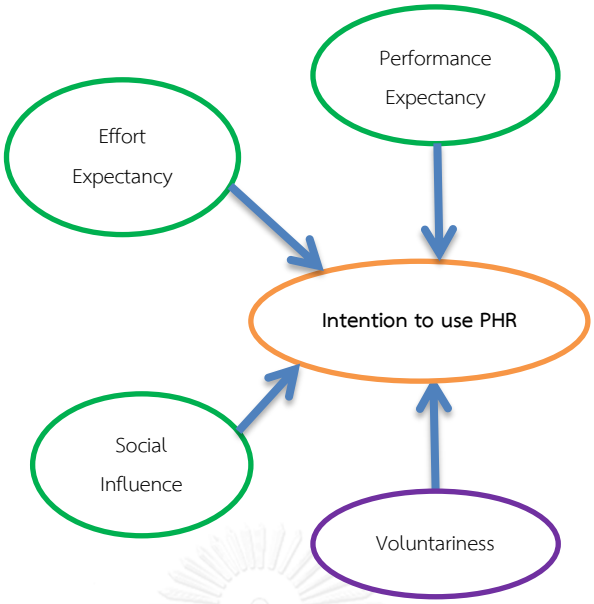

Figure 1 The conceptual framework to identify factors affecting intention to use personal health record via smart phones

According to the first objective of this study was to study factors affecting community pharmacy customer's decision to use personal health record via smart phones, the first part of the conceptual framework which was shown about predictors influence intention to use personal health record before use was focused on this research. The dependent variable of the study was intention to use PHR as shown in figure 2.

Data collection tool and measurement scale of each variables were shown in table 1.

Table 1 Outcomes measurement

Variables	Operational Definitions	Data collection tools	Measurement scale	Attributes
Performance expectancy	The degree to which respondents perceived of getting	Factors influence intention to use Microsoft HealthVault	Continuous scales (Five points Likert scales)	strongly disagree=1 to strongly agree=5

	benefits from the personal health record via smart phone(29) (28).	application questionnaire		
Effort expectancy	The degree to which respondents perceived of using the personal health record via smart phone is easy and comfortable (11, 28-30).	Factors influence intention to use Microsoft HealthVault application questionnaire	Continuous scales (Five points Likert scales)	strongly disagree=1 to strongly agree=5
Social influence	The degree to which respondents perceived their important people believe they should use the personal health record via smart	Factors influence intention to use Microsoft Health Vault application questionnaire	Continuous scales (Five points Likert scales)	strongly disagree =1 to strongly agree =5

	phone(11, 28-30).			
Voluntariness	The degree to which respondents perceived of using personal health record via smart phone is voluntary or free will(11, 28).	Factors influence intention to use Microsoft Health Vault application questionnaire	Continuous scales (Five points Likert scales)	strongly disagree =1 to strongly agree =5
Intention to use PHR	The degree to which respondents intend to use personal health record via smart phone(11).	Factors influence intention to use Microsoft Health Vault application questionnaire	Continuous scales (Five points Likert scales) Converted to Category scales	strongly disagree =1 to strongly agree =5; no intention to use PHR (1-3) = 0 intention to use PHR (4-5) = 1
Pattern of PHR use	Some functions in	1. Microsoft Health Vault	1. Functions of the Microsoft	

	the personal health record system via smart phone that the respondents have used according to their characteristics (non-diabetic or hypertensive respondents, diabetic respondents, or hypertensive respondents) after registration and the frequency of using per week(29) and reasons of hardly used the personal health record system via smart phone.	application use behavior questionnaire 2. Semi-structured interviewing	Health Vault application use 2. Frequency of use per week(29) (Continuous scales) 3. The reasons the participants did not use or hardly used the Microsoft Health Vault application	

Demographic data: age, gender, highest education level, incomes, frequency of smart phone use, illness history, and health behavior(9, 28).

Examples of questions

Performance expectancy (five points Likert scales: strongly disagree, quite disagree, neutral, quite agree, strongly agree)(73)

- Using Microsoft Health Vault will help me to manage health information.
- Using Microsoft Health Vault will help me to record health information continuously.
- Using Microsoft Health Vault has privacy and security for my health information.
- Using Microsoft Health Vault will help me to set health goals such as weight control, diet control, blood sugar or blood pressure control.
- Using Microsoft Health Vault will help me to monitor health behaviors such as weight control, diet control, blood sugar or blood pressure control.
- Using Microsoft Health Vault will help me to talk to health professionals such as doctors, pharmacists about my health condition, illness history, medication use, drug allergies, etc. more conveniently.
- Using Microsoft Health Vault will help me to take care of overall health better.

Effort expectancy (five points Likert scales: strongly disagree, quite disagree, neutral, quite agree, strongly agree)(11)

- I am ability to use the Microsoft Health Vault.
- I am ability to record health information in the Microsoft Health Vault.
- I am ability to read and interpret health information that is shown in the Microsoft Health Vault.
- Learning how to the Microsoft Health Vault is easy for me.
- I am ability to use functions of the Microsoft Health Vault as I need.

Social influence(11) (five points Likert scales: strongly disagree, quite disagree, neutral, quite agree, strongly agree)(11)

- My family supports me to use the Microsoft Health Vault.
- My friends support me to use the Microsoft Health Vault.
- My colleagues support me to use the Microsoft Health Vault.
- Healthcare professionals such as doctors, pharmacists, etc. support me to use the Microsoft Health Vault.

Voluntariness(11) (five points Likert scales: strongly disagree, quite disagree, neutral, quite agree, strongly agree)(11)

- I am willing to show my health information in the Microsoft Health Vault.
- Using Microsoft Health Vault is in line with my willingness.
- I am not forced to use the Microsoft Health Vault.

Intention to use PHR (five points Likert scales: strongly disagree, quite disagree, neutral, quite agree, strongly agree)(11)

- I intend to search additional information about using the Microsoft Health Vault.
- I intend to use the Microsoft Health Vault in the future.
- I intend to use the Microsoft Health Vault in daily life.

Pattern of PHR use:

The personal health record via smart phone use behavior of the respondents according to their characteristics (non-diabetic or hypertensive respondents, diabetic respondents, or hypertensive respondents) is examined by

1. The questionnaire about use behavior after using for four weeks in each functions of the application, the objectives of use, and frequency of using per week(29) such as

    1.1 Using health information record function for

        - Recording or viewing illness history
        - Recording or viewing medication use history

- Recording or viewing immunization history
- Recording or viewing drug or food allergy history
- Recording or viewing lab test results such as cholesterol level
- Showing health information when you go to see doctors or pharmacists

1.2 Using weight control function for

- Recording weight or height
- Recording exercise behavior or calculating calorie burn from exercise
- Setting weight control goal or exercise goal
- Calculating calorie from dietary intake
- Monitoring exercise behavior trends for a period of time
- Monitoring dietary intake behavior trends for a period of time
- Monitoring weight level trends for a period of time

1.3 Using blood pressure function for

- Recording blood pressure or pulse rate measurement
- Monitoring blood pressure level trends for a period of time
- Showing blood pressure level trends for a period of time to health professionals such as doctors or pharmacists

1.4 Using blood glucose level function for

- Recording blood glucose measurement
- Monitoring blood glucose level trends for a period of time
- Showing blood glucose level trends for a period of time to health professionals such as doctors or pharmacists

2. Semi-structured interviewing about the reasons the participants did not use or hardly used the personal health record system via smart phone. Lists of questions are:

2.1 Do you usually use any personal health record application or health and fitness application via smartphone?

2.2 What are your concerns or barriers of using the personal health record application via smartphone?

2.3 How different between this personal health record application and other health and fitness application via smartphone in aspects of advantages and ease of use?

2.4 Do you think that only few people have used personal health record application or health and fitness application via smartphone?

2.5 In your views, why do people hardly use personal health record application or health and fitness application via smartphone?

2.6 Give some recommendations to improve personal health record application via smartphone to increase use?

Demographics(9, 28)

- Age
- Gender: male, female
- Highest education level: doctor's degree, master degree, bachelor degree, diploma, senior high school graduated, junior high school graduated, elementary school graduated
- Average incomes per month: ≤ 10,000 baht, 10,001-30,000 baht, 30,001-50,000 baht, 50,001-80,000 baht, 80,001-100,000 baht, ≥ 100,001 baht
- Frequency smart phone use: (average time period of use for each time, average number of times of use per day)
- Illness history: no chronic diseases, diabetes, hypertension, coronary heart disease, obesity
- Health awareness: health information searching, vitamins and dietary supplements intake, exercise, doctor visit frequency, self-assessment of health, use self-monitoring health device, self-assessment of healthcare

3.3 Participants selection

The study is conducted in Bangkok. The population of the study is customers in the drug store setting in Bangkok. The unit of analysis is one customer in the Pharmax Pharmaceutical Center.

The study has been designed to use the convenient sampling method and recruited the participants that meet the inclusion criteria and volunteer to be sample. The consent from all participants will be obtained.

Due to the Microsoft Health Vault application have four main functions which are health history record, weight control, blood glucose measurement, and blood pressure measurement and the pattern of health behavior between chronic disease people and healthy people are different, the participants of the study will be classified into three group. They are:

1. The participants who don't have diabetes or high blood pressure but they want to control weight. They will be taught how to record health history, how to record health indicators and health behaviors (Weight, height, dietary intake, and exercise), view health indicators and health behaviors trends (Weight, height, dietary intake, and exercise).

2. The participants who have diabetes will be taught how to record health history, record blood sugar level, and view blood sugar level trends as a graph.

3. The participants who have high blood pressure will be taught how to record health history, record blood pressure level, and view blood pressure level trends as a graph.

For the participants who have both diabetes and high blood pressure can select which functions of the application they want to use. They can select both blood sugar function and blood pressure measurement function.

Inclusion and Exclusion criteria of participant:

For the context of the research, the study is conducted in the suitable two branches of Pharmax Pharmaceutical Center.

Inclusion criteria

- Working age drug store customers who is not less than 23 years old because they are working-aged adults who can afford a smartphone and have the ability to share their private health information without consent from their guardians
- Have smartphone only IOS and Windows phone, usually use their own smartphone, and can download the Microsoft Health Vault application
- Able to use the internet and be proficient in English

Sample size calculation

The Binary Logistic Regression Analysis has been applied to analyze the outcomes to identify factors affecting community pharmacy customers' decision to use a personal health record via a smartphone(76).

The sample size will be calculated for the Binary Logistic Regression Analysis. In sample size calculator program for Binary Logistic Regression Analysis, the anticipated effect size, desired statistical power level, number of predictors, and probability are required. The effect size of all predictors in this study cannot be calculated, so some rules of thumb are used. Fifteen cases per one predictor are calculated. There are four predictors in this research. The calculation for the sample size was 4 x 15 = 60 cases. This study conducted two data collection process which are prior use and after use the PHR application. About twenty percent of the number of sample size was added to prevent the low response rate problem in after used phase. Thus, a total sample size of (20/100 x 60) + 60 = 72 cases was selected(76).

3.4 Data collection tool development

Both the questionnaire of before using the personal health record via smart phone to measure both the predictors and intention of use and the after using the personal health record via smart phone questionnaire to investigate the pattern of use were developed to use as data collection tool of the study.

3.4.1 Validity test

The questionnaire that is generated will be tested for face validity. Four experts who were specialized in human behavior theory and statistical analysis were invited to check whether the questionnaires were comprehensive and conform to the variables that were measured or not. The questions were adapted to be more clearly and the measurement scales were adjusted more properly.

3.4.2 Reliability test

The pilot study has been conducted with 30 general customers at department stores to test reliability of intention to use PHR questionnaire and PHR use behavior questionnaire. They also provided some comments about the questionnaire.

The reliability of the questionnaire was assessed by the Cronbach's alpha coefficient. The Cronbach's alpha coefficient for all variables in the study, intention to use PHR (INT), performance expectancy (PE), effort expectancy (EE), social influence (SI), and voluntariness (Vol) were 0.87, 0.92, 0.87, 0.88 and 0.78, respectively, which were all more than the conventional level of 0.7(77). The summary of reliability test for intention to use the PHR questionnaire was shown in table 2

Table 2 The summary of reliability test for intention to use the PHR questionnaire

Variable	Number of Items	Cronbach's Alpha	Standardized Cronbach's Alpha
Intention to use PHR	3	0.866	0.866
Performance expectancy	7	0.913	0.919
Effort expectancy	5	0.873	0.871
Social influence	4	0.877	0.883
Voluntariness	3	0.779	0.781

3.5 Data collection method

There were three approach processes to have participants in the study

1. The promotion activities were created to introduce about the Microsoft Health Vault application in the special events of the drug store such as the anniversary drug store foundation event. Most member customers of the drug store were invited to go to the event. The promotion handbills about the Microsoft health Vault application were distributed to inform how to download and use it, various features and functions and benefits of the application, contact channels for applying the project. The member customers who are interested and qualified were recruited in the study.

2. The member customers who were interested and qualified could apply to participate in the study directly at the health screening counter when they go to the Pharmax Pharmaceutical Center to buy medicines. They can also ask to have health screening for risks of non-communicable diseases.

3. The promotion handbills about the Microsoft health Vault application were sent to the member customers of the drug store by mail to inform about new Microsoft Health Vault application service of the Pharmax Pharmaceutical Center. The member customers who were interested to use the application could go to the drug store to apply and learn how to use it.

All participants will be:

- Inform about general information of mobile personal health records
- The Microsoft HealthVault application preview was shown detailing functions and features. The participants were educated how to download and use the functions of the Microsoft Health Vault application according to their characteristic group (non-diabetic or hypertensive respondents, diabetic respondents, or hypertensive respondents). They were also helped to register and record some basic information in the application.

- Be asked to do the before use the application questionnaire to study factors influence decision to use Microsoft Health Vault application and hand in on the register date before real use. In the demographic part of the questionnaire, the participants were asked about their illness history (at the section 4 question number 7). This question would help to identify which classified group (non-diabetic or hypertensive respondents, diabetic respondents, or hypertensive respondents) was suitable for that participant.

During the PHR use period, manual guides were sent to participants to educate how to use the personal health record application, contact email and mobile phone number of researcher also provided to allow participants to ask when they had some problems about using the personal health record via smart phones.

Due to each participant were not recruited into the study at the same time and each participant had time data collection period of application use about one month(28, 29), the complete data collection period for all 72 participants of the study was about three months.

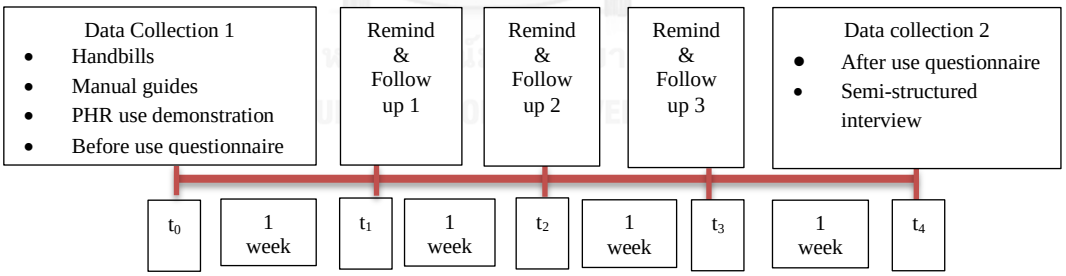

Figure 2 Timeframe of the study process

In the research plan, the reminder and follow up system was designed as shown in figure 2. All the participants were contacted every week during one month period of use by phones, messages, or e-mail, etc. in order to remind them to use or ask if there are some problems about using the application(28, 29).

After using period for four weeks, all participants were asked to do the Microsoft Health Vault application use behavior (after use the application) questionnaires by phone(28). This survey is conducted to examine functions of the

applications that had been used, and frequency of use per week according to their characteristics (non-diabetic or hypertensive respondents, diabetic respondents, or hypertensive respondents). The before use questionnaire and the after use questionnaire of each participant were matched. Semi-structured telephone interviewing about the reasons the participants did not use or hardly used the personal health record system via smart phone was also asked(31).

However, the collected data of the participants who could not be followed to do the Microsoft Health Vault application use behavior (after use the application) questionnaires were not be analyzed in the study.

3.6 Result data collection and analysis

All outcomes from before use questionnaires were analyzed by Binary Logistic Regression Analysis to identify factors affecting community pharmacy customers' decision to use a personal health record via a smartphone (alpha < 0.05)(76). The data analysis was performed using SPSS version 22.

The prediction equation was:

Intention to use PHR = a(Performance expectancy + b(Effort expectancy + c(Social influence) + d(Voluntariness)

The descriptive analysis was applied to analyze the community pharmacy customer's behavior of using personal health record via smart phones according to their characteristics (non-diabetic or hypertensive respondents, diabetic respondents, or hypertensive respondents) as frequency and percent.

The demographic variables such as gender, age, highest education level, incomes, illness history, etc. were also analyzed as the descriptive analysis and interpret the results as percent.

3.7 Ethical approval

The study protocol, demonstration materials, data collection tools, and all related documents were approved and monitored by the Ethics Review Committee for Research Involving Human Research Subjects, Health Science Group, Chulalongkorn University. The research project number is 166.1/58. The time period of approval is from 24 November 2015 to 23 November 2016.

CHAPTER IV

RESULTS

The results of this study had three parts. The first part showed the demographic data of the participants. The second part showed about the reliability test result of the factors influence intention to use Microsoft Health Vault application questionnaire (before use questionnaire), the descriptive statistics, the correlation between each predictors and the intention to use the PHR, the result of factors affecting community pharmacy customer's decision to use personal health record via smart phones and the prediction equation by applying the Binary Logistic Regression Analysis. The third part showed the result of Microsoft Health Vault application use behavior about functions of the Microsoft Health Vault application use according to their characteristics (non-diabetic or hypertensive respondents, diabetic respondents, or hypertensive respondents), frequency of use per week (Continuous scales), and the reasons the participants did not use or hardly used the Microsoft Health Vault application.

4.1 Demographic data

All 72 participants were varied in gender, highest education level, incomes, and illness history as shown in table 3.

Table 3 Characteristic of all participants classified by gender, highest education level, incomes, and illness history

Characteristic	n	%
Gender	72	100
Male	23	31.9
Female	**49**	**68.1**

Highest education level	72	100
Elementary school	0	0
Junior high school	1	1.4
Senior high school	4	5.6
Diploma	2	2.8
Bachelor's degree	**41**	**56.9**
Master's degree	21	29.2
Doctor's degree	3	4.2
Incomes /month (baht)	72	100
< 10,000	5	6.9
10,001 – 30,000	**27**	**37.5**
30,001 – 50,000	22	30.6
50,001 – 80,000	7	9.7
80,001 – 100,000	6	8.3
> 100,000	5	6.9
Illness history	72	100
No chronic disease	**59**	**81.9**
Diabetes	4	5.6
Hypertension	4	5.6
Coronary heart disease	1	1.4
Obesity	5	6.9
Hyperlipidemia	2	2.8
Hepatitis B	1	1.4
Thyroid disease	1	1.4
Allergic rhinitis	1	1.4

All 72 participants were varied in age, frequency of smart phone use, and health awareness as shown in table 4.

Table 4 Characteristic of all participants classified by age, frequency of smart phone use, and health awareness

Characteristic	n	Mean±SD	Mode	Min	Max
Age	72	34.58±10.46	**23**	23	64
Frequency of smartphone use	72				
Times of use/day		11.36±7.81	**10**	3	50
Average period time of use (minutes)		14.51±10.72	**10**	1	60
Sum of Health awareness	72	10.21±1.70	**11**	7	14
Health information searching		-	1	0 (9)	**1 (63)**
Vitamins and dietary supplements intake		-	1	0 (24)	**1 (48)**
Exercise		-	0	**0 (50)**	1 (22)
Doctor visit frequency (times/year)		-	**0 – 3**	0 – 3	6 – 12
Self-assessment of health		3.47±0.65	**4 (34)**	2 (4)	5 (2)
Use self-monitoring health device		-	**0**	**0 (63)**	1 (9)
Self-assessment of healthcare		3.44±0.73	**3 (32)**	2 (6)	5 (4)

4.2 Binary Logistic Regression Results of factors affecting intention to use Microsoft Health Vault application questionnaire (before use questionnaire)

The descriptive statistics, the correlation between each predictors and the intention to use the PHR, the result of factors affecting community pharmacy customer's decision to use personal health record via smart phones and the prediction equation were analyzed by applying the Binary Logistic Regression Analysis(76).

4.2.1 Descriptive statistics

A sample size of seventy-two was analyzed. The descriptive data of all variables in the study were shown in table 5.

Table 5 The descriptive data of all variables in the study

Variable	Weight mean ranging	Mean ± SD	Scales
Intention to use PHR	3.78 ± 0.71	11.33 ± 2.12	1 – 5
Performance expectancy	4.07 ±0.55	28.49 ± 3.86	1 – 5
Effort expectancy	4.02 ±0.55	20.10 ± 2.73	1 – 5
Social influence	3.67 ±0.62	14.69 ± 2.48	1 – 5
Voluntariness	4.25 ±0.55	12.74 ±1.65	1 - 5

When continuous scales (five points Likert scales) of intention to use PHR was converted to category scales (1 = intention to use PHR, 0 = no intention to use PHR). From data collection of 72 participants about the intention to use PHR questionnaire, there were 46 people (63.9%) who intended to use the PHR application as shown in table 6

Table 6 The descriptive data of Intention to use PHR in category scales

	Frequency	Percent
Intention to use PHR	46	63.90
No intention to use PHR	26	36.10
Total	72	100.00

4.2.2 Correlation between each predictors and the intention to use the PHR

The hypothesis of the study was:

H_0: r = 0

H_1: r ≠ 0

1) Performance expectancy correlates to intention to use PHR.

2) Effort expectancy correlates to intention to use PHR.

3) Social influence correlates to intention to use PHR.

4) Voluntariness correlates to intention to use PHR.

5) Performance expectancy does not correlate to effort expectancy.

6) Performance expectancy does not correlate to social influence.

7) Performance expectancy does not correlate to voluntariness.

8) Effort expectancy does not correlate to social influence.

9) Effort expectancy does not correlate to voluntariness.

10) Social influence does not correlate to voluntariness.

The correlations of all predictors with intention to use PHR were shown in table 7.

Table 7 The correlation of all independent variables toward intention to use PHR

	1	2	3	4	5
1. Intention to use PHR	1.000				
2. Performance expectancy	**0.609***	1.000			
3. Effort expectancy	**0.426***	**0.445***	1.000		
4. Social influence	**0.673***	**0.534***	0.353	1.000	
5. Voluntariness	**0.553***	**0.672***	**0.509***	**0.451***	1.000

Note * statistical significant ($p < 0.001$)

The correlations of all predictors with intention to use PHR were shown in figure 3.

Figure 3 Correlation of all predictors with intention to use PHR (n = 72; $^{*}p < 0.001$)

All predictors were significantly correlated to the intention to use PHR.

4.2.3 Binary Logistic Regression Analysis results

The hypothesis of the study was:

H_0: $\beta_1 = 0$, $\beta_2 = 0$, $\beta_3 = 0$, $\beta_4 = 0$

H_1: $\beta_1 \neq 0$, $\beta_2 \neq 0$, $\beta_3 \neq 0$, $\beta_4 \neq 0$

1) There will be positive relationship between intention to use PHR and performance expectancy.

2) There will be positive relationship between intention to use PHR and effort expectancy.

3) There will be positive relationship between intention to use PHR and social influence.

4) There will be positive relationship between intention to use PHR and voluntariness.

Analytical strategy for assessing the model

In this study has aimed to find how each independent variables influence the intention to use PHR. Other previous studies have shown all four predictors have significant effects on the intention to use PHR as shown in the figure 1 the conceptual framework of the study. The study did not want to adapt the model by adding or deleting some independent variables which has to use stepwise method both forward and backward to improve the study model. Hence, the data was analyzed using Binary Logistic Regression Analysis by enter method. All independent variables of the model were analyzed at the same time.

The inferential goodness-of-fit test is the Hosmer–Lemeshow (H–L) test that yielded a $\chi^2(8)$ of 9.02 and was insignificant ($p > .05$), suggesting that the model was fit to the data well(78). From the Model Summary of the Logistic Regression Analysis, the Nagelkerke R Square is 0.600 which indicating goodness-of-fit of 60.0% between the predictors and the intention to use PHR(78). The –2log likelihood value is 52.71. For statistical tests of each predictor in the study, the odds ratio of each predictor was shown in the table 8. Both social influence and performance expectancy were significant predictors of intention to use PHR ($p < 0.05$). The Prediction Equation is:

Z = - 25.36 + 2.01 Performance expectancy* + 0.49 Effort expectancy + 3.68 Social influence* + 0.78 Voluntariness

Table 8 Logistic Regression analysis of 72 customers for intention to use (Enter method)

Predictor	*p*	Odds Ratio	95% C.I. for Odds Ratio	
			Lower	Upper
Performance expectancy	0.03	7.48	1.18	47.51
Effort expectancy	0.53	1.62	0.36	7.27
Social influence	0.00	39.56	5.17	302.69

Voluntariness	0.37	2.18	0.39	12.13

Only social influence (SI) and Performance expectancy (PE) had a significant unique contribution in the prediction of intention to use PHR as shown in Table 8 ($^{*}p < 0.05$)

Multicollinearity which is a statistical phenomenon in which a perfect or exact relationship between the predictors exists, is also tested. It leads to difficulty in estimating of each predictor's coefficients and can cause incorrect interpret the relationship between dependent variable and predictors. In this study, multicollinearity problem was ruled out because:

- The correlations Matrix of each predictor was all less than 0.8 as shown in table 7.

4.3 Personal health records via smartphone use behavior

After all 72 participants had been educated how to use the Microsoft Health Vault application and had tried using it for a month, they were asked to do the Microsoft Health Vault application use behavior questionnaire (after use)(29). Their response will show whether they used the application or not, functions that they used, and frequency of use(29). Moreover, the participants were interviewed about "From their views, why do people hardly use personal health record via smartphone?"

4.3.1 Personal health record via smartphone use behavior according to characteristics of the participants

From all 72 participants, there were only 38 participants who could do the Microsoft Health Vault application use behavior questionnaire. The response rate was about 52.78%. There were about 26 people from 38 people who used the Microsoft Health Vault application. (68.42%) The proportion of participants who used and did not use the Microsoft Health Vault application was shown in table 9.

Table 9 Number of participants who used and did not use the Microsoft Health Vault application

Used	Did not use

26 (68.42%)	12 (31.58%)

All 38 participants were classified according to their characteristic such as gender, illness history, or health awareness as shown in table 10, 11, 12, respectively.

Table 10 Number of participants who used and did not use the Microsoft Health Vault application classified according to gender

	Male	Female
Used	9 (23.68%)	17 (44.74%)
Did not use	3 (7.89%)	9 (23.68%)

Table 11 Number of participants who used and did not use the Microsoft Health Vault application classified according to illness history

	Healthy	chronic
Used	25 (65.79%)	1 (2.63%) (hyperlipidemia)
Did not use	8 (21.05%)	4 (10.53%) (Hypertension, allergy, hepatitis B, thyroid)

Table 12 Number of participants who used and did not use the Microsoft Health Vault application classified according to health awareness

	Health awareness	Not Health awareness
Used	15 (39.47%)	11 (28.95%)
Did not use	4 (10.53%)	8 (21.05%)

Sum score of health awareness was measured from health information searching, vitamins and dietary supplements intake, exercise, doctor visit frequency, self-assessment of health, use self-monitoring health device, self-assessment of healthcare

The criteria for:

Health awareness: sum score of health awareness was 11 to 15

Not health awareness: sum score of health awareness was 3 to 10

4.3.2 Personal health record via smartphone use behavior according to features and functions of the Microsoft Health vault application

For this study, the features and functions of the Microsoft Health Vault application were classified into four groups.

1) Health record function: this function is available for users to record their health information such as illness history or chronic disease, medication use, vaccination history, drug or food allergy, lab results, and users can show their health information that is recorded in the application to the health professionals when they go to see doctors or pharmacists.

2) Weight control function: Users can use this function to record their weight, their exercise behavior, and their dietary behavior. They can set their weight goal too. Moreover, they can track and monitor their weight trends, their exercise trends, and dietary trends.

3) Blood pressure function: Users can use this function to record their blood pressure value. They can also monitor and track their blood pressure trends. Users can show their blood pressure trends that are recorded in the application to the health professionals when they go to see doctors or pharmacists.

4) Blood sugar function: Users can use this function to record their blood sugar value. They can also monitor and track their blood sugar trends. Users can show their blood sugar trends that are recorded in the application to the health professionals when they go to see doctors or pharmacists.

All participants were taught how to use the Microsoft Health vault application such as how to record the data, how to monitor or show the data. Each participant could select to use many functions of the application that were matched with their characteristics or their requirements.

From the figure 4, weight control function was the most popular function that had been used because most participants in the study were healthy people.

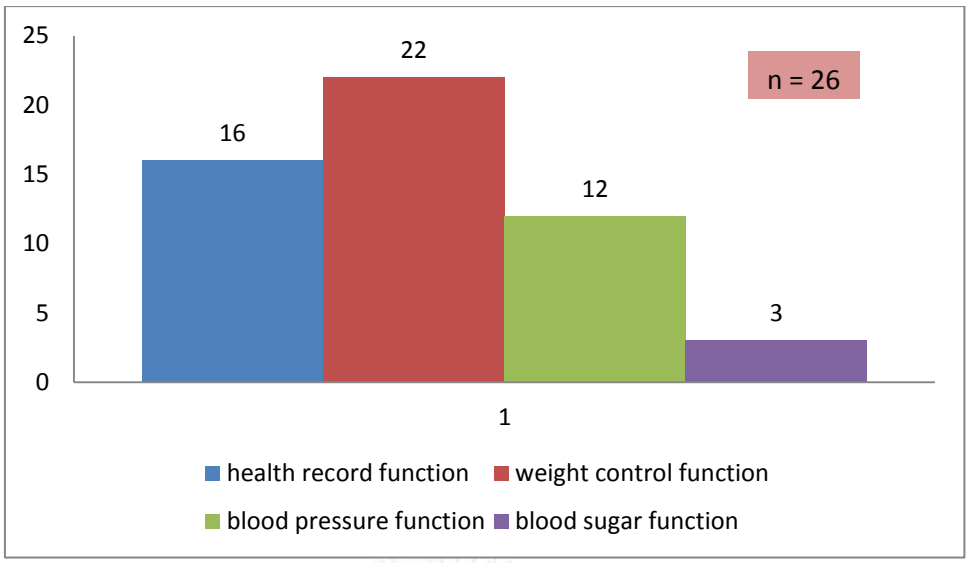

Figure 4 The number of participants who used various functions of the Microsoft Health Vault application (The total participants that used the application was 26)

For health record function, there were 16 participants who used the application to record their health data. There were 9 people who recorded their illness history or chronic disease. Seven people recorded their lab results. Five people recorded their medication use. There was only one person who recorded vaccination history. Only one participant recorded drug allergy. And five people showed their health data in the application when they went to see doctors. The results were shown in figure 5.

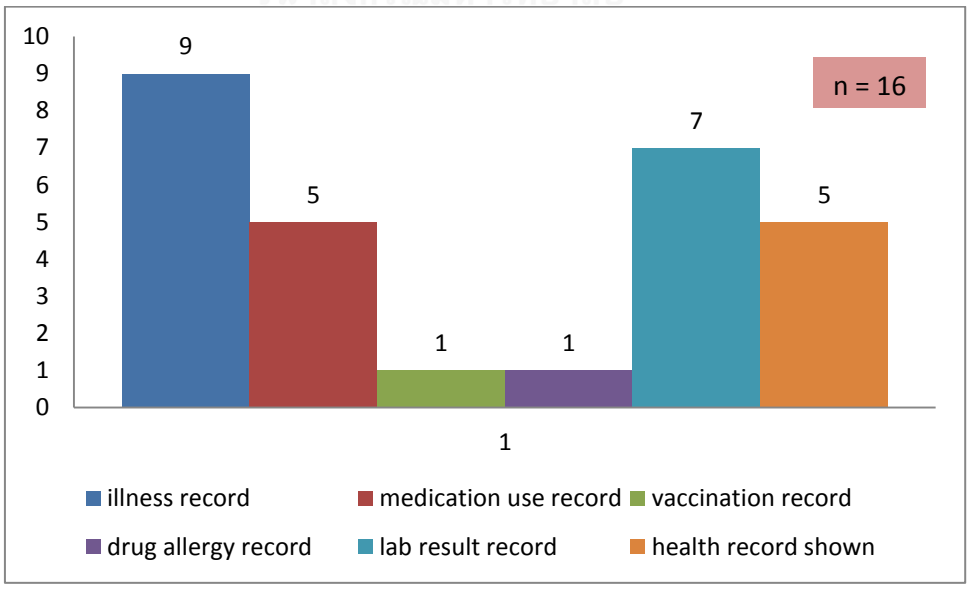

Figure 5 The number of participants who used health record functions of the Microsoft Health Vault application (The total participants that used this function was 16)

For weight control function, there were 22 participants who used the application to help them control their weight. Twelve participants had recorded their weight in the application. The frequency of weight record was varied from once a week to every day for a week. The average of frequency for weight recording was twice a week. Seventeen participants had recorded their exercise behavior in the application. The frequency of exercise record was varied from once a week to five times per week according to their exercise behavior. The average of frequency for exercise recording was twice a week. There were three participants who used the application to set their weight goal. The average of frequency for weight goal setting was once a week. Five participants used the application to record their dietary intakes. The frequency of dietary intakes record was varied from twice a week to four times per week. The average of frequency for dietary intakes recording was twice a week. Only one participant used the application to track exercise behavior for twice a week. Two participants used the application to track their dietary intakes. One tracked dietary intakes once a week. Another one tracked dietary intakes three times a week. Two participants used the application to track their weight. One tracked weight once a week. Another one tracked weight seven times a week. The results of weight control function used were shown in figure 6.

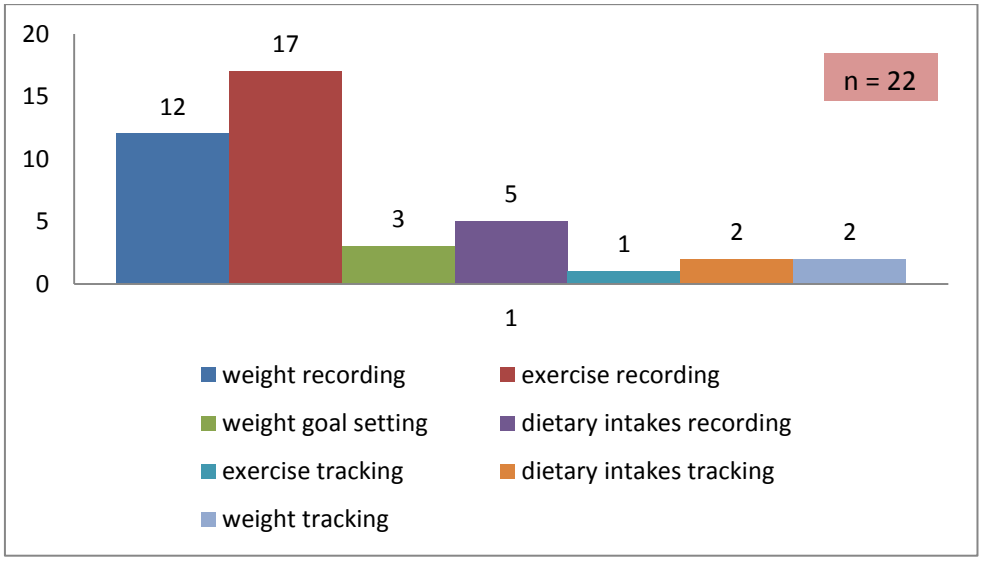

Figure 6 The number of participants who used weight control functions of the Microsoft Health Vault application (The total participants that used this function was 22)

For blood pressure function, there were 12 participants who used the application to help them control their blood pressure. Twelve participants had recorded their blood pressure in the application. The frequency of blood pressure record was varied from once a week to every day for a week. The average of frequency for blood pressure recording was once a week. Four participants used the application to track their blood pressure. The frequency of blood pressure tracking was varied from once a week to seven times per week. The average of frequency for blood pressure tracking was once a week. Only one participant showed his father's blood pressure values that were recorded in the application to health professional. The results of blood pressure function used were shown in figure 7.

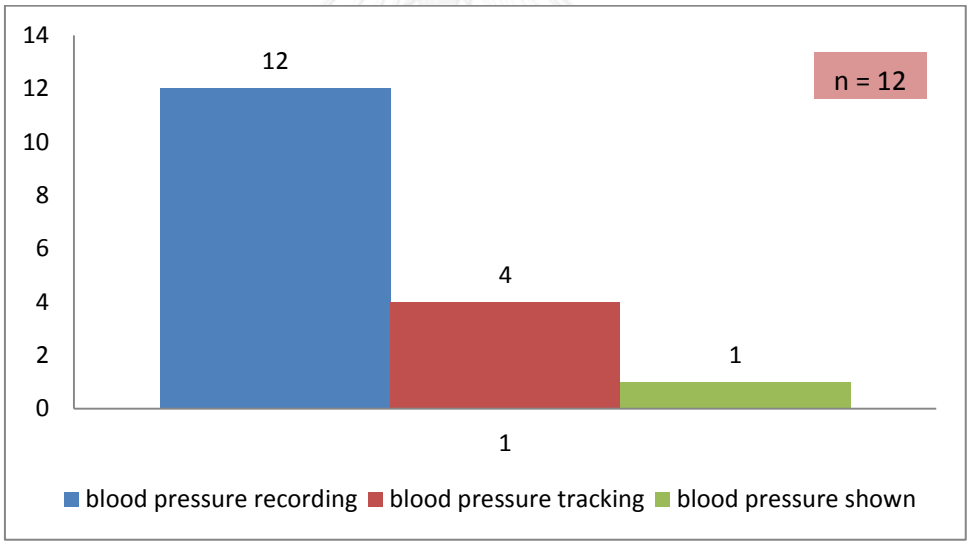

Figure 7 The number of participants who used blood pressure functions of the Microsoft Health Vault application (The total participants that used this function was 12)

For blood sugar function, there were 3 participants who used the application to help them control their blood sugar. Three participants had recorded their blood sugar in the application. The frequency of blood pressure record was varied from once a week to every day for a week. The average of frequency for blood sugar recording was once a week. Two participants used the application to track their

blood sugar. The frequency of blood sugar tracking was once a week. Two participants showed blood sugar values that were recorded in the application to health professionals. The results of blood sugar function used were shown in figure 8.

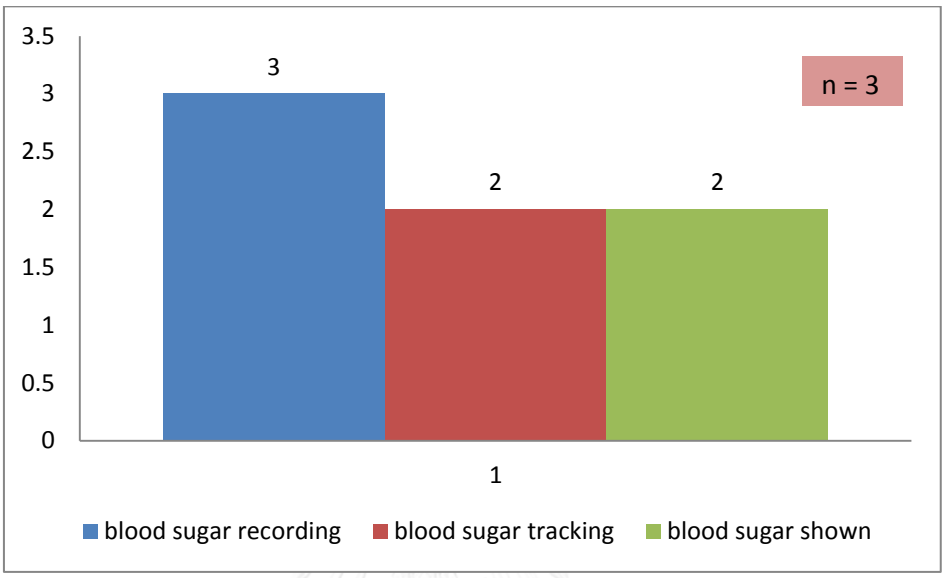

Figure 8 The number of participants who used blood sugar functions of the Microsoft Health Vault application (The total participants that used this function was 3)

4.3.3 Personal health record via smartphone adoption semi-structured interview

After 38 participants had done the Microsoft Health Vault application use behavior questionnaire (after use), were asked some list of questions about PHR application use. Only 19 participants agreed to show their opinions about the reasons that make people hardly use the personal health record via smartphones. The most popular reason that the participants thought few people use he personal health record via smartphones was the application is not important for healthy people. They thought this application is useful for patients who have severe illness or become patients of some specific clinics such as coronary clinic, diabetes clinic. Moreover, patients will be more enthusiastic to record their health information, their measurement values if their doctors ask them to do. When doctors ask patients to show their records in the application and assess patients' health behaviors from recorded data. Users will acknowledge the advantages of the application to the

treatment. There were many reasons that few people use personal health record via smartphone as shown in table 13.

Table 13 Reasons for people hardly use the personal health record via smartphone (n = 19)

Reasons for people hardly use the personal health record via smartphone	**Amount** (n = 19)
1) Not health-concerned person - “My health is quite okay. I am not person who are interested in healthcare activities like do exercises or control diets. So I do not have benefits to use this application.” - “I am still young and healthy. I am not health-concerned person such as I hardly go to have health check at hospital. I am not interested in any healthcare activities.” - “I don’t like to search for healthcare knowledge and I never used any health and fitness apps before.” -“I am not sporty woman. I don’t have any diseases. I don’t want to lose weight. I don’t have any reasons to persuade me to use it.”	6 (31.58%)
2) Not necessary or important for healthy person (just data repository) / duplicate with EMR in hospital - “I’m quite healthy and don’t have any diseases. I don’t need to record health information in the apps. If I have illness, it will be better to go to see the doctor.” - “My health condition is good and I usually have health check annually so I don’t need to use the	10 (52.63%)

application like this. By the way, I am interested in applications that provide healthcare knowledge or drug information searching more than PHR application." - "The PHR application is not quite useful for healthy person but It may be useful for chronic disease patients. - "according to the functions of the application, it is important for some specific patient group like diabetic clinic or coronary heart disease clinic that patients need to monitor lab results and have lifestyle modification such as do exercises, control dietary intake, control weight." - "I feel this application has advantage in emergency cases like accident injury not usual cases."	
3) Burden of data entry/key in / not automatically transfer data from medical devices/ not automated application - "I have to record data. The application cannot transfer measurement data from medical devices." - "I don't think it is useful to record health data in the application because my medical record at hospital has already contained my health information. It is duplicate data." - "It is not convenient for me to record data. I think it is waste time." - "I prefer automated applications to PHR application that I have to key in health data routinely." - "it would be great if I do not have to key in data	9 (47.37%)

manually.” - “I use the application to manage health data of my father who have many chronic diseases such as strokes, coronary heart disease, diabetes. Hence, I have to key in a lot of health information almost every day. It would be better if health data can be automatically transferred between the medical devices and the application.”	
4) Not be able to understand medical language or interpret the measurements - “Although I record the measurement in the application such as systolic blood pressure, diastolic blood pressure, lab results. I cannot understand or interpret the measurement by myself. I still need to consult with doctor.”	1 (5.26%)
5) Little well known because lacks of social advertisement and public promotion - “I have never known any PHR application like Microsoft Health Vault before. I have never known that there is PHR application that is free and can run on smartphone.” - “I have never seen PHR application promotion activities in public. I have never heard my family or friends talk or mention about using PHR application on smartphone.” - “I have just known this PHR application from your research. Is there any advertisement about this application in social media?” - “In my opinion, continuation of social promotion and communication process like help support	5 (26.32%)

services will help to increase the number of users." - "I think the PHR application on smartphone like Microsoft Health vault is not popular in general people."	
6) The application is not attractive or interesting - "I think the application is not attractive to use. It is just the application that allows users to record and collect health data in one place. It does not have feedback or recommendation features to assess health information that is recorded in the apps. Moreover, I usually use blood pressure monitoring device which automatically records the measurements, I don't need to key data in the application again."	2 (10.53%)
7) Have to learn how to use the application/ not easy or too complicated to use the application - "The Microsoft health Vault have many features and functions and have many process to log in, record, and see results. I need a period of time to learn how to use it and get used with it. I think the application is not easy to understand and use when is compared to other automated applications such as pedometer applications." - "The application is too complicated. Sometimes I feel confused and do not understand how to use it."	2 (10.53%)

8) Doctors do not persuade to use the application or not ask to monitor and show trends when they go to the hospitals - “Doctors should support chronic disease patients to use PHR application to monitor their health conditions.” - “My doctor has never told me to record or monitor blood pressure when I am at home. He has never asked me or want to know about blood pressure trends result.”	1 (5.26%)

CHAPTER V

DISCUSSION

The research finding of the study is discussed and compared with the results of other related studies. The discussion topics are classified according to the objectives of the study.

5.1 Factors affecting intention to use a personal health record via their smartphone

The first purpose of this research was to study the factors affecting community pharmacy customers' intention to use a personal health record via their smartphone by applying the unified theory of acceptance and use of technology (UTAUT) theory. The result showed that social influence and performance expectancy were significant factors in the intention to use PHR. The goodness of fit model was substantial and accounted for 60.0% of the variance for the intention to use a PHR. This is similar to the results of Kijsanayotin, et al.(11), Maillet, et al.(30), and Iqbal, et al.(25). For the study of Kijsanayotin, et al.(11), a cross-sectional survey had been applied with community health center administrative officers. The self-administered questionaires which was developed based on the unified theory of acceptance and use of technology (UTAUT) theory were used as data collection tools to identify factors influence health IT adoption. The results showed that performance expectancy, effort expectancy, social influence, and voluntariness influenced IT acceptance. The study also showed that health IT use was influenced by intention to use the system, previous IT experiences, and facilitating conditions. For the study of Maillet, et al.(30), a cross sectional survey was conducted to explain the relationship of the acceptance and actual use of electronic patient record and nurses' satisfaction. The questionnaire was also developed based on the unified theory of acceptance and use of technology (UTAUT) theory. The results showed that performance expectancy had strongest effect to the actual use of the electronic patient record. For the study of Iqbal, et al.(25), the aim of the study was to measure

the relationship between electronic health record use intention and electronic health record adoption behavior. The research was conducted with primary health care physicians. The results from logistic regression analysis showed that the key factors influenced electronic health record adoption were the intention to use EHR, perceived usefulness, and ease of use. The participants of other studies were health information technology workers or health professionals who had already worked with IT or health records while the participants of this study were community pharmacy customers who have never used personal health record via smartphone before. However, the result of this study showed that both social influence and performance expectancy significantly influenced the intention to use PHR which agreed to the results of Kijsanayotin, et al.(11), Maillet, et al.(30), and Iqbal, et al.(25).

Lai, et al.(34) reported that social influence would play an important role with users' intention at the initial stage of adoption because users have no experience or very little experience of benefits coming from using a personal health record via their smartphone(34). this may support the result of the study that social influence significantly influenced the intention to use PHR via smartphone of community pharmacy customers who have no experiences about PHR application using on smartphone. In case of users who have an experience of using PHR, user satisfaction about usefulness or the ease of use has strong effect to the intention to use and continuation of use. Moreover, according to social influence theory of Kelman(35) said that an individual's beliefs, attitudes, and behavior are influenced by their important people through three processes which are compliance, internalization, and identification. Compliance occurs when an individual is influenced by rewards or punishments, approval or disapproval. Internalization occurs when an individual is influenced by intrinsic rewards or personal values. Identification occurs when an individual is influenced to create or maintain satisfying or beneficial relationship with others. When users have no or little experience about system use at the initial stage of adoption, compliance-based social influence has strong effect on maintaining system use. When users accumulate more experiences of using the system, the effect of compliance-based social influence will decrease. Their study also found that social influence patterns are different across various groups. Social influence has

significant effects in bottom-up group. It has limited effects in peer-level group and has no effects in top-down group.

Like the result of Alwahaishi, et al. study(19) which aimed to identify factors affecting customers' acceptance and use of information and communications technology based on new hybrid UTAUT theoretical model. The findings of this research indicated that performance expectancy, perceived playfulness, social influence, and facilitating conditions had significant effects on behavioral intention and ICT use. It emphasized the important effects of social influence and performace expectancy on intention to use information system(19).

Venkatesh, et al. study(29) supported the agreement that the unified theory of acceptance and use of technology (UTAUT) theory which includes four main constructs such as performance expectancy, effort expectancy, social influence, and facilitating conditions is suitable use to study user acceptance and technology use both in organizational and non-organizational settings. Venkatesh, et al. study (29) was conducted in consumer context like this research. When Venkatesh, et al. study(29) modified UTAUT model by adding some relevant factors such as hedonic motivation, price value, and habit or adding moderating factors like age, gender, and experience in the model. The variance of intention to use technology and technology use were explained better. The method of Venkatesh, et al. study(29) also conducted two-stage survey which collected all predictors and intention to use data and frequency of actual mobile internet use data. The second survey was conducted after first stage survey four months. In this research, after use of PHR data collection was conducted after before use of PHR one month because of time constraint and resources restriction(29).

Akbar study(28) also supported the agreement to use the unified theory of acceptance and use of technology (UTAUT) theory to study user acceptance and new technology use. Although Akbar study(28) was conducted in academic context, the results still showed four main constructs of the UTAUT model such as performance expectancy, effort expectancy, social influence, and facilitating conditions were important determinants of intention to use and actual use of technology in any different contexts. The data collection method of this study had

both before and after use of the technology for some period of time. It was similar to the Akbar study(28). The times of data collection method of the study was modified from the original UTAUT model from four times to twice. The time duration of data collection method of the study was also modified from one week, five weeks, thirteen weeks, and thirty-seven weeks to at the first time of introducing the PHR application and after that for a month(28). This was because of resources and time constraint. Moreover, the actual use of technology of the original UTAUT model was measured through system logs while actual use of PHR application in this study was measured by self-reported questionnaire(28). This was because of limitation of feature and function of the Microsoft health Vault application. The result of Akbar study(28) showed attitudes towards the technology use had significant effect on intention to use, but attitudes construct was not included in this research conceptual framework. The Akbar study(28) indicated that the results from researches which applied the UTAUT model to study user acceptance and use of technology may be different if they were conducted in different in cultural or organizational contexts. Attitudes towards the technology use may have significant effect on intention to use in university students because they were young and have more salient attitude(28).

Other related study like Lin, et al. study(36) which tried to understand factors affecting intention to use Web site by applying technology acceptance model (TAM) also supported that not only information system quality like information quality, response time, and system accessibility significantly affected user's beliefs of usefulness and ease of using Web site, but other factors such as subjective norms and peer influence(79), computer experience, and innovation characteristics also had important effects on user's beliefs(36).

This study has clarified the understanding of factors which influence the intention to use a personal health record via a smartphone. When the results of the study were compared to other related studies, it showed that social influence and performance expectancy had strong effect on customer's intention to use PHR. This could be beneficial to develop PHR functions and implement some strategies to enhance PHR acceptance and use. Personal health record functions which provide advantages according to users' requirements and communication to users' other

important person such as securing messaging function of recommendations or feedback from health professionals and social support or peer pressure function are important to increase adoption and use. This indicates the impact of social influence and performance expectancy on the intention to use a personal health record.

5.2 Community pharmacy customer's behavior of using personal health record via smart phones

The second objective of this research was to study community pharmacy customer's behavior of using personal health record via smart phones. The result from the Microsoft Health Vault application use behavior (after use) questionnaire showed that from 52.78% of response rate, the amount of participants who used the Microsoft Health Vault application was about 68.42%. Most participants who used the applications are healthy and health-awareness people so the function of the Microsoft health vault that was mostly used is weight control function. This function allows users to record and track their weights, exercises, and dietary intakes. The result from semi-structured interviews the participants about the reasons that make people hardly use the personal health record via smartphones from their views showed that the most top-three popular reasons were the PHR application is not important for healthy people (52.63%), burden of data entry (47.37%), and little well known because of little social advertisement or promotion to public (26.32%), respectively. There are many previous researches that have studied about main goal of PHR system, the good characteristics of PHR system, features and functions requirements for PHR system to be a self-management tool, and reasons for PHR non-adoption or discontinuation of use.

According to Brandt, et al.(10), Google Health, which is a personal health record application similar to the Microsoft Health Vault application, was discontinued in 2012. There were 22 reasons for discontinuation such as it is only a data repository and a lack of incentives or additional extrinsic rewards for patients and health providers to use it, lack of compensation to health professionals to assist patients to use the PHR, lack of customer service model or department, user-directed data entry caused burden of use and incorrect data, patient-direct data entry is not feasible,

little advertising efforts and lack of good marketing strategy made many patients were unaware that personal health record applications existed, lack of social discussion or systematic peer pressure to share their health information on social networks to stimulate users to achieve desired outcomes, not enjoyable, no high engagement activities, it didn't scale, lack of electronic medical record use promotion from the private sectors, the privacy policies of 1996 HIPAA regulations did not support share and access health information of patients through personal health record system. The personal health record system should create a trust model for users to keep their sensitive medical information. Moreover, the electronic health record system of each healthcare provider was not integrated to other systems and not integrated to personal health record system. This caused difficulty to share and exchange health information between the systems(10). These reasons for discontinuation of the Google Health could be some good recommendations for developers of personal health record system like the Microsoft Company to develop the Microsoft Health Vault application. Developing features and functions of the personal health record system to response users' requirements can enhance personal health record adoption in the future.

The result from Johansen, et al.'s study(18) showed that self-management interventions have positive effects on chronic disease patients. Personal health records which support as self-management tools should be based on patients' needs. It needs to be integrated with electronic health record system at healthcare providers and should be shared access both ways. Good PHRs should provide secure e-mail communication functions and educational modules(18). According to Johansen, et al.'s study(18), the PHR application is useful for users who have chronic diseases which require self-management interventions. Moreover, it should integrate and share health information with the electronic health record system of hospitals and provide secure communication function between patients and their physicians. Johansen, et al.'s study result(18) support the minority of PHR use in the study. The Microsoft Health Vault application which was used as representative PHR system in the study lacks of some functions such as integration with other health record

systems, automated data transferring from medical devices or health and fitness devices, and communication function with health professionals.

The Microsoft HealthVault application has many features and functions supporting good personal health records such as free software, web-based system, security standards, health information repository, health status monitoring, intelligent data presentation and data export(14). However, it still lacks of some important functions which are necessary for good self-management tools. According to Genitsaridi, et al.study(14), the main goal of the PHR system is to support patient to manage and maintain their health record by themselves. Patients should be center to collect complete health information. Potential PHR system can improve healthcare delivery, help physicians to make diagnoses more accurately, and help reducing healthcare costs. The study defined the requirements for efficient PHR system. It should have intelligent alerts, be linked with external monitoring services, be able to provide understandable health information summaries, provide mechanisms for importing and exporting data, and use of terminology standards such as SNOMED CT, LOINC, ICD-10. To enhance PHR system use, the system should be free license to copy and open source software. Other users can modify the software according to their needs and can access the source code of the software to provide convenience for customize or extend the system. This would support the integration between the PHR and EHR systems. Good PHRs require web-based systems. Users can access their personal health record at anytime and anywhere that has internet connection and browser. The web-based PHR system does not need to be installed and downloaded. It can support mobile personal health record because it can be easily integrated with mobile communication devices. The quality characteristics of general software system are performance efficiency, compatibility, usability, reliability, security, maintainability, portability, and context coverage. The requirement functions of the efficient PHR system are categorized into five categories. The first category is recording of Problem, Diagnosis, and Treatment (PDT). It contains patient problems (diseases or illness), diagnosis process and results, treatment process, medications, hospitalizations. The secondary category is Self Health Monitoring. It includes functions to help especially chronic disease patients to

monitor their health status such as blood pressure record, dietary record. The third category is Communication Management which includes functions that provides communication between patients and their healthcare professionals such as appointment scheduling, appointment reminders, prescription renewal services, drug refill services, and healthcare professionals' contact information. The forth category is Security and Access Control. It contains functions that are related to access control and security mechanisms such as Authentication (verify the user that he is the person he claims to be), Authorization (verify that the authenticated user has the right to access the system that he requests), Audit (capturing all access events in the system), Delegation (the ability of user to transfer rights to access the system to other users such as healthcare professionals which is very useful for emergency situation case.), and Data Security (data exchange and data storing encrypted). The last category is Intelligence Factors which includes functions such as additional educational resources, data presentation, data export, the system rule based recommendations to provide decision support like doctor visit suggestion for abnormal cases, and clinical trials resources. Moreover, the study of Genitsaridi, et al.(14) showed that there are three types of PHR system based on architectural design. They are standalone, tethered, and interconnected PHR system. The PHR system which can be as an effective self-management tool should be at least tethered or interconnected PHR system. These kinds of systems can be linked with other electronic health record (EHR) systems and health information can be transferred between PHR and EHR systems(14). The Microsoft Health vault application which was used in the study was designed as standalone PHR system. The application cannot automatically transferred data from any medical devices such as blood pressure monitoring devices, blood glucose monitoring devices, smart watches, weighing apparatus. It cannot link or integrate with other electronic health record systems at hospitals. The participants of the study had to key in and manage their health data. This make most participants did not prefer using the application because it waste their time, key in burden, more incorrect data, and not get along with their lifestyles.

According to Liu, et al. study(64), there were seven main challenges and barriers to PHR system adoption and use. From interviewing end-users both patients and health professionals, some end-users reported that PHR system was too complicate to use, waste time and cause of data error from direct data recording, and it would only be useful for patients who have serious health condition or in emergency cases. This supports the results of semi-structured interviewing about participants' PHR use concern issues in this study. Although the Microsoft Health Vault application which was used as representative PHR system in the study was developed by the Microsoft Company. It can make users have trustworthiness, familiarity, and confortable to use the system. The application has many features and functions that meet users' requirements such as health record summary provision, security and privacy protection for share and access information. There are some functions that should be added or developed the PHR system to enhance PHR use and adoption such as functions to ensure accurate data like automated data error checking or automated data transferring from medical monitoring devices instead of direct data entry, avoiding medical jargon such as specific description of diseases which was difficult for general end-users to interpret and understand, and provision functions to support communication between patients and health professionals and integration with other electronic health systems. Patient-provider communication function is very important for PHR system to be helpful for efficient healthcare delivery(64).

Ramanathan, N., et al. study(2) which aimed to identify user preferences for self-monitoring and self-management features of mobile health applications also supported understanding users' preferences and concerns about using mobile health application is essential to design broadly scalable mobile health application platform. The collaboration among software developer, social and behavioral psychologist, health insurance officer, and healthcare professional will lead unique and integrated perspectives for developing broadly scalable and adaptable mobile health application(2).

In Sunyaev, et al. study(12), the 25 characteristics of ideal PHR system were identified to crate criteria framework to evaluate good PHR system. Then the study

used this PHR criteria framework to evaluate both Google Health and Microsoft Health Vault PHR applications. The results from the study showed some functions which are not available or partially available in Microsoft Health Vault. For patient information functions, medical terminology is over-used. For personal control functions, exist of possibility to access PHR system in emergency cases is partially available if the application integrates with some healthcare service providers. For additional services functions, healthcare cost information capturing is only available through integration with insurance companies. Some functions like securing messaging, educational relevant health information, social support groups, address book, quality comparison, localization, and searching features are not present. For functions like prescription refills, appointment scheduling, reminders, decision support, filing referral requests, medicine information were only available through integration with healthcare service providers. The Microsoft Health Vault can only integrate with multiple medical devices which available through the HealthVault Connection Center(12). The Microsoft Health Vault evaluation results of Sunyaev, et al. study(12) support and agree to most participants' opinions about less PHR adoption semi-structured interview result of this study. The PHR system developers should develop the application by adding communication and integration functions such as devices integration, securing messaging, social support groups, prescription refills, appointment scheduling, reminders, decision support, filing referral requests to response end-user's needs and could help to improve healthcare delivery more efficiently as self-management tool.

In Kratzke, et al. study(37) clarified an overview of using health application on smartphone for health promotion intervention for healthcare, consumer health behavior change, and education aspects. Besides physical activity and healthy lifestyle functions which are included in most health and fitness apps on smartphone. Other important functions of health and fitness application on smartphone should include function to support real-time interactions between patients and their physicians such as patient monitoring and feedback to motivate health behavioral modification, medication reminders, medication refill. This will support continuous healthcare management especially in chronic disease patients.

Reducing operational costs and worker time savings from using mobile health application could provide cost-effective healthcare model(37). This implication supported the results were related to the significant effect of social influence and performance expectancy on intention to use PHR and semi-structured interviewing data from some participants that increase useful features and functions to provide interactions between patients and their physicians would increase PHR use. Understanding major concerns for choosing health apps like content quality of the apps, usability and technical concerns, regulation, and data security and privacy would be benefit to develop health apps design. Major barriers of adoption and use health apps included content quality of the apps were not developed from health professional input or based on medical practice guidelines or accepted health behavior change theory, difficulty of use, poorly user interface design, run only on some specific platforms, and some technical problem to access health apps(37). From semi-structured interview data, these barriers also were limitations of the Microsoft Health Vault application use.

Direito, et al. study(44) which designed to study the effectiveness of using walking and running health apps to improve cardiorespiratory fitness in young people aged 14 -17, compared to usual physical activity behavior alone as control group and tried to compare effectiveness of physical activity intervention, self-efficacy, enjoyment, psychological need satisfaction (perceived competence, autonomy, and relatedness), usability, and acceptability of game-based story health apps and no game-based story health apps also supports that function of health apps on mobile phone such as SMS intervention delivery can help promote health behaviors, including physical activity. The result showed that besides important functions to facilitate self-regulatory behavior change such as goal setting, self-monitoring, feedback on performance provision, and behavior goal review, designing health apps which can make user perceives of enjoyment, autonomy, competence, relatedness, and self-efficacy would have potential to change user's physical activity behavior(44).

Detmer, et al. study(69) also indicated that only integrated PHR system model has potential to be transformative tools for patient-centric care. It helped improve patient physician communication and self-health care. To facilitate widespread

adoption of integrated PHRs, both public and private healthcare sector stakeholders should cooperate to eliminate all major barriers to implement, determine relevant policies, cost and resource allocation, and empower patients to use PHR continuously(69).

Bailey, et al. study(70) conducted systematic review to provide comprehensive overview of the functionality and quality of current available mobile applications to support patient self-management of medication use. The results showed mobile medication management applications can provide features like medication taken reminders, prescription refills notification, medication use history creation could help patient take their medication safely and appropriately. Most popular functions available in these kinds of application were medication reminders or alerts. The research also supported functions like medication reminders or alerts and data exporting and sending email to third party such as healthcare provider could improve patient medication use and improve patient-provider communication about healthcare. Some mobile health application could incorporate novel strategy such as gaming or rewards systems to incentivize medication self-management. Another feature such as drug interaction checking was also important for chronic disease patient with multiple medication use. It is essential to ensure that the functionalities, content, and quality of available mobile health applications can fulfill end-users' needs(70).

Kharrazi, et al. study(4) conducted systematic review advantages and disadvantages of mPHR on three smartphone platforms (iOS, Android, and BlackBerry). The mPHR on iOS platforms were viewed as the most potential applications when compared to Android and BlackBerry. This will support the Microsoft Health Vault application which runs on iOS platform. The mPHR applications on Android platform are on the rise because most of them are open source. The allowance of modification and developing the applications can make use entrust to keep their personal health information in open source applications. This research reviewed only standalone mPHRs and excluded other mobile browser-based or cloud-based system mPHRs. The mobile browser-based or cloud-based system mPHRs are necessary because their operating systems are flexible to support

integration and data transferring with other electronic health record systems (EHR) at healthcare providers. From the results of Kharrazi, et al. study(4), there is no predefined standards for common components and application features of mobile PHR application. The compatibility of different mobile PHR platforms and electronic health record systems (EHR) of healthcare providers is barrier for sharing and integration among health record systems. The reliability of information which is recorded and managed by patients in mPHR is questioned for health professionals. The health record information may be incomplete, inaccurate, and out of date so using this data to provide intervention can cause risks of life-threatening especially with patients have many chronic diseases and use many medicines. The possibility of data error can decrease the value of PHR. Other major concern of using mPHRs is security concerns. The effective mobile PHRs should include features to provide decision support such as medication interaction feedback and automated reminders. The long term continued use of mPHR may provide chance of success health behavior change in chronic disease patient(4). Kharrazi, et al. study results(4) supported the suitable and architectural design for mobile PHR on smartphone which conformed to the Microsoft Health Vault application and major barriers of mPHR adoption which some concerns agreed to the respondents' opinion from the semi-structured interview of this study.

Higgins study(6), also indicated good health and fitness apps should have user friendly interface, free trial version, reliable, easy to use, include features about goal setting, real-time personalized feedback provision, allow data synchronizing with other health and fitness apps or devices, support social networking, easy review of periodic data summary, alerts system when health and wellness is going off course, and expert consultation available. The effective health and fitness applications on lifestyle modification should be developed based on behavior change theory models and health professional involvement because getting benefit from using the apps requires high actively engagement of users. The important features include goal setting, self-monitoring, performance, individual tailored feedback features, goal reviewing, progression, and data synchronizing with other health and fitness apps and devices. The future health and fitness applications should develop security and

privacy to protect personal health data and incorporate game design to increase fun and improve user engagement and compliance to achieve goal. The future ideal apps may cover all major aspects of health and fitness so users do not need to use many various specific apps. The results and recommendations from this study supported understanding psychosocial factors facilitate application use is as important as health professional involvement(80). The recommendations would be beneficial to health apps developers to design appropriate features included in the PHR apps like the Microsoft Health Vault or other health and fitness apps in the future to enhance health application use to improve health status and well-being. From Veronin study(71), the guidance ADDIE model was created to be PHR adoption framework in community pharmacy settings. The two major phases of the ADDIE project were educational materials development as tools for pharmacist-patient communication and implementation the program in community pharmacy setting. This model contained five phases which were analysis, design, development, implementation, and evaluation. The ADDIE model was assumed to be accepted and used in all pharmacy communities in the near future(71). From the national survey in 2012, only about 7-10% of Americans reported they have used a PHR. This indicated very small number of Americans has used PHR although medical and technology stakeholders have tried to push PHR adoption. This study also supported that community pharmacy setting is suitable for generating PHR adoption and use because community pharmacies are the first-line encounter for patients to seek accessible and visible healthcare services. At present, most pharmacists use health information technology to provide care. Community pharmacists also have important role to educate and communicate with patients to improve their health behaviors. Community pharmacists are expected to be powerful person to empower patient to adopt and use PHR. Although the ADDIE model was generated to increase PHR knowledge and access to PHR in order to enhance PHR use, the PHR adoption rate was still low and had limited success. It may be because of complex healthcare environment, lack of motivation among users without live threatening illness to use PHR, and difficulty of motivating patients to maintain their own health records. Other barriers of PHR adoption in community pharmacy setting included lacks of incentive

for community pharmacist to facilitate patients to use PHR, inadequate space and limited computer access, workflow issues, and difficulty of PHR adoption defining (How does PHR adoption be measured? At signing up the account or maintaining specific core data set, or time frequency of accessing to the account). It needs reasonable timeframe about few years to transform the public's perception about using and maintaining PHR in a positive way(71). The Veronin study(71) also suggested that focus group interviews with representative patients and community pharmacy participants about PHR adoption would provide greater depth of information about participants' attitudes to provide recommendations for improve PHR use(71).

CHAPTER VI

CONCLUSION, LIMITATION, AND RECOMMENDATION

6.1 Conclusion

This study aimed to understand the factors affecting community pharmacy customers' intention to use a personal health record via their smartphone in Bangkok by applying the unified theory of acceptance and use of technology (UTAUT) theory. The result showed that the intention to use a personal health record via a smartphone was correlated to the perception of getting benefits from using it, perception of ease and comfortable to use, perception of influences from other important persons, and perception of voluntariness. Among these factors, social influence and performance expectancy had the strongest effects on the intention to use. To facilitate and enhance intention to adopt and use a personal health record via a smartphone, the personal health record application should have some useful functions that provide communication between users and significant others such as their families, friends, and health professionals. These people will encourage and support patients to use a personal health record as a self-care tool to improve their health status. Further studies should be conducted to find factors which influence actual use of a personal health record via a smartphone to compare different predictors between pre-adoption and adoption stages and learn more about patterns of use in various environmental settings or different characteristic groups. Moreover, future studies related to promotion of continued use of a personal health record at the post-adoption stage will be interesting and valuable.

For the objective about understanding community pharmacy customer's behavior of using personal health record via smart phones, the results showed that there were about 68.42% of participants who used the PHR application from 52.78% of response rate. The questions of the Microsoft Health Vault application use behavior questionnaire which were classified according to four main features and functions of the Microsoft Health Vault application were health record function,

weight control function, blood pressure function, and blood sugar function. Most respondents were healthy customers without any chronic diseases had used functions of the PHR application conform to their health characteristics. The weight control function was the most popular function which had been used because this function includes weight management, exercise management, and dietary intakes management. This function can be used for both healthy and chronic disease customers. For other functions like health record function, blood pressure function, and blood sugar function are suitable for specific customers who have some serious health problems or have chronic diseases such as hypertension, diabetes. The frequency of use of health record function cannot determine as routine activities per week. Users recorded all health information when they use the PHR application at initial time and edited data when their health information changed. Moreover, users used health record function according to their doctor visit in order to show their health information to physician or recorded lab results and new medication. The average of frequency for using weight control function was twice a week. The average of frequency for using blood pressure function and blood sugar function were once a week.

From some respondents' views about reasons of less use of personal health record via smartphone, most respondents thought that this PHR system application is more necessary for patients with serious health problems than general healthy customers and the PHR system architectural design should be able to transfer data from other medical monitoring devices automatically. It should not have burden of data entry which can lead to time wasting and data errors. It would much get along with daily's activities lifestyle. Other reasons which participants concerned were it would be difficult to persuade not health-concerned people to use PHR system, PHR application is little well-known because of lacks of social advertisement to show how PHR system can be used in various purpose functions and public promotion, the user interface of the PHR application is not attractive or interesting, the PHR application use is quite complicated and needs period of time to learn how to use it, general end-users who do not work related to healthcare field cannot understand medical terminology or interpret measurements which were presented in PHR system, and

lack of persuasion from healthcare professionals to empower patients to use PHR system and monitor their health status.

6.2 Limitations

1. Sample size was quite small. Due to using personal health record application via smartphone concept is not popular and well-known in public, the study method had to be designed to educate each respondent face-to-face to educate about PHR system general concept and knowledge background, inform about all research goal and process, and demonstrate how to use the PHR application. It was quite much time-consuming. Hence, it was quite difficult to make large amount of sample size to participate and use the PHR application in the constraint period of study time. Besides, convenient sampling method was applied in the study. Due to there were two times of data collection (before and after PHR application use) in the study, the community pharmacy setting which was the site of study required some specific characteristic to support follow up and tracking the respondents like the Pharmax Pharmaceutical Center. It has electronic customer's profile information system for permanent customers which are about 4000 customers. From all above limitations, it effected on small sample size of the study. Small sample size can cause the power of statistical analysis which would make only few independent variables had significant effects on intention to use PHR.

2. Low response rate: Small number of respondents who were followed up and use the PHR application. There are many reasons for this limitation such as:

- Most participants were not convenient to go to the Pharmax Pharmaceutical Center which was the study site to do after use questionnaires and participate in semi-structured interview. Data collection of after use stage was conducted via telephone. However, almost half of all participants did not pick up the calls or reply the research email and some respondents gave wrong telephone numbers.

- Most of respondents were healthy community pharmacy customers who do not have any serious health problems. PHR system may not necessary for them to use routinely.

- The PHR application on smartphone is quite new for community pharmacy customers. Most respondents do not have any background knowledge about personal health record and advantages of it. They also have no experiences of using PHR system. Moreover, using PHR system required ability of technology using, proficient in English. Most target chronic disease customers were old and could not use smartphone fluently. The respondents required time, efforts, and assistants to learn how to use PHR system.

3. This study was conducted with Thai community pharmacy customers about intention and use of PHR system application via smartphone, with a mean age around 34. The findings of the study may not generalizability in different countries, different age groups, and different kind of PHR system. PHR use behavior was measured by self-reported questionnaire which can cause measurement and method biases. Future research can be conducted in different context and adding other relevant factors which may help explain variance of intention and use of PHR(29). Moreover, enhance using of PHR system via smartphone in community pharmacy settings require some specific characteristics which support appropriate environment to help customers always use PHR system. For example:

- Community pharmacies should have electronic medical record system to record and maintain customer's general profile and their important health information.

- The electronic medical record system of community pharmacy should be able to integrate and share information with the electronic medical record system of hospitals to provide complete and accurate patient health information. This will also promote collaboration and communication between physicians and pharmacists to deliver healthcare services efficiently.

- Pharmacists at community pharmacy settings require not only sell medicines and do counseling, but also follow up and monitor chronic disease customers routinely. Pharmacists should have important role to educate customers to use PHR system. They should ask chronic disease customers to monitor and record their health problems, daily measurements, medication use, and their lifestyle activities. Pharmacists should ask some chronic disease customers to visit community

pharmacy and hospital routinely. Moreover, they should ask to access and view patient health information recorded in PHR system to evaluate patient's health status and give recommendations or feedbacks to maintain and improve health outcomes. This would make PHR system is more well-known. It also stimulates customers to acknowledge of the benefits of PHR system and feel more comfortable to use it. However, recommendation patients from viewing their PHR system in healthcare services at community pharmacy settings require time consuming, cost investment, and human resources which could impact business return of investment.

4. This study conducted only face validity test of both prior PHR use and after PHR use questionnaires by four experts in health behavioral change theory and statistical analysis to check whether the question items were conformed to the operational definitions of all variables of the study. However, this study did not conduct content validity test of the questionnaires by calculating the index of Item Objective Congruence (IOC) of each questions.

5. The reminder and follow up system was conducted once a week during the one month use period. All participants were contacted by email, telephone calls, and text messaging to ask if there were any problems of using the PHR application and helped them to use it. However, this study did not investigate the effective of the reminder and follow up system for supporting PHR use. For further studies, they should control the pattern of the reminder and follow up system and investigate feedbacks from participants of the study to improve the effective reminder and follow up system.

6.3 Recommendations

6.3.1. Effective PHR application characteristics

The results of PHR use pattern and semi-structured interview can help technology developing industries to better infrastructure design and marketing strategy implementation to enhance technology use of customers in various demographic groups at various stages of adoption and use(29). Effective personal health record system application on smartphone should be:

1. Infrastructure design: It should be designed to support link and integrate with other electronic health record systems such as other PHR systems, EHR systems of healthcare providers, other health and fitness applications, and medical monitoring devices. Terminology standards and the core data set should be determined. Data can be exchanged and transferred between systems conveniently. It also allows data collection from multiple sources.

2. Required features and functions: The PHR system should include functions which can help patients to improve their health. It would not be only a health data repository but also provide monitoring functions such as goal setting, performance tracking and reviewing, alerts, reminders, real-time feedback and recommendation from their health professionals to increase communication, social network sharing, and intelligent data export/import.

3. Security and privacy protection: Some health data is sensitive information. Patients do not want it disclosure. The good PHR system should be designed to access control functions like authentication, authorization, audit, and delegation. This makes users feel more trust and comfort to record their health data.

4. Mobile PHR applications need to be designed to be attractive and acceptable to variety of user groups. User interface of the PHR application should be friendly to users. It should be easy and not too complicated to learn how to use it. If the content of the application is designed as game-based story or reward competitions, users could feel more fun and enjoyable to use the application to improve their health status.

5. Like other software development, the effective PHR system application should be designed to response user requirements such as

- PHR application for healthy people should include functions for health promotion and health prevention like physical activity motivation, weight control, dietary tracking.

- PHR application for chronic disease patients such as diabetes, hypertension, coronary heart disease, obesity, or some specific disease like HIV should include functions for improve intervention like medication adherence, health monitoring, and lifestyle modification.

Besides, the PHR application should be designed by considering health professional input. PHR applications can be as self-management tool and communication tool between patients and their health professionals so PHR application developers should consider what health professionals want and concern about providing healthcare services through PHR application. The PHR application which is developed based on reliable user acceptance theories would be accepted and continued used by target users. The further researches should determine optimal content and features of mobile PHR applications to support self-management from patient perspective.

6.3.2 Collaboration of relevant healthcare stakeholders

The rich understand about factors influencing user acceptance of technology can clarify the strong effect of the important people like family, friends, and health professionals to encourage PHR use. PHR application which provides more interaction between patients and their health professionals such as physician's feedbacks how patient should do after viewing patient's health trends in the PHR. PHR application which allows users to share their health performance with their family and friends on social network will motivate users to use PHR application. Moreover, suggestion of some participants from semi-structured interview indicated that people have never known about personal health record and never used it. Public promotion campaign can help to increase PHR use.

Both public and private healthcare stakeholders should cooperate to propose strategies to promote PHR use such as cost investment, determine support data integration policies, health professional incentives.

6.3.3 Appropriate community pharmacy environment

Community pharmacy is the first counter which people will get healthcare service. Community pharmacists has important role on health promotion and health prevention. They should provide healthcare knowledge to people to take care health.

1. Community pharmacists should be suitable person to teach patients how to use PHR as self-management tool to maintain their health status. They should not

only dispense or sell medicines but they should monitor patients' health measurement trends and give useful feedbacks for patients to improve their health status. This will make patients acknowledge the advantages of using PHR application. However, community pharmacists should get some incentives to educate patients to use PHR and provide feedbacks.

2. At present, there is no standard electronic health record system in community pharmacy. Community pharmacy customers' health information profiles are not recorded systematically in electronic form. Moreover, there is not integration or data transferring among health information at community pharmacies and between health information at community pharmacies and EHR systems at healthcare providers. In referral cases, patient health profiles are often recorded in paper-based and patients have to take them to hospital themselves. This will make only patients have burden of PHR data management. If community pharmacy has systematic electronic health record system which can integrate with other EHR systems of healthcare providers, it will help reducing data errors and saving time of healthcare services.

3. Some physical environments of community pharmacy do not support for PHR adoption such as limited spaces, lack of electronic equipment such as personal computer, no wireless or internet connection, cost and labor resource constraint, and limited time for long health education provide.

6.3.4 Specific target user group

The personal health record via smartphone is quite innovation. Based on Diffusion of Innovations Theory, it would be good to initially introduce the personal health record via smartphone use in the Innovators and the Early Adopters group. These two groups are people who have more motivation to learn and try using the personal health record via smartphone. For another interesting target group is health awareness people because they usually have good health behavior and are interested in tools which could help them to improve health status. When the PHR use promotion is initially implemented in these target groups, the PHR application via smartphone use could rapidly growth in the future.

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APPENDIX

Questionnaire of Factor affecting intention to use personal health record via smartphone (Microsoft Health Vault application) of drug store customer (before actual use)

Part 1: Decision Agreement of using the Microsoft Health Vault application via smartphone

Explanation Please check ✓ in ❒ for each statement that is true of you.

Statement	Agreement Scales				
	Strongly Disagree	Quite Disagree	Neutral	Quite Agree	Strongly Agree
1. Using Microsoft Health Vault will help me to **manage health information**.					
2. Using Microsoft Health Vault will help me to **record health information continuously**.					
3. Using Microsoft Health Vault **has privacy and security** for my health information.					
4. Using Microsoft Health Vault will help me to **set health goals** such as weight control, diet control, blood sugar or blood pressure control.					

Statement	Agreement Scales				
	Strongly Disagree	Quite Disagree	Neutral	Quite Agree	Strongly Agree
5. Using Microsoft Health Vault will help me to **monitor health behaviors** such as weight control, diet control, blood sugar or blood pressure control.					
6. Using Microsoft Health Vault will help me to **talk to health professionals** about my health condition, medication use, drug allergies, etc. more conveniently.					
7. Using Microsoft Health Vault will help me to **take care of overall health** better.					
8. I am ability to **use** the Microsoft Health Vault.					
9. I am ability to **record** health information in the Microsoft Health Vault.					

Statement	Agreement Scales				
	Strongly Disagree	Quite Disagree	Neutral	Quite Agree	Strongly Agree
10. I am ability to **read and interpret** health information that is shown in the Microsoft Health Vault.					
11. Learning how to the Microsoft Health Vault is **easy** for me.					
12. I am ability to **use functions** of the Microsoft Health Vault **as I need**.					
13. **My family** supports me to use the Microsoft Health Vault.					
14. **My friends** support me to use the Microsoft Health Vault.					
15. **My colleagues** support me to use the Microsoft Health Vault.					
16. **Healthcare professionals** such as doctors, pharmacists, etc. support me to use the Microsoft Health Vault.					

Statement	Agreement Scales				
	Strongly Disagree	Quite Disagree	Neutral	Quite Agree	Strongly Agree
17. I am **willing to show my health information** in the Microsoft Health Vault.					
18. Using Microsoft Health Vault is **in line with my willingness**.					
19. I am **not forced to use** the Microsoft Health Vault.					

Part 2: Intention to use the Microsoft Health Vault application via smartphone

Explanation Please check ✓ in ❒ for each statement that is true of you.

Statement	Agreement Scales				
	Strongly Disagree	Quite Disagree	Neutral	Quite Agree	Strongly Agree
20. I intend to **search additional information** about using the Microsoft Health Vault.					
21. I **intend to use** the Microsoft Health Vault **in the future**.					
22. I **intend to use** the Microsoft Health Vault **in daily life**.					

Part 3: Demographic information

1. Gender

❒ Male ❒ Female

2. Age.....years old

3. Highest education level

❒ Elementary school graduated ❒ Junior high school graduated

❒ Senior high school graduated ❒ Diploma

❒ Bachelor degree ❒ Master degree

❒ Doctor's degree ❒ Others .....

4. Average incomes per month

❒ ≤10,000 baht ❒ 10,001-30,000 baht ❒ 30,001-50,000 baht

❒ 50,001-80,000 baht ❒ 80,001-100,000 baht ❒ ≥100,001 baht

5. **Average number of times** of smartphone use per day.....times

6. **Average time period** of smartphone use for each time.....minutes

7. Illness history

❒ No chronic diseases ❒ Diabetes ❒ Hypertension

❒ Coronary Heart Disease ❒ Obesity ❒ Others .....

8. Are you interested in healthcare information such as browsing for medical and healthcare information, reading health and fitness books?

❒ Yes ❒ No

9. Do you take any vitamins or dietary supplements?

❒ Yes ❒ No

10. Do you exercise regularly? Or are you a member of any fitness clubs?

❒ Yes ❒ No

11. How many times do you go to doctor visits per year?

❒ 0 – 3 times ❒ 3 - 6 times ❒ 6 – 12 times ❒ more than 12 times

12. How is your self-assessment of overall health? (1 = bad, 5 = good)

❒ 1 ❒ 2 ❒ 3 ❒ 4 ❒ 5

13. Do you use any medical monitoring devices such as blood glucose monitoring devices, blood pressure monitoring devices?

❒ Yes ❒ No

14. How is your self-assessment of health awareness? (1 = bad, 5 = good)

❒ 1 ❒ 2 ❒ 3 ❒ 4 ❒ 5

Part 4: Contact information

15. Contact information

Mobile phone number: ..... E-mail:.....

Questionnaire of Pattern of personal health record via smartphone use (Microsoft Health Vault application) of drug store customer (after actual use for a month)

Part 1: Function and objective of use and frequency of use per week

Explanation Please check ✓ in ❒ for each function and objective you used and indicate frequency of use per week.

1. Health information record function

❒ No used this function

If **used** this function, please check ✓ in ❒ for objectives of used and identify frequency of used.

❒ Used for recording or viewing illness history such as chronic diseases in average.....times/week

❒ Used for recording or viewing medication use history such as drug name, strength, drug indication in average.....times/week

❒ Used for recording or viewing immunization history in average.....times/week

❒ Used for recording or viewing drug or food allergies history such as medication name, allergies reactions in average.....times/week

❒ Used for recording or viewing lab test results such as cholesterol level in average.....times/week

❒ Used for showing health information when going to see doctors or pharmacists in average.....times/week

2. Weight control function

❒ No used this function

If **used** this function, please check ✓ in ❒ for objectives of used and identify frequency of used.

❒ Used for recording weight or height in average.....times/week

❒ Used for recording exercise behavior or calculating calorie burn from exercise in average.....times/week

❒ Used for setting weight control goal or exercise goal in average.....times/week

❒ Used for calculating calorie from dietary intake in average.....times/week

❒ Used for monitoring exercise behavior trends for a period of time in average.....times/week

❒ Used for monitoring dietary intake behavior trends for a period of time in average.....times/week

❒ Used for monitoring weight level trends for a period of time in average.....times/week

3. Blood pressure function

❒ No used this function

If **used** this function, please check ✓ in ❒ for objectives of used and identify frequency of used.

❒ Used for recording blood pressure or pulse rate measurement in average.....times/week

❒ Used for monitoring blood pressure level trends for a period of time in average.....times/week

❒ Used for showing blood pressure level trends for a period of time to health professionals such as doctors or pharmacists in average.....times/week

4. Blood glucose function

❒ No used this function

If **used** this function, please check ✓ in ❒ for objectives of used and identify frequency of used.

❒ Used for recording blood glucose measurement in average.....times/week

❒ Used for monitoring blood glucose level trends for a period of time in average.....times/week

❒ Used for showing blood glucose level trends for a period of time to health professionals such as doctors or pharmacists in average.....times/week

Part 2: Contact information

5. Contact information

Mobile phone number: ..... E-mail: .....

VITA

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2012 – 2015 Chulalongkorn University, Master's Degree of Social and Administrative Pharmacy

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March 2014 – Present Phramongkut Hospital, Part time outpatient pharmacist

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2009 - June 2012 Central Office for Healthcare Information, Managing medicines database for reimbursement in the Civil Servant Medical Benefit Scheme (CSMBS) system

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