EFFECTIVENESS OF A PHARMACIST-LED EXPERT SYSTEM FOR MEDICATION ADHERENCE AND BLOOD PRESSURE CONTROL OF ADULTS WITH HYPERTENSION IN THE PHILIPPINES: A RANDOMIZED CONTROLLED TRIAL

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A Dissertation Submitted in Partial Fulfillment of the Requirements
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ประสิทธิผลของระบบผู้เชี่ยวชาญโดยเภสัชกรต่อความร่วมมือในการใช้ยาและการควบคุมความดันโลหิตของผู้ใหญ่ที่มีความดันโลหิตสูงในประเทศฟิลิปปินส์: การทดลองแบบสุ่มที่มีกลุ่มควบคุม

น.ส.มาร์การิตา กูเตียเรส

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรดุษฎีบัณฑิต
สาขาวิชาเภสัชศาสตร์สังคมและบริหาร ภาควิชาเภสัชศาสตร์สังคมและบริหาร
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By	Miss Margarita Gutierrez
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มาร์การิตา กูเตียเรส : ประสิทธิผลของระบบผู้เชี่ยวชาญโดยเภสัชกรต่อความร่วมมือในการใช้ยาและการควบคุมความดันโลหิตของผู้ใหญ่ที่มีความดันโลหิตสูงในประเทศฟิลิปปินส์: การทดลองแบบสุ่มที่มีกลุ่มควบคุม. (EFFECTIVENESS OF A PHARMACIST-LED EXPERT SYSTEM FOR MEDICATION ADHERENCE AND BLOOD PRESSURE CONTROL OF ADULTS WITH HYPERTENSION IN THE PHILIPPINES: A RANDOMIZED CONTROLLED TRIAL) อ.ที่ปรึกษาหลัก : ผศ. ภญ. ดร.รุ่งเพ็ชร สกุลบำรุงศิลป์

ในฟิลิปปินส์เนื่องจากความร่วมมือในการใช้ยาต่ำทำให้มีเพียงร้อยละ 20 ของผู้ป่วยที่สามารถควบคุมความดันโลหิตได้ นักวิจัยได้ศึกษาโดยเพิ่มการให้คำปรึกษาแก่ผู้ป่วยในโครงการสุขภาพของรัฐ ซึ่งมีวัตถุประสงค์เพื่อประเมินผลของการให้คำปรึกษาต่อความร่วมมือในการใช้ยาและการควบคุมภาวะความดันของผู้ป่วย

ดำเนินการทดลองแบบสุ่มและมีกลุ่มควบคุมสิบสถานที่ศึกษาในภูมิภาค IV-A ของประเทศฟิลิปปินส์ ระหว่างเดือนพฤษภาคม พ.ศ. 2564 ถึง เดือนมกราคม พ.ศ. 2565 โดยมีการวัดผลในวันเริ่มการศึกษาและในช่วงเวลาที่แตกต่างกัน 3 ช่วง ผู้ป่วยที่เข้าร่วมการวิจัยทั้งหมด 417 คน เป็นกลุ่มควบคุม 203 คน และกลุ่มทดลอง 214 คน ผลการวิจัยพบว่ากลุ่มทดลองให้ความร่วมมือมากกว่ากลุ่มควบคุมร้อยละ 430.40 (OR = 5.30, p = 0.0001) การให้ความร่วมมือในการใช้ยา (OR = 2.53, p = 0.000) น้ำหนักมวลรวม (OR = 0.939, p = 0.016) และการรับรู้ความรู้ (OR = 1.2023, p = 0.000) สามารถทำนายการควบคุมความดันโลหิตอย่างมีนัยสำคัญ

การวิจัยนี้สรุปว่าระบบผู้เชี่ยวชาญโดยเภสัชกรส่งผลให้ความร่วมมือในการใช้ยาและการรับรู้ความรู้ของผู้ป่วยดีขึ้นอย่างมีนัยสำคัญและผลนี้คงอยู่เป็นเวลา 6 เดือน แต่มีผลทางอ้อมต่อการลดความดันโลหิต ในเชิงนโยบายผู้วิจัยเสนอให้ใช้ระบบผู้เชี่ยวชาญโดยเภสัชกรเพื่อให้ความรู้แก่ผู้ป่วยในโครงการ PhilPEN

สาขาวิชา เภสัชศาสตร์สังคมและบริหาร ลายมือชื่อนิสิต .....

ปีการศึกษา 2564 ลายมือชื่อ อ.ที่ปรึกษาหลัก .....

6278302033 : MAJOR SOCIAL AND ADMINISTRATIVE PHARMACY

KEYWORD: Hypertension, expert system, Patient counselling, Patient education

Margarita Gutierrez : EFFECTIVENESS OF A PHARMACIST-LED EXPERT SYSTEM FOR MEDICATION ADHERENCE AND BLOOD PRESSURE CONTROL OF ADULTS WITH HYPERTENSION IN THE PHILIPPINES: A RANDOMIZED CONTROLLED TRIAL. Advisor: Asst. Prof. RUNGPETCH SAKULBUMRUNGSIL, Ph.D.

In the Philippines, the Hypertension control rate is only 20% due to low medication adherence. The author proposes an intervention to supplement government program. The aim of the study is to assess the effect on medication adherence and blood pressure control of patients.

A randomized control trial was conducted at ten study sites in Region IV-A of the Philippines between May 2021 and January 2022. Outcomes are measured at enrollment as well as at three different time intervals. A total of 417 patients were eligible for the study with 203 in the control group and 214 in the intervention group. The intervention group were 430.40% (OR = 5.30, p = 0.0001) more likely to be adherent. Medication adherence (OR = 2.53, p = 0.000), BMI (OR = 0.939, p = 0.016), and perceived knowledge (OR = 1.2023, p = 0.000) have been found to significantly predict blood pressure control.

The research concludes that a pharmacist-led expert system intervention significantly improved patients' medication adherence and perceived knowledge and persisted for six months but only indirectly on blood pressure. The author proposes policy recommendation to use the Pharmacist-Led Expert System in conjunction with PhilPEN as a complementary patient education program.

Field of Study:	Social and Administrative Pharmacy	Student's Signature .....
Academic Year:	2021	Advisor's Signature .....

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Lastly, this paper is dedicated to my late mother, Maria Theresa M. Gutierrez, the woman who inspired me to become a pharmacist and educator.

Margarita Gutierrez

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CHAPTER I

INTRODUCTIONS

BACKGROUND AND RATIONALE

In the Philippines, the leading causes of death are non-communicable in etiology, with cardiovascular diseases (CVD) as the highest in terms of prevalence.(1) According to previous studies, the most important modifiable risk factor to prevent all CVD-related morbidity and mortality is hypertension.(2, 3) Hypertension is characterized as a medical condition where the walls of the arteries are subjected to high force by circulating blood, objectively diagnosed as a systolic blood pressure (SBP) reading of greater than or equal to 140 mmHg or a diastolic blood pressure (DBP) reading greater than or equal to 90 mmHg in two separate measurements.(2, 3) In the country, the estimated prevalence of hypertension is 29 million (28% of the population), which is present in all socioeconomic classes and is projected to increase over time.(4-8) In a 2013 national survey, 75% of the hypertensive Filipino patients were on medications, but 73% of these patients continued to have uncontrolled hypertension.(9) Furthermore, it is estimated that 11 out of every 100 Filipinos have pre-hypertension.(4)

Clinical studies have shown that the use of pharmacological intervention may mitigate morbidity and mortality in adult patients with moderate to severe primary hypertension.(10, 11) However, while effective pharmacotherapies are available, patient adherence is reported to be as low as 20–50% globally.(12, 13) Medication adherence, as described in chronic illness, is the degree to which a person's conduct is consistent with the health care provider's approved guidelines for taking medication. (14) In the Philippines, the estimated adherence rate is 66%, resulting in a blood pressure control rate of only 20%.(12, 13, 15)

One of the goals of the Universal Health Care Act of 2019 in the Philippines is to improve the devolved local health systems through institutionalized support mechanisms like medicine access programs and health promotion.(16) Among the existing projects is the Philippine Package of Essential and Non-Communicable

Diseases Intervention (PhilPEN), a national initiative to prioritize cost-effective approaches in resource-poor settings with an appropriate level of treatment for common chronic conditions of Filipinos.(17) Notably, the program includes a provision for free medicine but does not include a standardized pharmacist-led patient education program.

In other countries, comprehensive pharmacy programs with patient education as an intervention was associated with substantial and sustained improvements in adherence specially among patients with complex medication regimens.(18) However, in the Philippines, this is not a common practice. One possible reason is the decreasing number of licensed pharmacists entering the workforce to fill community pharmacy and local public health positions.(19, 20)

The author, through this research, proposes an intervention that will complement the PhilPEN program and maximize the public health pharmacist's capacity for patient education through the use of an expert system. Expert Systems (ES) are computer programs that emulate human "expert" reasoning and problem-solving.(21) This research proposed and tests an intervention to address the problem of medication adherence. This study will also produce data that can be used to/as:
Baseline data to plan and/or monitor future interventions
Identify factors that influence medication adherence
Understand the best predictors of blood pressure control

This research could be used to make recommendations for public health programs and policies to help reduce cardiovascular-related deaths in the Philippines. This is necessary because there have been very few studies and publications on medication adherence in the Philippines. To date, no research has been published in the Philippines to test the use of an expert system for drug adherence and blood pressure control.

RESEARCH QUESTIONS

The author, through this research, answered the following research questions:

1.) What are the characteristics of Filipino hypertensive patients?

2.) What is the effect of the pharmacist-led expert system intervention on medication adherence and blood pressure control in patients?

RESEARCH OBJECTIVES

To answer the research question, the author was guided by the following research objectives:

1.) To describe the baseline characteristics of the participants in terms of their sociodemographic and clinical characteristics.

2.) To create an expert system intervention for hypertensive patients that addresses both intentional and unintentional adherence.

3.) To determine whether and to what extent the expert system intervention improves medication adherence and blood pressure control in patients when confounders are controlled.

HYPOTHESES

The study hypotheses are summarized in line with the research question and the research objectives in Table 1.

Table 1: Table of Hypotheses

Research Question	Research Objectives	Alternative Hypothesis (H_a)	Statistical Hypothesis
What are the characteristics of Filipino hypertensive patients?	To describe the baseline characteristics of the participants in terms of their	There is a statistically significant difference between the	Levene's test for equality variance H_o: The expert system intervention group and control group have equal variance. H_a: The expert system intervention

Research Question	Research Objectives	Alternative Hypothesis (H_a)	Statistical Hypothesis
	sociodemographic and clinical characteristics.	patients in the expert system intervention group when compared to the control group at baseline with a 95% confidence interval.	group and control group do not have equal variance. H_o: $\sigma 1 = \sigma 2$ H_a: $\sigma 1 \neq \sigma 2$ Test of mean difference H_o: The mean dependent variable (DV) of the expert system intervention group is equal to that of the control group at baseline. H_a: The mean DV of the expert system intervention group is significantly different to that of the control group at baseline. H_o: $\bar{x}_1 = \bar{x}_2$ H_a: $\bar{x}_1 \neq \bar{x}_2$ Chi-Square Test of Independence H_o: There is no association between the groups and the categorical variable under test at baseline. H_a: There is an association between the groups and the categorical variable under test at baseline. H_o: Observed = Expected H_a: Observed ≠ Expected
What is the effect of the pharmacist-	To create an expert system intervention for	The model significantly explains the	Test statistic F (Wald chi2) H_o: the model did not significantly improve our ability to predict the

Research Question	Research Objectives	Alternative Hypothesis (H_a)	Statistical Hypothesis
led expert system intervention on medication adherence and blood pressure control in patients?	hypertensive patients that addresses both intentional and unintentional adherence. To determine whether and to what extent the expert system intervention improves medication adherence and blood pressure control in patients when confounders are controlled.	variance in medication adherence and blood pressure. The intervention significantly improved medication adherence and blood pressure while controlling for the confounders. The medication adherence and blood pressure is significantly different in different time points.	medication adherence and blood pressure of hypertensive patients H_a: the model significantly improves the ability to predict the medication adherence and blood pressure of hypertensive patients H_o: Wald chi2 = 0 H_a: Wald chi2 ≠ 1 Assessing individual predictors using two-tailed Z test. H_o: The Independent Variables (IV) does not significantly predict the medication adherence and blood pressure of hypertensive patients H_a: The IV significantly predicts the medication adherence and blood pressure of H_o: $\beta = 0$ H_a: $\beta \neq 0$ Repeated measures ANOVA H_o: The mean dependent variables (DV) is equal in all time points. H_a: The mean DV of expert system is significantly different H_o: $\bar{x}_1 = \bar{x}_2 = \bar{x}_3 = \bar{x}_4$ H_o: $\bar{x}_1 \neq \bar{x}_2 \neq \bar{x}_3 \neq \bar{x}_4$

CONCEPTUAL FRAMEWORK

Blood pressure, expressed as SBP and DBP, is the primary dependent variable in the study. The value of which is used to determine whether or not blood pressure is under control. Medication adherence, as measured by MPR, mediates this. MPR is then used to determine whether or not the patient is adhering. Figure 1 depicts the study's conceptual framework.

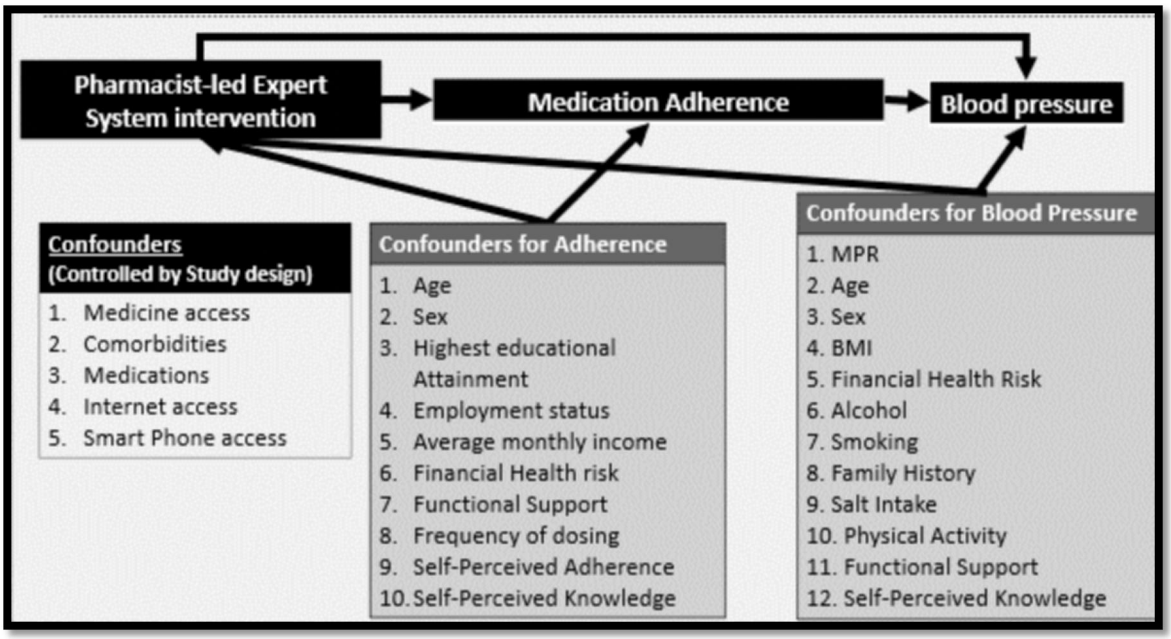


Figure 1: Conceptual framework

The primary independent variable is the pharmacist-led expert system intervention. To ensure the accuracy of the estimator for the impact of the intervention, confounding variables are controlled for through the study design and statistical analysis. The confounders that were controlled through the study design restrictions are the patient's medicine access, comorbidities, type of medication, access to the internet, smart phone, and geographic location. The confounders were controlled statistically through inclusion in the panel data analysis. The factors controlled for medication adherence are: age, sex, highest educational attainment, employment status, average monthly income, financial health risk, functional support, frequency of dosing, self-perceived adherence, and self-perceived knowledge. MPR controls age, gender, BMI, financial health risk, alcohol, smoking, family history, salt intake, physical activity, and functional support for blood pressure.

CONCEPTUAL AND OPERATIONAL DEFINITION

The conceptual and operational description of variables is outlined and defined in Table 2

Table 2: Operational and Conceptual Definition

Variable	Conceptual Definition	Operational Definition	Basis of inclusion in the model
Blood Pressure	Blood pressure is the force exerted by pumping blood against the walls of the arteries of the body.	Using a standard procedure and a calibrated sphygmomanometer, blood pressure is measured as the average of two readings of SBP and DBP on a mmHg scale.(3)	The main dependent variable that objectively measures the clinical outcome of the intervention is measured in SBP and DBP.
Controlled Hypertension	The World Health Organization (WHO) definition of diagnosed hypertension is with a SBP reading of ≥ 140 mmHg and/or a DBP reading of ≥ 90 mmHg in two separate measurements.(3)	Controlled hypertension is defined as having an SBP of less than 140 mmHg and a DBP of less than 90 mmHg.	The main dependent variable that measures the clinical outcome of the intervention.
Medicine	Medication	Medication adherence is	MPR and

Variable	Conceptual Definition	Operational Definition	Basis of inclusion in the model
Adherence	adherence for chronic disorders, as described by the WHO, is the degree to which a person's conduct with respect to taking medication is consistent with the accepted guidelines of the healthcare provider. (19)	defined as having a MPR of 0.8 or greater. (42, 43) The adherence stage is based on the transtheoretical theory of five phases of change: pre-contemplation, contemplation, preparation, action, and maintenance stage. (71) Action and maintenance stages are considered as medication adherent.	Medication Adherent are measures of the mediator of blood pressure and the dependent variable of interest.
Pharmacist led Expert System Intervention	Expert systems are computer programs that emulate human "expert" reasoning and problem-solving.(21) In this study, the expert system creates a personalized medication adherence tool for the patient and pharmacist.	The intervention group is defined as patients who received the expert system intervention, while the control group received the usual care under the PhilPEN program.	The main independent variable under study.
Age	Age is the length	In this study, age is	Six studies in

Variable	Conceptual Definition	Operational Definition	Basis of inclusion in the model
	of time a person has lived, and the WHO suggests that the age be determined by the completed units of time, counting the day of birth as zero. (22)	measured in years.	Filipino patients indicated that younger hypertensive individuals (> 40 years of age) appeared to have worse adherence rates compared to older hypertensive individuals. In addition, people over the age of 65 years are at a greater risk of hypertension. (3, 23-27) As a result, age is a confounding factor in this study.
Sex	Sex can be either of the two major groups (male and female) into which humans and most other living beings	In this study, the sex can either be male or female, based solely on biological reproductive function. Gender and sexual orientation are not	There are two studies that found an association between adherence and sex in patients,

Variable	Conceptual Definition	Operational Definition	Basis of inclusion in the model
	are divided on the basis of their reproductive functions.(28)	considered.	thus making it a confounder. (23, 29)
BMI	Anthropometric measurement is defined as weight in kilograms divided by a square in meters of height. This measure is closely associated with body density and the thickness of the skin.(22)	Body Mass Index is computed by collecting the patient's height and weight using a calibrated tape measure and weighing scale. The formula is BMI = kg/m2, where kg is the weight of the person in kilograms and m2 is the height of the person in square meters.	The risk of hypertension was higher among the overweight and obese population groups (BMI at a rate of 25 kg/m2), making it a confounder.(30)
Socioeconomic status	The descriptive term for a person's position in society, using criteria such as educational attainment, occupation, and/or income.(22)	For the purpose of this study, information about education and occupation was collected using a closed-ended question. Medical expenditure and family income are measured through medical expenditure and Family income was measured on the basis of	Studies conducted in Filipino hypertensive patients determined that adherence improved with increased educational attainment and having an

Variable	Conceptual Definition	Operational Definition	Basis of inclusion in the model
		estimated monthly family income. Total medical expenditure included outpatient and inpatient costs for the past year.(31) In order to quantify the financial risk to health, medical costs were divided by family income. The monthly family income categories are based on the indicative scale of monthly family income (family of 5) in the Philippines for the year 2017 of the Philippines Statistics Authority.(32) Poor: < PHP 9,520 Low-income class (but not poor): PHP 9,520 to PHP 19,040 Lower middle-income class: PHP 19,040 to PHP 38,080 Middle middle-income class: PHP 38,080 to PHP 66,640	occupation, thus making it a potential confounder.(27)(35)

Variable	Conceptual Definition	Operational Definition	Basis of inclusion in the model
		Upper middle-income class: PHP 66,640 to PHP 114,240 Upper-income class: PHP 114,240 to PHP 190,400 Rich: > PHP 190,400	
Risk Factors	A characteristic or action is correlated with an increased likelihood of a defined outcome; the concept does not indicate a causal relationship.(22)	In this study, patients were asked if they had any of the WHO's risk factors for hypertension, such as smoking, drinking alcohol, eating salty foods, and leading a sedentary lifestyle. One of the non-modifiable risk factors is a family history of hypertension.(3)	Patient trait or action that may explain the variation in medication adherence and blood pressure of patients. The inclusion in the model reduces the omitted variable bias on the estimation of the intervention coefficient.
Health Behavior	The combination of knowledge, practices, and attitudes that contribute to motivating health-related actions.(22)	In this study, patients were asked about their perceived knowledge of hypertension and medication, perceived adherence, tobacco, alcohol, salty food	Health behavior can either promote and maintain good health or, if harmful, can be a determinant of

Variable	Conceptual Definition	Operational Definition	Basis of inclusion in the model
		consumption, and sedentary lifestyle.	disease.(22)
Functional Support	Functional support is often described as a belief that support services, such as material assistance, emotional support, companionship, or knowledge, are accessible from one's social network if needed.(33)	Functional support for the purpose of this study is defined as a patient's perceived functional support.	Functional support is found in three studies to have a direct relationship with medication adherence in Filipino hypertensive patients. (35, 39, 41).

CHAPTER II

LITERATURE REVIEW

PHILIPPINE HEALTH SYSTEM

The Philippines is an archipelago of 7,107 islands, divided into 17 administrative regions, with a total population of approximately 106.7 million.(4) The structure of the health system is decentralized and consists of three tiers: primary, secondary, and tertiary care. There are six "facility tiers" operated by different political and administrative units. Barangay health units (BHUs) are managed by barangay and municipal governments; rural health units (RHUs) are operated by municipal governments; and city health offices are governed by city governments.(34) These are the units that provide the primary level of care. The municipal or "district" hospitals and the provincial hospitals that are managed by the provincial government provide the secondary level of care. Regional hospitals and medical centers operated by the Department of Health (DOH) are tertiary level providers. According to the DOH, RHUs and BHUs have been the most visited health facilities in almost all regions except in the National Capital Region (NCR) and the Cordillera Administrative Region (CAR).(4) Because of the affordability, the majority of Filipinos from low-income households prefer to seek treatment in a government facility.(4)

The government signed the Universal Health Law in 2019, which seeks to initiate a major reform drive to achieve "universal coverage" aimed at raising the number of disadvantaged families participating in PhilHealth. PhilHealth is the national health insurance program that will provide a comprehensive benefits package and reduce or eliminate co-payments.(35) Adequate funding must be provided to ensure the availability and accessibility of health services, including human resources, health facilities, and health financing. (36) With this new legislation, it is then necessary to establish key indicators so as to create a sound implementation plan to ensure quality health services.

The intervention proposed in this research is designed to complement the PhilPEN of the government. The PhilPEN approach was adopted by the DOH for nationwide implementation in 2012.(37, 38) The policy statement of PhilPEN specifically states that the government will provide quality clinical interventions and services for lifestyle-related non-communicable diseases in the country through an integrated, comprehensive, and community-based response for the prevention and control. The PhilPEN intervention is estimated to cost PHP 530.7 billion over the next 15 years and will yield an estimated return on investment of 0.1 per Philippine peso invested. These clinical interventions, though expensive, are estimated to avert 43,327 deaths over the next 15 years.(5)

There are 15 local government units (LGU) with coordinated and functional hypertension and diabetes clubs.(39) As of March 31, 2018, 98,380 patients were risk measured using PhilPEN. 31,553 were diagnosed with hypertension, 6,050 were diagnosed with both hypertension and diabetes, and 21,734 were considered to be at 30% and above risk for cardiovascular incidents.(39) In a systematic review conducted by Pinlac, Castillo (40) in 2015, they identified that there is receptiveness of the LGUs to implement DOH-mandated cost-effective NCD interventions and are willing to facilitate implementation of the nationwide initiatives.(40) However, there seems to be a need for regular monitoring of the programs to ensure their sustained implementation on the ground. There is, likewise, a need for greater coordination across sectors by the DOH to avoid duplication and fragmentation of NCD-related efforts. Notably, there are no pharmacist-led patient interventions embedded in the program.

MEDICATION ADHERENCE

In the Philippines, the devolution of the health system has resulted in a low mean availability of essential medicines in public health facilities.(41) In order to respond to the problem, the National Center for Pharmaceutical Access and Management (NCPAM) of the Department of Health was created in 2011 and implemented the DOH Complete Treatment Pack Program (ComPack). This is a medicine access

program designed for the most common diseases in the country to reach low-income families.(42) The anti-hypertensive medications covered under the program are: Amlodipine, Losartan (as potassium salt), and Metoprolol (as tartrate).(43) Nonetheless, despite the provision of free medications, patient adherence will need to be assessed. The estimated nationwide adherence rate is 66 percent, with a blood pressure control rate of 20 percent, while globally it is reported to be as low as 20–50 percent.(12, 13, 15)

Medication adherence, as described in chronic illness, is the degree to which a person's conduct is consistent with the health care provider's approved guidelines for taking medication.(14) Adherence in previous studies (44) is measured by either using subjective or objective measures, summarized in Table 3.

Table 3: Measure of adherence

	Code	Description
Subjective measures (self-reported adherence)		
Hill-Bone High Blood Pressure Compliance Scale(45)	HB-HCT(45)	This scale uses the 14-item Likert scale to measure three behavioral domains (a) reduced-sodium consumption (b) appointment keeping (c) drug taking.(45) Cronbach's alpha =0.74 and 0.84.
Self-structured questionnaires (ten items) (29)	SSQ-10(29)	Researcher created tool which was validated with 23 respondents who served as the pilot study of this research.(29) Cronbach's alpha value= 0.7
Morisky Medication Adherence Scale(46)	MMAS-8(46)	MMAS-8 is a sequence of eight binary questions, and "No" is one point. The score of 8 shows high adherence, 6-7 is medium, and < 6 is low adherence.(46) Cronbach's alpha = 0.83
11 item adapted MMAS-8(47)	Adapted MMA8(47)	10 to 11-item questionnaire with scores ranging from 0 to 44. Adherent have scores, 0 to 21 and Non-adherent scores, 22 to 44. (47) Cronbach's

	Code	Description
		alpha = 0.932
Medical Outcomes Study Specific Adherence Scale(48)	MAOSS(48)	Assesses the propensity of the participant to adhere to eight hypertension-related self-care habits, including the ability of the patient to maintain a salt and low fat or weight loss diet, to take prescription drugs, to minimize or quit smoking, to reduce or avoid alcohol, to exercise regularly, to avoid stress, and to use relaxation strategies for the past 4 weeks measured using the Likert 6-point scale. The higher the mean score, the greater the adherence. (48) Cronbach's alpha = 0.811
Binary adherence question	Binary(24)	Is the respondent taking the right drug at the right dose at the right time, answerable by yes or no. (24)
Medication Adherence Questionnaire(25)	MAQ (25)	A total score of 0-1 was defined as adherent while 2 or above was considered as non-adherent(25)
Adherence Self-Report Questionnaire(49)	ASRQ(49)	A brief self-administered questionnaire measuring "timing adherence," defined as taking medications at the correct dose and intervals. Has six items describing adherence to the timing of medication intake. Adherence was defined as an ASRQ score of less than or equal to 2. (49) specificity 90.3% and sensitivity 14.6%
Objective measures		
Proportion of Days Covered(23)	PDC(23)	Days in which the patient was covered by at least one drug for each form of medicine, depending on the date of prescription and the days of delivery

	Code	Description
		divided by the number of days of drug coverage and multiplied by 100. Medication adherence was established using a standard PCD threshold of more than 80 per cent. Data on filled medicines, including names of products, fillings and days of delivery, were collected from pharmacy claims databases. (23)
Medication Possession ratio	MPR(50)	Calculated by dividing the no of day supply dispensed by the no of days evaluated multiplied by 100%. For the research they used the formula Possession ratio = days supplied for 1stRX/(filldateof2ndRX-filldateof1stRX). The possession ratio of 0.8 or greater was deemed to be adherent.(50, 51)

The WHO compliance study indicated that there are five interactive aspects of adherence to drugs: social and economic factors; patient-related factors; health team and system-related factors; treatment-related factors; and condition-related factors. (52) A systematic analysis of the literature published between 2000 and 2020 was performed by the author to define and explain the factors associated with drug adherence in hypertensive Filipino patients. Out of the original 1,514 papers, 15 of the studies met the requirements and were included in the study. The overall number of study participants is 21,668 with an age range ranging between ages 18 to 75 years old. (44).

The factors that were consistently associated with adherence were all health system related: accessibility of health services; positive relationship with providers of health services; specialty clinics and programs for hypertension; and health insurance. The factors found to be negatively associated with adherence are: 1.) Social economic

factors: younger age, civil status as a single person, low educational attainment, and unemployment 2.) Patient-related factors include a lack of health literacy and awareness, as well as knowledge of hypertension, attitude toward hypertension, self-efficacy, and functional support. 3.) Therapy-related factors: erratic drug regimen schedule, Thiazide use, and complementary and alternative medicines 4.) Factors related to the condition: low illness perception and the absence of comorbidities These factors, illustrated in Figure 2, are considered as possible confounders and were therefore studied or controlled through the present research. (44).

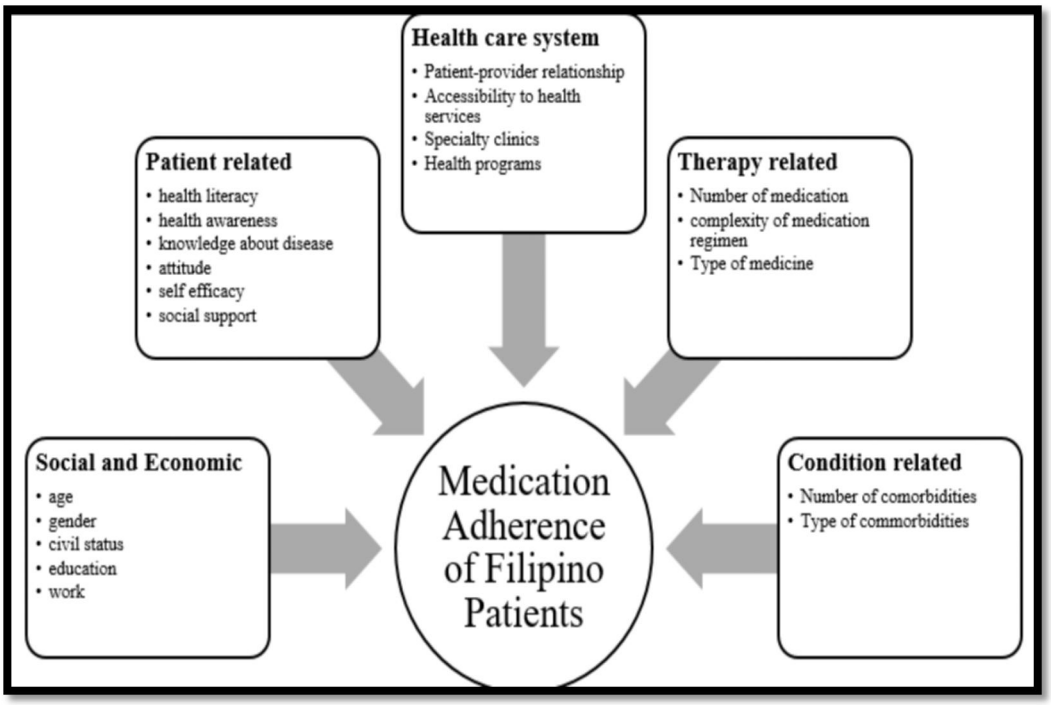


Figure 2: Medication adherence of Hypertensive Filipinos based on WHO framework

There are three main types of medication non-adherence; nonfulfillment, non-persistence, and nonconformance. Nonfulfillment refers to the act of the patient buying the medication prescribed but never taking it. Non-persistence is seen when the patient buys the medication, starts taking it, but after a certain point, stops doing so. Lastly, nonconformance is when the patient buys the medication, starts taking the medication, does not completely stop taking the medication, but at times may

fail to do so. (53) The PhilPEN program, in conjunction with the proposed expert system intervention, aims to address all three types.
Another way to categorize the type of non-adherence is intentional and non-intentional non-adherence. Intentional non-adherence occurs when a patient makes a specific decision not to take the prescribed medication, and non-intentional non-adherence occurs as a result of forgetting or misunderstanding instructions about the drug schedule.(54)

An example of intentional non-adherence is the perception and/or presence of side effects that hinder the patient from following the medication orders. In a study done by Garner (2010) on a group of hypertensive patients, the most common concern, and therefore cause of medication non-adherence, was due to their negative perceptions of the side effects of the medications that they were taking. (55) It was identified then that negative perceptions about side effects are often due to the insufficient knowledge of the patients concerning their medications. Patients included in the study noted that if the observed medication side effects were explained beforehand, then medication adherence would less likely be affected.(55) Previous research has found that patients' beliefs and ideas about medicines and their use have an impact on adherence to treatment.(56)

An example of non-intentional non-adherence is forgetfulness due to complexity of treatment, frequency of changes in the prescribed drug regimen, and the overall duration of the treatment. Studies have shown that when a more complex treatment (i.e. multiple drugs, irregular administration times, high frequency of dosing) is prescribed, patients are likely to be more non-adherent to their medication.(53) This is mainly because the complexity of the regimen makes it harder for some people to remember how to take the drugs as they were ordered in the prescription.(53) Forgetfulness accounts for 30% of cases of unintended non-adherence.(57) Again, the proposed expert system intervention addresses both types.

PATIENT EDUCATION AS INTERVENTION

In other countries, patient education intervention is utilized to address the problem of medication adherence.(58, 59) Health education may be offered to individuals or groups using various methods. Individual approaches to health provider individual approaches include: counselling, clinical consultation, and house visits, while group approaches may include: seminars, seminar groups, panel discussions, and workshops.(58) In other nations, outstanding health results are correlated with adherence to medications in combination with effective patient education.(59) The content of patient education is focused on a complete understanding of their disease, lifestyle changes, and/or drug regimens.(59)

To serve as a theoretical basis, the researcher conducted a systematic review and meta-analysis to find the pooled data evidence on the impact of educational approaches and their impact on adherence to medications and regulation of blood pressure in the treatment of hypertensive Filipino patients. Out of the initial 1,514 articles, 10 articles met the criteria and were quality-assessed and systematically reviewed; one randomized controlled trial (60), two quasi-experimental pretest-post studies with control (61, 62), four quasi-experimental pretest-posttest studies with no control (63-66) and three observational post-intervention test. (24, 47, 49). The result reveals that, to date, there are no standard educational programs intended to increase adherence to anti-hypertensive drugs in Filipino patients (67). The characteristics of the intervention are summarized in Table 4.

All of the included studies offered verbal education to patients on hypertension management. Out of this, two employed telephone conversations as needed. Two studies utilized a specialty clinic technique; the majority were in the form of a group seminar workshop (n = 8), and the other four had face-to-face patient counselling sessions.(67) To date, there is no published study that uses expert systems as an intervention.

Table 4: Summary of Interventions

First Author (Year)	Mean Age (SD)	Intervention Description	Setting	Study population	Frequency of Contacts	Duration
Calano 2019(66)	48.96 (5.58)	Targeted health education, motivational interviews and blood pressure tracking, including individual lifestyle change plans and home-to-home visits.	Bulacan, Philippines	Adults with hypertension.	4 sessions (every 2 weeks)	2 months
Encabo 2017(47)	60.5	Pharmacist led Seminar, Pamphlet and one on one patient counselling	Caloocan, Philippines	Adults with hypertension.	2 sessions (1 seminar and One on One after 1 week)	0.5 months
Gabiola 2019(63)	49.42	Received monthly lectures on health education issues like diet, exercise and	Manila, Philippines	Adult with pre-hypertensive and stage 1 HTN	6 sessions (every month)	6 months

First Author (Year)	Mean Age (SD)	Intervention Description	Setting	Study population	Frequency of Contacts	Duration
		other cardiovascular health related topics. All are given daily visits to primary care, fitness classes and one-on-one wellness sessions with a dietitian.				
Ku 2015(24)	62.8 (11.2)	Free services, including oral maintenance and out-patient care, were offered where primary care and different clinical specialty services were identified. Self-management education (SME) is	Batac, Philippines	Adults with hypertension and/or Diabetes	2-6 months (As needed by the patients)	1-6 months

First Author (Year)	Mean Age (SD)	Intervention Description	Setting	Study population	Frequency of Contacts	Duration
		available to patients.				
Mejia 2019(61)	60 above	Health Education and Lifestyle Program (contains 5 key health strategies, namely, disease awareness, medication regimen, dietary regimen, healthy lifestyle and stress management.	Bulacan, Philippines	Adults with hypertension.	10 sessions (every week)	2.5 months
Pablo 2018(64)	56.89	A medication adherence and CAM intervention seminar was conducted by two (2) registered	Quezon City, Philippines	Adults with hypertension and/or Diabetes	1 session (2 hours)	0.03 months

First Author (Year)	Mean Age (SD)	Intervention Description	Setting	Study population	Frequency of Contacts	Duration
		pharmacists. The 2-hour educational seminar tackled Hypertension, Diabetes, CAM and medication adherence.				
Palileo 2011(49)	61.30 (10.85)	PGH General Medicine Out-patient Continuity Clinic where each patient is assigned to his own "personal physician." educator.	Manila, Philippines	Adults with hypertension.	2-6 months (As needed by the patients)	1-6 months
Ursua 2014(62)	53.2 (10.8)	Four 90-minute workshop sessions were conducted monthly by the CHWs, using a simplified	New York City and New Jersey, USA	Adults with hypertension (Filipino Immigrants)	4 sessions (4 workshop, monthly in-person visits, and twice monthly	4 months

First Author (Year)	Mean Age (SD)	Intervention Description	Setting	Study population	Frequency of Contacts	Duration
		version of the National Heart, Lung and Blood Institute (NHLBI) Safe Heart, Safe Family (HHF) curriculum tailored to be administered by the CHWs in the FA group.			phone calls)	
Ursua 2018(60)	53.9 (10.4)	The intervention of the Community Health Worker (CHW) was driven by the Health Belief Model and the Functional support Theory. The intervention was provided by four Filipino CHWs	New York City, USA	Adults with hypertension (Filipino Immigrants)	4 sessions (monthly with phone follow up as needed)	8 months

First Author (Year)	Mean Age (SD)	Intervention Description	Setting	Study population	Frequency of Contacts	Duration
		employed by Kalusugan Coalition, Inc., a group affiliate of the report.				
Yi 2019(65)	59.5	Faith-based intervention the program provided frequently scheduled volunteer-led screening and therapy activities for congregants of faith-based organizations.	New York City and New Jersey, USA	Adults with hypertension (Filipino Immigrants)	6-12 sessions (every 2-4 weeks)	6 months

There are limitations in terms of generalizability and sustainability as most research is focused on a very specific geographic area and target group. Three of the interventions were targeted towards Filipino immigrants and were conducted in the United States of America. Of the studies conducted locally, 3 were collected in a rural area and 4 were in an urban area. The frequency and duration of instruction are also varied across all studies. The frequency of patient contact ranged from 1 to 12 sessions, and the duration of intervention ranged from 2 hours to 8 months. The HillBone High Blood Pressure Compliance Scale was the most frequent outcome

measure scale that was utilized in the studies. Overall, the studies have different measures of adherence; therefore, a standardized mean difference was used in the pooled analysis.

The total number of adult hypertensive study participants is 1,639, with a mean age range of 48.96–62.8 years old. The included studies were conducted between the years 2011 and 2019. The findings of the pooled data analysis indicate that there was poor to moderate quality evidence to support better drug adherence among Filipinos through educational interventions. Using fixed effect meta-analysis, the use of patient education is estimated to increase the standardized self-reported adherence to 0.869 ($p = 0.05$, $I^2 = 94.98\%$) and the proportion of adherent patients to 77.4% ($p = 0.001$, $I2 = 78.92\%$). The mean decrease in SBP is estimated to be -14.568 ($p = 0.001$, $I^2 = 0\%$) for studies with a control group and -12.907 ($p = 0.001$, $I^2 = 83.56\%$) for quasi-experimental studies with no control group. For DBP, the estimated mean decrease is -5.412 ($p = 0.001$, $I^2 = 0\%$) for studies with a control group and -5.592 ($p = 0.001$, $I^2 = 58.6\%$) for quasi-experimental studies with no control group. (67)

Despite the low to moderate quality of evidence, the findings of this review indicate that educational interventions have the potential to improve adherence and blood pressure among Filipinos with hypertension. The author attempted to incorporate some of the best practices in the previous research into the current expert system intervention while balancing it with sustainability.

PHARMACEUTICAL PICTOGRAMS

Failure to comply with the recommended action plan due to communication gaps between healthcare practitioners and patients is one of the factors contributing to the intervention failure.(68) One of the interventions used in other countries to improve this is the use of pictograms in patient information materials. Pictograms come from the Latin word pictus, which means "painted" and the suffix –graph, which means "something written". They are pictures that represent a word or phrase.

(69, 70) They are a form of communication that provides meaning through its pictorial resemblance to a physical object or action, and they are potentially easier to use than reading written instructions.(68, 71)

In previous research, pictograms had a positive effect on the acquisition and comprehension of drug information, decreased medication dosing errors, and improved adherence.(68, 72) For example, it has proven value when used in a pill card (medication instruction) to increase adherence to antihypertensive drugs in patients with hypertension.(73)

There are two reference systems for pictograms generally used in pharmacy; the one published in the United States Pharmacopeia (USP)(74) and the International Pharmacy Federation (FIP)(75). USP provides 82 pictograms in .gif or .eps format, and the entire pictogram library may be downloaded after the license agreement has been approved. The USP grants a license (free of charge) to use pictograms provided that the licensing requirements are met.(74) USP Pictograms are generic graphic images that have been widely used in Western countries to help communicate orders, precautions, and/or alerts to patients and customers. However, published studies on their usability and readability in a variety of environments, including South Africa, have revealed potential flaws.(68) On the other hand, FIP pictograms developed in June 2009 were pre-tested in a diverse population. It was last revised in February 2017 to resolve language problems, suggesting that potentially, FIP pictograms have a greater capacity to accommodate multicultural societies, such as the Philippines.(68) The evaluation they conducted is according to international standards for the evaluation of the comprehensibility of pictorial symbols.(75)

The testing of pictograms for comprehension is necessary because the culture of each country is different and may cause people to understand the meaning of an image differently. In addition, it was suggested that it be important to include the target group in the assessment of pictograms and pictogram-enhanced content, as it has been shown that different audiences can vary considerably in their perception

and response to pictograms.(76, 77) Simply put, pictogram comprehension can vary significantly in different countries.(78)

The researcher conducted a study to investigate if pharmaceutical pictograms, specifically the USP and FIP, were understandable by Filipinos. This will determine if these materials are a feasible form of pharmaceutical communication that may be incorporated into the expert system intervention. After conducting the research, the result proved that even in an internationally validated pictogram, added care is required when it is intended to be used as a stand-alone communication resource. As other studies have indicated, it is necessary not to neglect other types of patient communication and knowledge and to view pictograms as complementary to other types of patient therapy.(68, 79) The researcher therefore recommends that when dealing with the pictograms, it is best to complement them with both verbal and written instructions. This was taken into consideration when designing the current expert system intervention.

Only 17 pictograms out of 108 passed the 85% of the population (ANSI criterion). The education level of the patient is the most notable factor that predicts the comprehension of pictograms in Filipino patients. The pictograms that passed the criterion are pictogram #52 "For head ache" from FIP with a correct response percentage of 98.08%. It is notable that the USP pictograms #11 and #64 that also passed are also "For headache" but with a lower score compared to the FIP sourced. Thus, suggesting that it is preferred to use #52 for an indication of headache as seen in Appendix F. It is also worth noting that "for headache" is the only pictogram for an indication that is understandable to 85% of the participants.(80)

The other pictograms that passed the criterion are: the warning pictograms # 13 "Do not smoke" and # 33 "Do not take if pregnant". Pictograms that describe regimen # 20 "Take 2 times a day", # 50 "Take at bedtime", and # 90 "Take with meal". The pictograms that passed in the category of administration are # 21 "Place drops in lower eyelid" and # 105 "For injection." In terms of storage categories, # 42 "Do not

store medicine where children can get it" and # 89 "Do not freeze" passed. In the Instructions category, # 56 "Wash hands" and # 103 "Drink additional water"; and finally, in the Miscellaneous or Others category, # 14 "Check your pulse" and # 65 "Get emergency help". Based on the results of the study, these 17 pictograms are the most likely to be effective when used on Filipino patients. This is in line with the recommendations of the previous studies, which state that the comprehensibility of a graphic symbol must take into account users, tasks, and context of usage.(80)

The researcher also collected the pictures that failed the criterion but are useful for hypertensive patients and are in the upper quartile (top 25%), as these pictograms showed potential for use but may need further improvement to improve understanding. These are pictograms #28 "Take 2 hours after meals", #34 "Do not drink alcohol while taking this medicine", #46 "Poison", #57 "Do not take if breast-feeding", #73 "Take 3 times a day", #84 "Take with milk", #92 "Do not take if breast-feeding" and #95 "take in the morning". The strategy to improve them based on past literature is to combine the pictogram with written or oral instructions and verbal reinforcements, and for that reason, this technique was used in the current intervention.(81, 82) All the pictograms that are pretested and proven comprehensible were included in the database of the Expert system seen in Appendix F. All patient information sheets will have pictograms to further enhance patient education and retention.

DRUG USE BEHAVIOR MODELS

Transtheoretical Model (TTM)

The Transtheoretical Model (TTM) is utilized in the proposed intervention to deliver an individualized educational intervention based on the patient's motivation to change.(83) Theoretically, individuals go through five phases of change: pre-contemplation, contemplation, determination, intervention, and maintenance. As with each level of change, various intervention methods are most successful in bringing an individual to the next stage of change, as seen in Figure 3.(84)

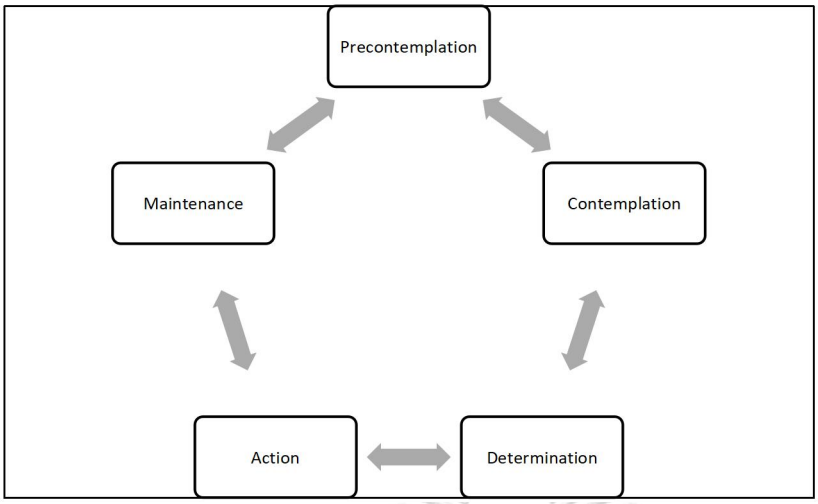


Figure 3: Transtheoretical Model of Change

Pre-contemplation: The patient does not plan to take medication in the near future (defined as in the next 6 months). They are also unaware that their conduct is problematic or that it has negative implications. At this point, patients sometimes underestimate the pros of behavioral change.(84)

Contemplation: Patients planning to adhere to their medication in the near future (defined as in the next 6 months) They understand that their non-adherence could be problematic and that a more thoughtful and realistic analysis of the pros and cons of behavioral change is needed. However, even with this awareness, the patient may feel ambivalent about changing their actions.(84)

Preparation (Determination): At this point, the patient is ready to adhere to their medication over the next 30 days. People start taking small steps towards behavioral improvement, and they feel that improving their actions will lead to a healthier life.(84)

Action: At this point, patients have recently changed their behavior (defined as within the last 6 months) and plan to keep adhering to the treatment plan. They can exhibit this by changing their problem behavior or learning new healthy habits.(84)

Maintenance: At this point, people have maintained adherence to medication for a while (defined as more than 6 months) and plan to sustain a change of behavior in the future. People at this point are trying to avoid a relapse to earlier stages.(84)

In the study conducted by Johnson, Driskell (85), instead of using the five stages, they divided the study participants into two classes based on the baseline stage of change: those not adhering to their medication are classified under "Pre-action" (pre-contemplation, contemplation, and preparation stage). And "post-action" means those already adhering to their medication, which are patients in the action and maintenance stage. This was conducted due to the similarity of interventions for the clusters. It's also worth noting that TTM is centered on critical assumptions about the essence of behavioral change and strategies for promoting such change.(86) The following set of assumptions relevant to TTM driving theory, study and practice:

There is no overarching explanation that can account for all the nuances of behavioral change. A more detailed model is most likely to arise from the synthesis of main theories.(86)

Behavior modification is a mechanism that unfolds through a series of stages over time.(86)

Stages are both stable and susceptible to transition, just as persistent behavioral risk factors are both stable and susceptible to transition.(86)

The majority of at-risk groups are not prepared for intervention and cannot be adequately supported by conventional action-oriented behavioral improvement programs.(86)

To maximize effectiveness, specific transformation procedures and concepts should be emphasized at different levels.(86)

Self-efficacy Model

For the patient counseling technique, the self-efficacy model will act as the guiding structure for the current intervention. Self-efficiency is the degree to which a person feels that he or she has the potential to accomplish an objective in challenging circumstances. Self-efficiency is being introduced as confidence to make and maintain progress and reduce the temptation to relapse.(87) It is believed that perceptions of personal effectiveness will decide whether coping activities are initiated, how much effort is invested, and how long they are maintained in the face of challenges and adverse experiences. Expectations for personal effectiveness are derived from four key sources of information in the self-efficacy model:

Mastery of experience – Is the previous achievement of having done something similar to the current conduct.(88)

Vicarious experience - Is learning to be successful by watching someone similar to us. (88)

Verbal persuasion - Is the motivation of others. (88)

Somatic and emotional states – Is the physical and emotional states triggered by thinking about a new behavior.(88)

The more reliable the observational sources, the greater the changes in perceived self-efficiency as seen on Figure 4: Self Efficacy Theory.(88-90) In a previous study, results suggest that self-efficacy has a significant direct effect that is mediated by functional support, specifically regarding diet and exercise. This study suggested that people with lower self-efficacy and less functional support have lower adherence.(91)

For this reason, the pharmacists will also attempt to include primary caretakers and family members in the counseling if possible.

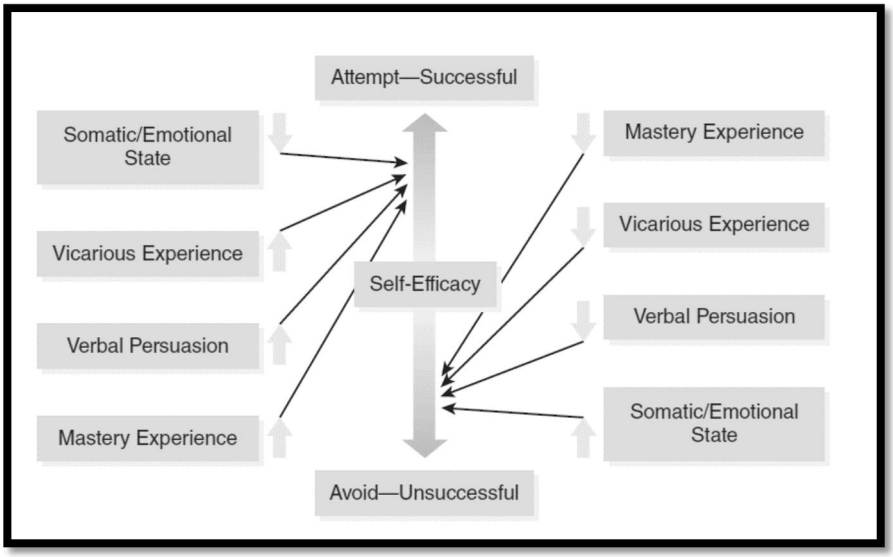


Figure 4: Self Efficacy Theory

Common-Sense Model of Self-Regulation

The customization of the contents was driven by the common-sense model of self-regulation (CS-SRM) for the personalized patient information materials that were created by the expert system. Patients' disease and intervention representations, as indicated by the CS-SRM, have five realms into which their health and disease beliefs fall, as seen in Figure 5.

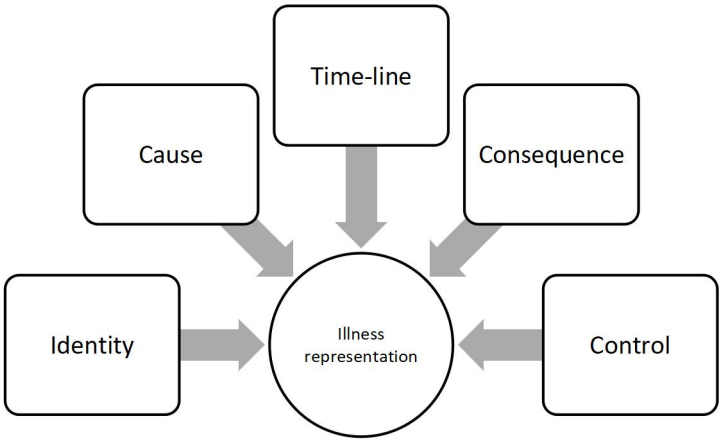


Figure 5: Common Sense Model: Illness Representation

Identity: The patient's label or diagnosis of the illness and the symptoms associated with the disorder. It could be the person's unique mark for their symptoms (for legitimization) as evidence of the label.(92, 93)

Cause: The individualistic ideas of the patient regarding the perceived origin of the disease, which may not be fully bio-medically correct. These may be environmental, biological or lifestyle factors. The portrayal were focused on knowledge obtained from personal experience as well as the views and speeches of significant others, health practitioners and media outlets.(92, 93)

Time-line: The patient's prediction of how long the condition will last. This can include the length and severity of the illness, as well as whether it is acute, chronic, or cyclical. The patient's beliefs were re-evaluated as time passed.(92, 93)

Consequences: The person's views about the effects of the disorder and how it can affect them both physically and socially. These can include side effects and social and financial costs. These representations can only evolve into more rational beliefs over time. (92, 93)

Control: The assumption that the disease can be healed or kept under control and the degree to which the person plays a part in doing this. This can also involve acts taken by physicians who are supposed to monitor symptoms. (92, 93)

Previous research has found that strategies that address patients' illnesses and interventional representations improve patient adherence.(93) The primary belief is that the more health care providers provide their patients with an adaptive view of their problem and/or action, the more adherent the patients are.(93) Patients with disease management skills can track the progression of their disease through intervention and distinguish between signs of change, signs of deterioration, and symptoms associated with intervention.(93) The current proposed interventions in this study aim to match patients' CS-SRM values with medical experience and provide patients with the adaptive understanding required to maintain their own well-being.

CLOUD BASED EXPERT SYSTEM

Cloud Computing transformed information technology as most information and processes are migrated to the cloud that changed where computing is done and fundamentally, how it is done.(94) More and more companies are investing in this technology that will inevitably transform the working climate and services in the healthcare industry.

The proposed expert system was designed using Google Workspace (formerly G Suite) for healthcare. This is a cloud-based software and product for computing, efficiency, and collaboration created by Google. Google workspace business starter is a subscription service for collaboration and productivity of health care teams for a cost of $4.20 USD/user/month.(95)

This is the chosen host system for the following reason: First is security. The system has mobile device management and device-level encryption with Android enterprise or Chromebooks for a file-sharing solution. The system is also HIPAA-compliant. HIPAA stands for Health Insurance Portability and Accountability Act (HIPAA) Privacy Rule, which ensures the protection of privacy, security, and integrity of protected health information.(96) It is also General Data Protection Regulation (GDPR) compliant.(95) This ensures that medical information and files are safe, secure, and always available for authorized healthcare providers. While the system maintains standards, control, governance, and compliance, it does not sacrifice accessibility as this can be accessed using mobile devices and personal computers through encryption.

Second is the customizable integrated and streamlined application package it offers. Google workplace allows pharmacist user to input and access patient information quickly and safely, because of the fast registration, communication, and feedback embedded in the system. The Pharmacists can fill out the online questionnaires using Google Forms (see Appendix G) at any mobile or personal computer with internet. The responses will generate data to a Google Sheet for monitoring of the

Pharmacist supervisor. The same spreadsheet is then used to generate the expert system output in Google docs that were emailed to the Pharmacists and the patients in Google mail (see Appendix H). Each email will receive a PDF output of patient information sheet Appendix J. The Pharmacist on top of the info sheet will also receive a tailored pharmacist notes Appendix I. With Google Calendar, the pharmacist can schedule google meetings and reminders about medication dosing. (97) The Google Meet and Google Chat features allow the patient to message and video call their pharmacist for any additional questions they may have. The system is summarized in Figure 6. The Google application is customizable, which allowed the researcher's team to input codes that enabled the expert system to function as designed. Within 60 seconds of collecting data via the Google form, tailored output is generated.

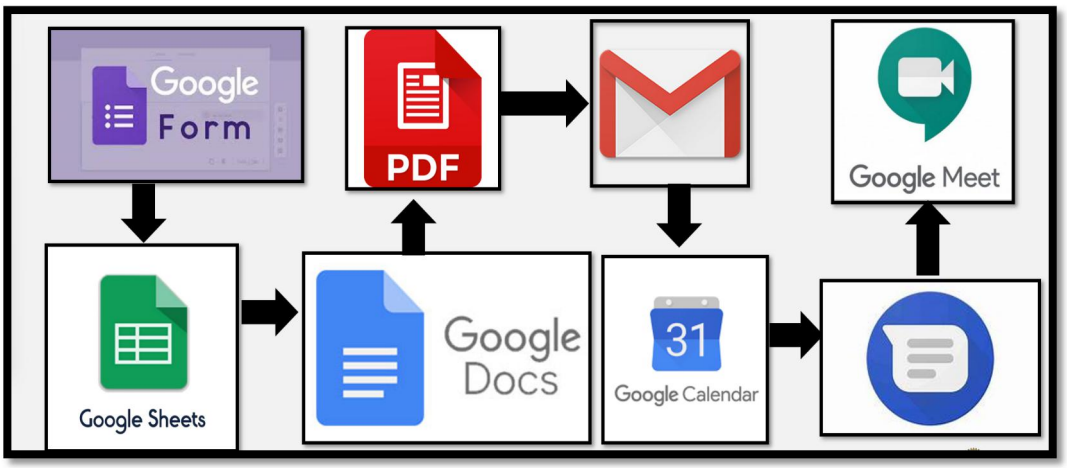


Figure 6: Pharmalasakit Expert system using Google Workplace

The third advantage is the ease of use of the system. Google functions are fairly familiar to Filipino users. During the fourth quarter of 2019, the most visited website in the Philippines was Google.com, with about 762.8 million monthly visits, with an average time per visit of 11 minutes and 16 seconds.(98) Adaption of the innovation is therefore expected to be faster compared to when developing an entirely new software system. Most Filipinos also use Google as their primary email provider.(98) According to Internet World Stats, the number of Internet users and the rate of penetration in the Philippines as of June 2019 was 79 million, or 73% of the population.(99) Approximately 74 million smartphone users were present in the

Philippines as of 2019, which has continued to grow since 2015. It is estimated that there will be about 90 million smartphone users in the country by 2025.(100) The ubiquity of mobile devices, coupled with their personal nature and features, makes cell phones an important medium for providing health interventions.(101)

CHAPTER III

METHODOLOGY

STUDY DESIGN

This research will use a randomized controlled trial (RCT) study design. The target sample population is hypertensive Filipino adults in Region IV-A enrolled in the PhilPEN program. Patients were randomly allocated to the intervention or control group in a 1:1 ratio. A 6-month trial, repeated measures, panel data encoding, were done subsequently. The study design is illustrated in Figure 7. The RCT was chosen because it is the gold standard for evaluating interventions in health care. Randomization balances confounding factors within groups and reduces the impact of unobserved confounding variables.(102) In case of drop outs, intention to treat analysis were used in this study.

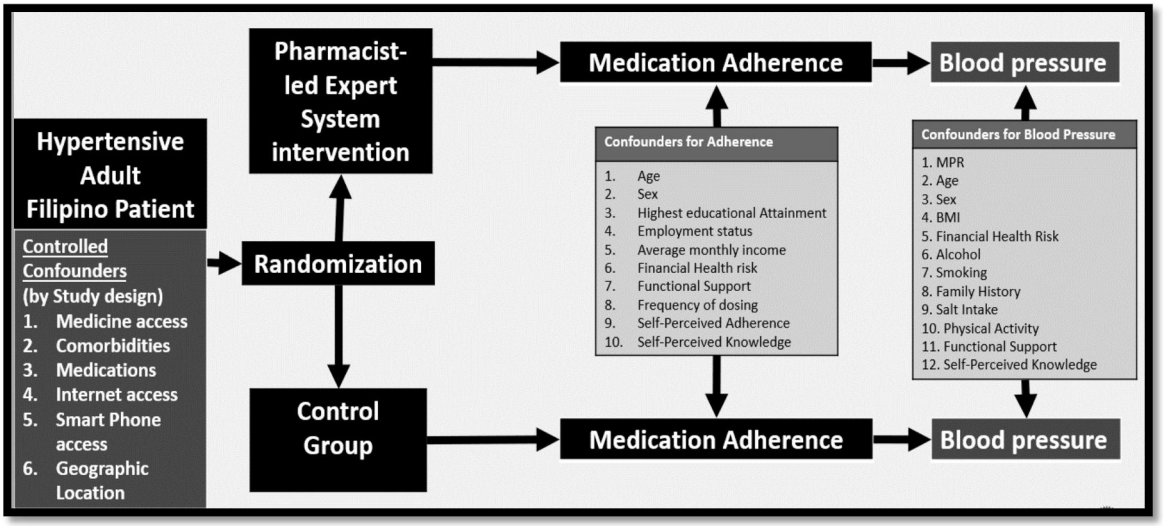


Figure 7: Randomized Controlled Trial Design

STUDY SETTING AND PARTICIPANTS

The targeted participants are Filipinos residing in Region IV-A of the Philippines. These regions are selected based on their use of Filipino as a primary language. Filipino is the national language of the country and can be the basis for translation to other dialects. Participants must be 18 years old or older, clinically diagnosed hypertensive, receiving DOH ComPack medicine, a PhilPEN program member for at least three months, and prescribed Losartan, Amlodipine, and/or Metoprolol for the next six

months. The patient or primary caregiver should have a smartphone and internet access.

Exclusion criteria are patients with pre-existing medical problems such as, but not limited to, severe psychiatric illness, history of heart attack, congestive heart failure, stroke, renal dialysis and/or some other acute or terminal illness. The patients must not be a participant to a prior CVD-related trial. Eligibility criteria is designed to control for confounder for adherence and blood pressure.

Recruitment was done in collaboration with the Municipal Health Officer and the Department of Health personnel handling the DOH ComPack in the region. Recruitment started after securing all necessary permits from the Single Joint Research Ethics Board (SJREB), the Department of Health (DOH), and local government units (LGU). After the informed consent was accomplished, the pharmacy led expert system was given to the intervention group not more than one day after the screening. The patient may at any time withdraw from the study. The follow-up was done after the 1st month, 3rd month, and 6th month of receiving the intervention. Intention to treat analysis was done in the case of drop outs.

SCREENING AND RANDOMIZATION

The researcher worked closely with the DOH, LGU, and community partners to identify potential patients from the local information database. Participants were invited through the monthly PhilPEN meeting where they were screened for the study. At each recruitment event, research assistants provided an overview of the research and the informed consent form.

The screening method was performed by research assistants upon receipt of the patient's signed informed consent. A computer-generated randomization scheme was used to assign patients to a control or intervention group. Three BP readings were taken at intervals of five minutes on alternate arms. After that, measurements of height and weight were taken. Socio-demographic and risk factor and health behavior

data were gathered using the survey questionnaire. The explanation of the study, consent, screening, and intervention took approximately 20–30 minutes per patient. For patients in the control group, participants received the standard care and follow-up surveys for the 1st, 3rd, and 6th months. For the patients in the intervention group, patients received the intervention according to the protocol of the expert system intervention not more than one day after the screening.

SAMPLING SIZE COMPUTATION

The basis for the computation of the sample size is based on a parallel randomized control trial design. The formula is for clinical superiority trials for dichotomous variables adapted from Zhong (102) shown in Figure 8

$$N = 2 \times \left(\frac{z_{1-\alpha} + z_{1-\beta}}{\mathrm{d} - \delta_0} \right)^2 \times p \times (1 - p)$$

Figure 8: RCT formula for clinical superiority

Where:

N = size per group

p = the response rate of standard treatment group

zx = the standard normal deviate for two-sided x;

d = the real difference between two treatment effect;

δo = a clinically acceptable margin;

The research question is if there is a difference in the outcome of patients receiving pharmacist-led expert intervention compared to usual care (control group). Control of blood pressure is the primary measurement. All parameters were assumed as follows: p= 0.8, zx= 1.645+0.845, d= 0.001 and δo = 0.1. The computed sample size is 202 patients per group, or a total of 404 participants. To validate if the computed

sample size is viable for a random effect model panel data analysis, the Equation 2 was used as seen in Figure 9.(103)

$$n = \frac{(1.96+0.84)^2}{\beta^2} \cdot \frac{\sigma^2_{residual}}{m \times MS_X}$$

Figure 9: Random Intercept Model for RCT

Where:

n = number of subjects

β = magnitude of the slope that the researcher intended to detect

σ^2 = residual is the within-subject variance of the response measure

m = number of within-subject measurements

MSX = mean squared distance between the subject's X's and their mean.

Using the following values and assumptions: β = 0.1, σ2= 5, m = 4 and MSX = 25 the computed sample size is 196. Therefore, the original computation is viable. The enrollment of participants was increased to 500 to anticipate possible attrition and to facilitate a balanced sampling in 10 study sites. The sample of 50 patients per study site was equally divided and randomized into 25 control groups and 25 intervention groups.

Moreover, this sample size would be sufficient to test 13 independent variables in a regression type statistical analysis based on the rule of thumb that there should be 30 subjects per additional independent variable. According to Green (104), the sample size should be N > 50 + 8 m (where m is the number of IVs) for multiple correlation testing and N > 104 + m for individual predictors testing in a regression type analysis.

There are five provinces in the IV-A region: Cavite, Laguna, Batangas, Rizal, and Quezon. A permit was granted only in Cavite and Laguna due to the COVID-19

Pandemic. Table 5 summarizes the most important information about the two regions. 10 municipalities out of 40 were randomly selected. Replacement municipalities were randomly selected in cases where criteria were not met and permits to conduct the study were not granted by the local government until 10 municipalities were secured.

Table 5: Profile of provinces

Province	Municipalities	Barangay	Population	Population Density
Cavite	16	829	4,344,829 (as of 2020)	2,800/km2
Laguna	24	681	3,382,193 (as of 2020)	1,800/km2

INTERVENTION DEVELOPMENT

Prior to the study, a systematic review of literature between the years 2000–2020 was conducted on Filipino patients with hypertension to explore issues related to medication adherence. (44) Previous research on patient education interventions was likewise systematically reviewed to determine previously validated and evidence-based strategies.(67) The algorithm was then created by incorporating it into the expert system design by the researcher. The author then hired a pharmacist computer programmer to do the coding on the Google suit system for cloud-based software customization.

A review of patient information materials about hypertension was also conducted, including pretesting of pharmaceutical pictograms. The content of the patient information material for the medications is adopted from the standard and validated information material used by the University of the Philippines College of Pharmacy and Philippine General Hospital Pharmacy Department. The researcher is also affiliated and part of the development of those materials. The pictograms adopted from the FIP and USP pictograms were likewise pre-tested on Filipino patients. The result of which served as a basis for inclusion in the expert system.

Using Google Workspace (formerly G Suite) for Healthcare, the online and cloud-based intervention is designed to address both the intentional and unintentional

non-adherence of patients. For intentional non-adherence, the expert system will generate personalized information material based on the patient's responses to a series of questions. The system incorporates the use of principles of transtheoretical theory of change, common-sense model of self-regulation, self-efficacy model, and pharmaceutical pictograms to increase adherence. (83, 87, 105) The system will also generate a tailored guide for pharmacists that may be used during patients' counseling. Both outputs aim to educate, change attitudes, and clarify the beliefs of patients.

For non-intentional non-adherence, the system will help motivate people who forget to take their medication through medication reminders. The expert system will send a reminder notification on the patient's smart phone for 30 days. In addition, the system also provides an opportunity for the patient to send messages or call the pharmacist for any additional questions they may have regarding their medication. To detail the algorithm of the expert system, the software code is designed to identify the patient's Transtheorethical theory (106) stage of adherence and recommend a counselling strategy line with self-efficacy theory after answering a series of question. (92, 105). The two data points will classify if the patient is in the 1.) Action/Maintenance stage, 2.) Contemplation/Preparation Change, or 3.) Pre-contemplation stage. In order to simplify the encoding in the expert system, and because the suggested intervention strategy is similar, all four of the stages are combined to form 2. The type of output of the information material and the suggested patient counselling technique were tailored according to the patient stage, as seen in Table 6.

Table 6: Strategy of Expert System Intervention

Stage	Strategy
Active	Tailored content
Maintenance	Instruction on how to use the Expert system

Stage	Strategy
Preparation Contemplation Pre-contemplation	Tailored content Instruction on how to use the Expert system Face to face counselling with the Pharmacist

If a patient is categorized as Active/Maintenance, the goal of the pharmacist is to motivate the patient to not relapse to non-adherence. For the other categories, the goal is to empower the patient and increase their determination to reach the action stage. In the present intervention, the strategies that were used by the counsellors are the following as seen in Table 7.

Table 7: Self efficacy strategy of Expert System Intervention

Stage	Self-Efficacy Technique	Strategy
Active Maintenance	Verbal persuasion Vicarious experience	The Pharmacist will give positive reinforcement to the adherent patient. And give an example story of an adherent patient that experienced good clinical outcomes in the long term.
Preparation Contemplation	Mastery of experience Vicarious experience Verbal persuasion	The Pharmacist will increase the confidence of the patient by demonstrating how to check the pulse and how to use the patient information materials and BP monitoring. If necessary, demonstrate physical exercise techniques and how to properly intake the medication. Throughout the counselling, the Pharmacist will give positive reinforcement to the adherent patient similar to the

Stage	Self-Efficacy Technique	Strategy
		intervention for A/M stage patients.
Pre-contemplation stage	Mastery of experience Vicarious experience Verbal persuasion Somatic and emotional	All techniques above were used by the counsellor but with the addition of techniques to address somatic and emotional states of the patients related to thinking about undertaking. For this, the Pharmacists will need to use active listening techniques to gather the cause of anxiety of the patient and address them. The key in this stage is the reassurance that the patient is capable of making the necessary changes in the lifestyle.

For the content of the tailored printed material, the expert system intervention is designed to collect the patient's satisfaction with the information and their own understanding of their condition from health providers. For all the gaps detected, the expert system generates the necessary information for the patient. The patient information material is designed to be a stimulus that will activate the patient's self-management of illness.(105, 107) see Appendix D and E. This principle is anchored on common sense model of self-regulation.

A daily medication reminder function on the patient's smart phone using the Google calendar app and Google messages were sent. Through this, the patient will receive a tailored daily dosing reminder for 30 days. In addition, the system allows a formal communication channel between the pharmacist and the patients, either through Google mail, Google chat, or through Google meet. Google mail and Google chat allow the patient to send written inquiries to the pharmacist, while Google meet allows the patient to have a call or video call with their pharmacist. This is an additional safety and convenience feature for the patient.

PHARMALASAKIT EXPERT SYSTEM INTERVENTION

The standard care under the PhilPEN program is that every month the patient will visit the rural health unit for a doctor's consultation, and afterwards they will be given a one-month supply of their medication. This process was undergone by patients randomized in the control group and is illustrated in Figure 10.

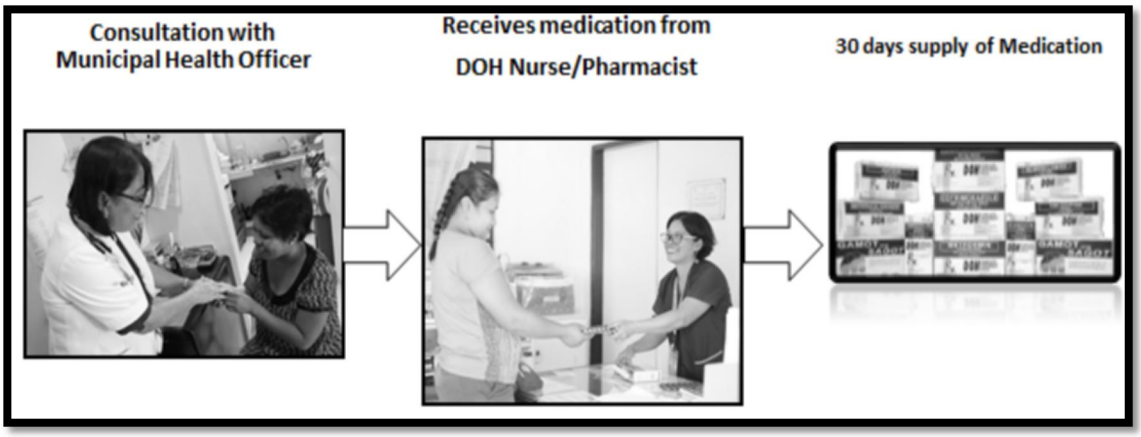


Figure 10: Standard care under PhilPEN program

The intervention created is called the PharMalasakit expert system. The name is derived from the compounded words Pharma and *Malasakit* because the intervention is pharmacist led and *Malasakit* is from a Filipino word that translates to concern, care, and compassion in English. The proposed intervention is an expert-system-generated, individualized, and stage-matched intervention for adherence to antihypertensive drugs. If randomized to the intervention group, the participants will receive an interview with a pharmacist after their consultation with the doctor. At this stage, the pharmacist is gathering data for encoding to the expert system and providing an orientation to the patient on how to activate their Google application through their smartphone. If the patient is unfamiliar with the technology or unable to use their smart phone, their primary caretaker would be trained in its place. Instantaneously, the tailored patient information leaflet is generated and sent to the patient and pharmacist's email. This will then be printed and given to the patient together with their medication. This process is illustrated in Figure 11. Because of the customized system, a medication reminder for 30 days is also generated on their smart phones and cued for Google message by SMS.

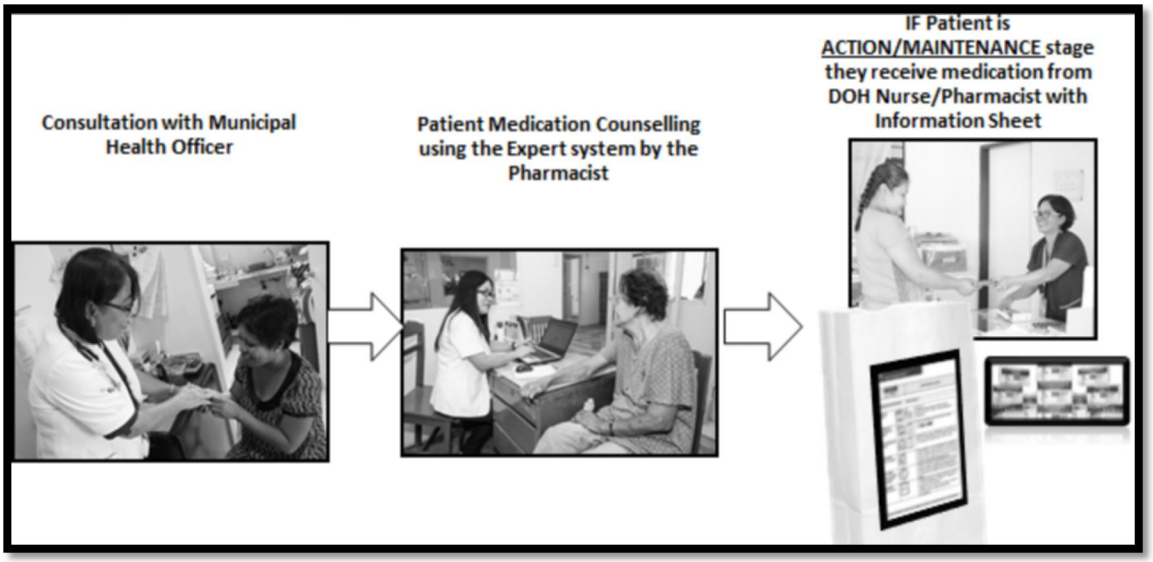


Figure 11: Proposed Expert system Intervention

If the patient is identified to be in the "Pre-action" stages (Pre-contemplation, Contemplation, and Determination), they will receive a face-to-face pharmacist counselling session. The pharmacist is guided by the expert system-generated pharmacist notes. The pharmacists that will deliver the intervention are employed by the research team. All pharmacists were fluent in Filipino and English, had a Bachelor's degree in Pharmacy, and were licensed by the Professional Regulation Commission. The pharmacists will participate in a 6-hour competency training for using the expert system and patient counselling technique prior to the intervention. This process is illustrated in Figure 12.

Overall, the Pharmalasakit expert system produces four outputs: 1.) a personalized patient information material, 2.) a medication reminder function in the patient's smart phone, 3.) a tailored guide for pharmacists that can be used during patient counselling, and 4.) a formal communication channel between the patient and the pharmacist.

In order to make sure that the intervention was implemented as designed, All the public health pharmacists in the randomized study site were invited to take part in the study with compensation of 15,000 PHP. Those who will agree to participate were asked to attend a training day. The study design required that all pharmacists

should complete the 6 hours lecture-workshop and pass the assessment. The assessment is a practical examination using a standardized patient. Overall, the training comprised a one-day workshop on how to use the expert system, how to conduct patient education using the pharmacist guide, how to increase patient's self-efficacy through patient counselling and how to implement the randomized controlled trial protocol in the study site. Standardization of skills of the pharmacists is done to ensure that study determines the effect of the intervention rather than of the training. In case the pharmacist in charge of the randomized study site refused to undergo the training or failed the assessment, a new study site was randomized and included in the study instead.

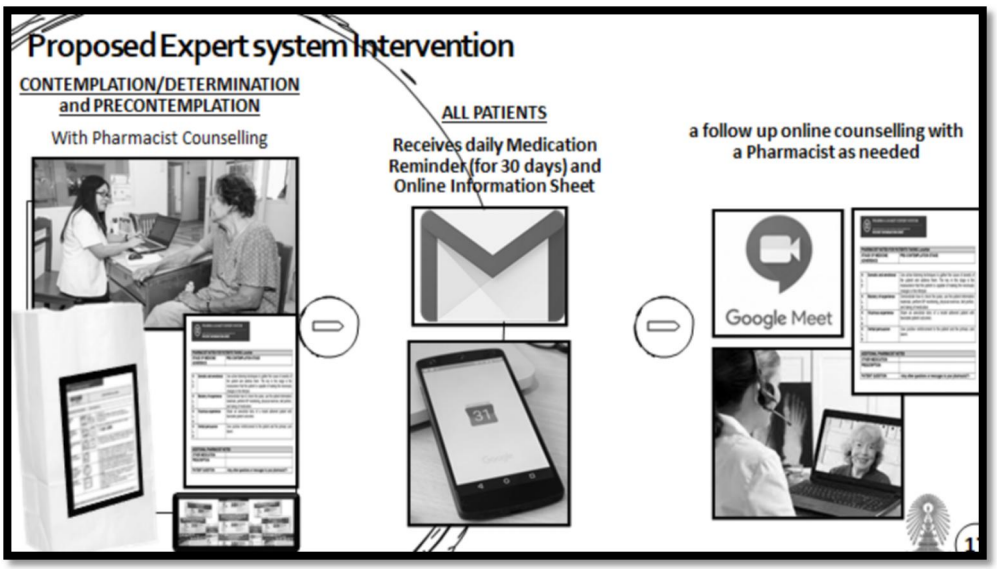


Figure 12: Proposed Expert system Intervention for Pre-Action patients

METHODOLOGY MATRIX

The summary of the methodology and statistical analysis are summarized in Table 8

Table 8: Methodology matrix

Objective/s of the study	Research/Statistical Hypothesis	Variables of the study (IV/DV)	Data Collection	Analysis of data
What are the characteristics	To describe the baseline	Baseline value:	Survey using the	Descriptive statistics

Objective/s of the study	Research/Statistical Hypothesis	Variables of the study (IV/DV)	Data Collection	Analysis of data
of Filipino hypertensive patients?	characteristics of the participants in terms of their sociodemographic and clinical characteristics.	DV for Pearson Chi Sex Education (Highest attainment) Currently employed Average monthly income (in PHP) Financial Health Risk Alcohol Smoking Family History Salt Intake Physical activity Functional Support Medication Medication Regimen Self-perceived	instruments at baseline (see Appendix A).	(percentage, mean and SD) Levene's test for equality of variance Pearson $\chi 2$ tests for categorical variables Two-sample t test for continuous variables

Objective/s of the study	Research/Statistical Hypothesis	Variables of the study (IV/DV)	Data Collection	Analysis of data
		adherence Self-perceived Knowledge DV for Two-sample t test Age Height Weight BMI		
What is the effect of the pharmacist-led expert system intervention on medication adherence and blood pressure control in patients?	To create an expert system intervention for hypertensive patients that addresses both intentional and unintentional adherence. To determine whether and to what extent the expert system intervention improves medication adherence and blood pressure control in	Model 1- MPR Model 2: Ln (Adherent to Medication) IV: Intervention Age Sex Highest educational Attainment Employment status	Survey using the instruments at the specified time points (baseline, month 1, month 3 and month 6) (See Appendix A, Appendix B)	Random-effects GLS regression Random-effects logistic regression Wald chi2 and Z test for the coefficient. Correlation

Objective/s of the study	Research/Statistical Hypothesis	Variables of the study (IV/DV)	Data Collection	Analysis of data
	patients when confounders are controlled.	Average monthly income Financial Health risk Functional Support Frequency of dosing Self-Perceived Adherence Self-Perceived Knowledge Model 3- SBP Model 4- DBP Model 5 –Ln (BP Control) IV: Intervention Age Sex BMI		Repeated Measures ANOVA

Objective/s of the study	Research/Statistical Hypothesis	Variables of the study (IV/DV)	Data Collection	Analysis of data
		Financial Health Risk Alcohol Smoking Family History Salt Intake Physical Activity Functional Support Self-Perceived Knowledge		

MEASURES AND DATA PROCESSING

The measurement tool and data coding of each variable are outlined and described in Table 9.

Table 9: Measurement tool and Scale of the Variables

Variable	Questionnaire or Measurement tool	Scale
Medication Adherence	The adapted medication possession ratio (MPR) is computed by counting the number of remaining tablets at the end of the month and performing the computation.	MPR is a continuous Variable (ratio scale). The closer the patient is to 1 the more adherent.

Variable	Questionnaire or Measurement tool	Scale
	MPR = ((# of supplied tablets in a month-# of tablets remaining after 30 days)) Medication adherence is defined as having a MPR of 0.8 or greater. The adherence stage was based on two questions related to the patient's adherence. (See Appendix A).	Medication Adherence is Categorical variable (nominal scale) 0 = Not adherent 1 = Adherent Self-Perceived Medication adherence is a categorical Variable 0 – pre-action stages (pre-contemplation contemplation and planning) 1 – post-action stages (action and maintenance)
Blood Pressure	The average blood pressure was measured using a calibrated Omron automatic BP monitor while using international standards and procedures for collecting. (63) Three BP measurements would be taken after the participants were seated for 5 minutes, each at least 5 minutes apart and with	SBP and DBP is a continuous variable in mmHG scale (ratio scale) Categorical variable (nominal scale) 0 = Uncontrolled

Variable	Questionnaire or Measurement tool	Scale
	alternate arms; the 2nd and 3rd measurements were averaged. Blood pressure control is having an SBP of less than 140 mmHg and a DBP of less than 90 mmHg.	blood pressure 1 = Controlled Blood pressure
Pharmacist led Expert System Intervention	Patients are randomly assigned to a control group or an intervention group. In the case of drop-outs, intention-to-treat analysis was used in this study.	Categorical variable (nominal scale) 0 = Control group 1 = Intervention group
Age	were measured by asking the participant's age; see Appendix A.	Age in years is continuous variable
Sex	were measured by asking the participant's biological sex (see Appendix A).	Categorical variable (nominal scale) 0 = Male 1 = Female
BMI	It was measured by measuring the height (m) and weight (kg) of the patient and computing it by dividing weight over squared height. See Appendix A.	Continuous variable (ratio scale) expressed as kg/m2
Socioeconomic status	It was measured by asking the participant's educational attainment level based on the 2017 Philippine Standard Classification of Education (PSCED). (108) Highest Educational attainment is asked as Categorical variable	In the analysis Categorical variable: Level of education / nominal scale (dummy variable)

Variable	Questionnaire or Measurement tool	Scale
	0-Early Childhood 1-Primary 2-Lower Secondary 3-Upper Secondary 4-post-secondary non tertiary 5-Short-Cycle Tertiary 6-Bachelor 7-Master 8-Doctoral Occupation based on Philippine Standard Occupational Classification (PSOC) (109) Occupation are asked as Categorical variable (nominal scale) Managers Professionals Technicians Clerical Service and sales Skilled agricultural, forestry and fishery Craft and related trades Skilled and Machine operators and assemblers Elementary occupations Armed forces occupations Others: ____	1-Primary 2-Lower Secondary 3-Upper Secondary 4-post-secondary non tertiary 5-Short-Cycle Tertiary 6-Bachelor 0-Master and Doctoral In the analysis it was coded as 0 – No work With work (Occupation class 1 to 10)

Variable	Questionnaire or Measurement tool	Scale
	Average monthly income (in PHP) (ordinal scale) < 9,520 9,520 to 19,040 19,040 to 38,080 38,080 to 66,640 66,640 to 114,240 114,240 to 190,400 > 190,400 High financial risk due to health was demonstrated by medical expenditure / family income ≥0.4. Patients with zero family income were described in the study as having high financial health risk.(31)	In the analysis it was coded (included in the model as a dummy variable) 1 - < 9,520 9,520 to 19,040 >19,040 In the analysis it was coded as Health Financial Risk (Categorical variable) / nominal scale 0 – Not High financial health risk 1 – High financial health risk
Risk Factors	were measured by asking the participant's consumption of salty foods, alcohol, and tobacco in the last 7 days prior to taking their blood pressure, family history of hypertension, and engagement in physical activity using a binary questionnaire (see Appendix A).	Categorical variable (binomial scale) Alcohol No Yes Smoking No Yes

Variable	Questionnaire or Measurement tool	Scale
		Salty food No Yes Physical Activity No Yes Family History of Hypertension No Yes
Functional support	were measured by asking the participant's perception of support from family and friends (see Appendix A).	Categorical variable (binomial scale). Perceived functional Support No Yes
Self-Perceived Knowledge	were measured by asking the participant's perception of whether the following criteria was explained to them clearly the Reason why I need to take the medicine What hypertension means How long I need to take this medicine Possible side effects of taking the medication How I should monitor my condition to see if the treatment is working Lifestyle for patients with hypertension Important precautions for hypertension	Continuous variable (Ratio scale) expressed as total Self-Perceived Knowledge score

Variable	Questionnaire or Measurement tool	Scale
	What to do if I miss the dose How to properly store my medication The self-perceived knowledge score is the total yes answer in the following. The higher the score, the higher the self-perceived knowledge. See Appendix C. The highest possible score is 9 points.	

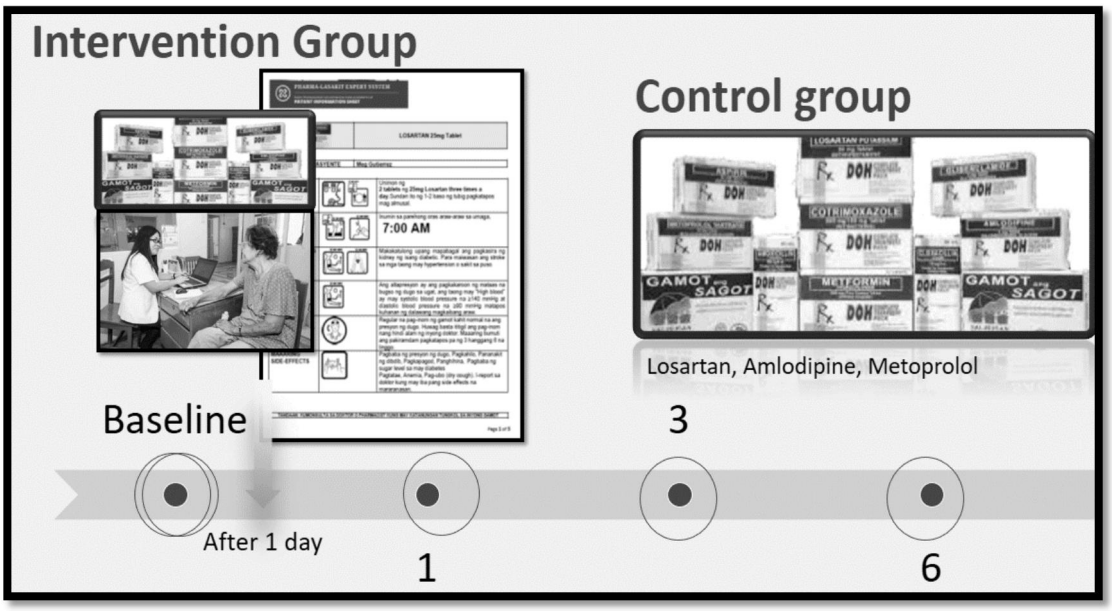


Figure 13: Data collection timeline

Throughout the data collection process, BP was measured by the research team using the calibrated Omron automatic BP sensor. Three BP measurements were taken after participants had been seated for 5 minutes, each at least 5 minutes apart; the 2nd and 3rd measurements have been combined by averaging. Measurements were taken at baseline, 1-month, 3-month, and 6-month intervals. The recommendations of the Joint National Committee (JNC) 7 were used to provide the timeline for the implementation of the intervention. In this research, an adopted Medication

Possession ratio (MPR) was used (50) to measure medicine adherence. This is measured by counting the number of remaining pills left after one month and dividing it with the number of pills supplied at the start of the month. To ensure the integrity of the data, the blister packaging at the start of each month is marked with a unique code. The same blister packaging with the proper code must be presented by the patient. Other measures such as BMI and risk factors will also be used in Appendix A at each time-point (screening/baseline, 1-month follow-up, 3-month follow-up, and 6-month follow-up). The timeline of the data collection is illustrated in Figure 13.

PRETESTING OF QUESTIONNAIRE AND EXPERT SYSTEM

The survey questionnaire and the expert system were pretested on twenty (n = 20) hypertensive Filipino patients from Region IV-A between October 1 and 6, 2020. Pretesting was conducted to ensure that errors associated with survey analysis were avoided in order to improve the accuracy of the results. The survey is administered to the respondents, followed by a debriefing interview. The interview includes questions about the survey and the data collection process. Respondents were asked to comment on the questionnaire design, especially on the ambiguity of words, misinterpretation of questions, inability to answer a question, sensitive questions, accuracy of their classification and several other issues related to the questionnaire.

The average age of the pre-test respondents is 56.1 years old. Seventeen of the respondents are older than 40 years old. 9 respondents were male and 11 were female. The items that become problematic are height and weight in cm and kilograms, since Filipinos prefer to express their height in feet, inches and pounds. Resolution is the research assistant's ability to measure first-hand using a calibrated measuring tape and weighing scale during data collection. The research assistant is responsible for recording and subsequent computation of BMI.

Years of formal education were also problematic. Patients answered the year when they graduated instead of years completed. As a resolution, it was restated as the

participant's highest educational attainment level based on the 2017 Philippine Standard Classification of Education (PSCED). (35) PSCED has 8 levels based on the Philippine Qualification framework. The same is true with occupations where respondents are not sure how to answer, whether in general terms or specific terms. This was resolved by using the Philippine Standard Occupational Classification (PSOC). (36) Furthermore, the research assistant data collection protocol will state that "no answer" was recorded if the patient prefers not to say so, and "none" if the patient is currently not employed or retired.

Many patients also preferred not to state their exact financial income for one month. To facilitate this, the questionnaire was revised to a closed-ended questionnaire with categories based on the annual family income indicative range for a family of 5 in 2017. (34) In turn, this will make the financial health risk estimate more accurate. The binary risk factor questions are easy to understand for the patients, except for the functional support question. In order to solve this, a description of what type of support was included in the question. Another problem encountered is that the patients cannot provide their accurate blood pressure measurements and MPR. Therefore, these outcome measures must be directly measured and collected by the research assistant using calibrated instruments and international standard protocol. Following the pretesting, it was discovered that some patients preferred the English version of the question, while others preferred the Filipino version. To address this issue, the questionnaire now includes both the Filipino and English versions of the question. The English version is italicized and enclosed in parentheses. Overall, the questionnaire and data collection protocol are adjusted based on the comments to ensure objectivity in data collection.

The following results were obtained for the beta testing of the Pharmalasakit expert system: Eight (8) patients are maintained on Losartan, eight (8) on Amlodipine, and four (4) on Metoprolol. Thirteen (13) of the patients were in the active/maintenance phase, five (5) were in the contemplation/determination stage, and two (2) were in

the pre-contemplation stage. A post interview was done and the patients confirmed that they were classified correctly using the two questions.

The binary questions are easy to understand for the patients. To be sure and to improve the data collection protocol, it should be stated by the pharmacist that if the patient is in doubt or they have any question in mind, it is better to respond with "No." It should also be clear in the data collection protocol that if the patient is taking 2 antihypertensive drugs, they should answer 2 expert system questionnaires, 1 for each medicine. If they are taking other medications (e.g., diabetes, asthma, etc.), they should not include them in their answers to the anti-hypertensive questionnaire.

Testing is done on the expert system to verify and validate that the software and application are bug-free and meet the technical requirements based on the intended design. A survey is also done to check if the output meets the user requirements effectively and efficiently. The software initially failed to execute properly five times. It was discovered that since the coding is case sensitive, it did not interpret the response "YES," which should be responded as "Yes". This was resolved by making the form case-sensitive and close-ended. There was also initially a problem in generating the information sheet for patients maintained on Metoprolol. For all detected errors in coding, debugging is performed on the software. Through the pretest, potential errors are identified, analyzed, and removed. All the problems encountered were solved and successfully retested.

STATISTICAL ANALYSIS

Descriptive statistics (percentage, mean, and standard deviation) of demographics and clinical measures between groups at baseline were computed using Pearson chi2 ($\chi 2$) tests for categorical variables and an independent two-sample t test for continuous variables. ANOVA and Pearson chi2 ($\chi 2$) tests will be used to determine if there are significant differences between time points. The Levene's test was used to

determine the consistency of the variance between the intervention group and the control group. This would be done to ensure that there is no substantial difference between the two groups at the baseline level and they are comparable.

Random-effects A Generalized Least Square (GLS) regression was used to assess the impact of the intervention on the outcome variables on the panel data. A random effects model was selected because of the repeated observations on the same patients and the key explanatory variable under evaluation is time invariant. Through this statistical study, the model is improved by capturing individual and time-invariant variables that influence the dependent variable but are not observed. Generalized least square estimators of the parameters of this model are more effective than those obtained in the simpler model, neglecting these unobserved variables.

Random-effects Logic regression will also be done to determine if the expert system increases the likelihood of blood pressure control and adherence to medication. The odds ratio was reported. The logistic regression model was used because it is more clinically significant and easier for practitioners and decision makers to understand. test was done on all outcome variables to confirm if there is a mediator effect.
The Stata/BE 17.0 for Windows (Revision 17 Jan 2022) and Microsoft® Excel® 2019 MSO (Version 2112 Build 16.0.14729.20224) 32-bit are the software that was used to organize the data and perform all statistical analysis.

ETHICAL CONSIDERATION

Since the participation of human subjects is essential in the conduct of the research, the proposal was submitted to the Single Joint Research Ethics Board (SJREB) for evaluation. SJREB is an integrated review board for multiple sites that is recognized by the Philippine Health Research Ethics Board. The research was granted clearance on January 14th, 2021 with a protocol number of SJREB-2020-92. By design, the research has the following features to ensure ethical compliance:
All patients will have informed consent and may, at any time, opt out of the study. Subjects were required to read and agree to an Informed Consent form prior to

participation in the study. Any participant who did not give their consent was automatically excluded from the population. See Appendix K for informed consent.

There are no identified physical, psychological, or social risks that may arise during the conduct of the study that are outside the normal risk of being a part of the PhilPEN program. All patients are enrolled in the ComPack program (currently receiving medicine) for at least 3 months. The intervention will serve as just an "add on" to the existing program. All willing patients from the control group will also receive the intervention after 6 months if they so wish.

Patients were fully aware of potential inconveniences and economic risk as a result of receiving a daily medication reminder and tailored drug information through the internet and/or mobile data. The participants are compensated with 50 PHP (1 USD) for each data collection.

The data protection plan using a HIPAA compliant database system was strictly followed to minimize the risks of breaching subject confidentiality. No personal information will be released or displayed to the public.

No genetic tests were conducted. Familial genetic information as a result of answering the survey questions was kept confidential.

A precaution protocol is in effect to avoid the dissemination of results to immediate family members or others without the permission of the researcher. Patients have the right to deny future data use and storage.

The patient and his or her legally appropriate representative will have access to his or her documents. They were notified in a timely manner if information became available that may be relevant to the patient's willingness to continue participating.

All information obtained from the study was solely used for obtaining information regarding the objective of the study.

There were no conflicts of interest (financial, proprietary, or professional) between the investigator and other institutions.

The result of the study will be made known to all participants. The resulting research papers were submitted to reputable journals for publication. The researchers intend to present the paper at scientific conferences for wide dissemination.

CHAPTER IV

RESULTS

BASELINE CHARACTERISTICS

In total, 500 patients were enrolled across 10 study sites in Laguna and Cavite provinces. There were 83 people, 42 who were not able to meet the inclusion criteria and 41 people who declined to participate after reading the informed consent. Table 10 shows the distribution by study site. There were 417 patients eligible for randomization to one of two groups: 203 were assigned to the control group, which received standard care, and 214 were assigned to the intervention group, which received the pharmacist-led expert system intervention. Figure 14 shows that 8 patients from each group were lost to follow-up after Time 1 (Intervention n = 6, Control n = 4) and Time 3 (Intervention n = 2, Control n = 4). The 6-month trial was completed by 401 patients, 206 from the intervention group and 195 from the control group, as seen in Table 10.

Table 10: Geographic distribution of sample population

Study Sites	Enrolled	Excluded	Total eligible for randomization	Control Group	Intervention Group	Dropouts	Completed the 6 months
Binan	50	10	40	20	20	0	40
Carmona	50	3	47	22	25	8	39
Imus	50	11	39	17	22	0	39
Kawit	50	12	38	20	18	1	37
Maragondon	50	5	45	24	21	2	43
Mendez	50	8	42	20	22	2	40
Naic	50	3	47	24	23	1	46
San Pedro	50	10	40	20	20	0	40
Tanza	50	11	39	16	23	1	38
Trece Martires	50	10	40	20	20	1	39
Total	500	83	417	203	214	16	401

Levene's test for equality variance was conducted to determine if both groups had equal variance at baseline for all main outcome variables. The results suggest that the expert system intervention group and control group have equal variance at baseline, as seen in Table 11.

Table 11: Test for equality of variance at baseline

Variables	Intervention		Control		Levene's test P value
	Mean	SD	Mean	SD	
SBP	139.04	19.82	142.62	20.85	0.4683
DBP	86.41	11.22	90.07	12.02	0.3195
MPR	0.69	0.17	0.71	0.19	0.1411

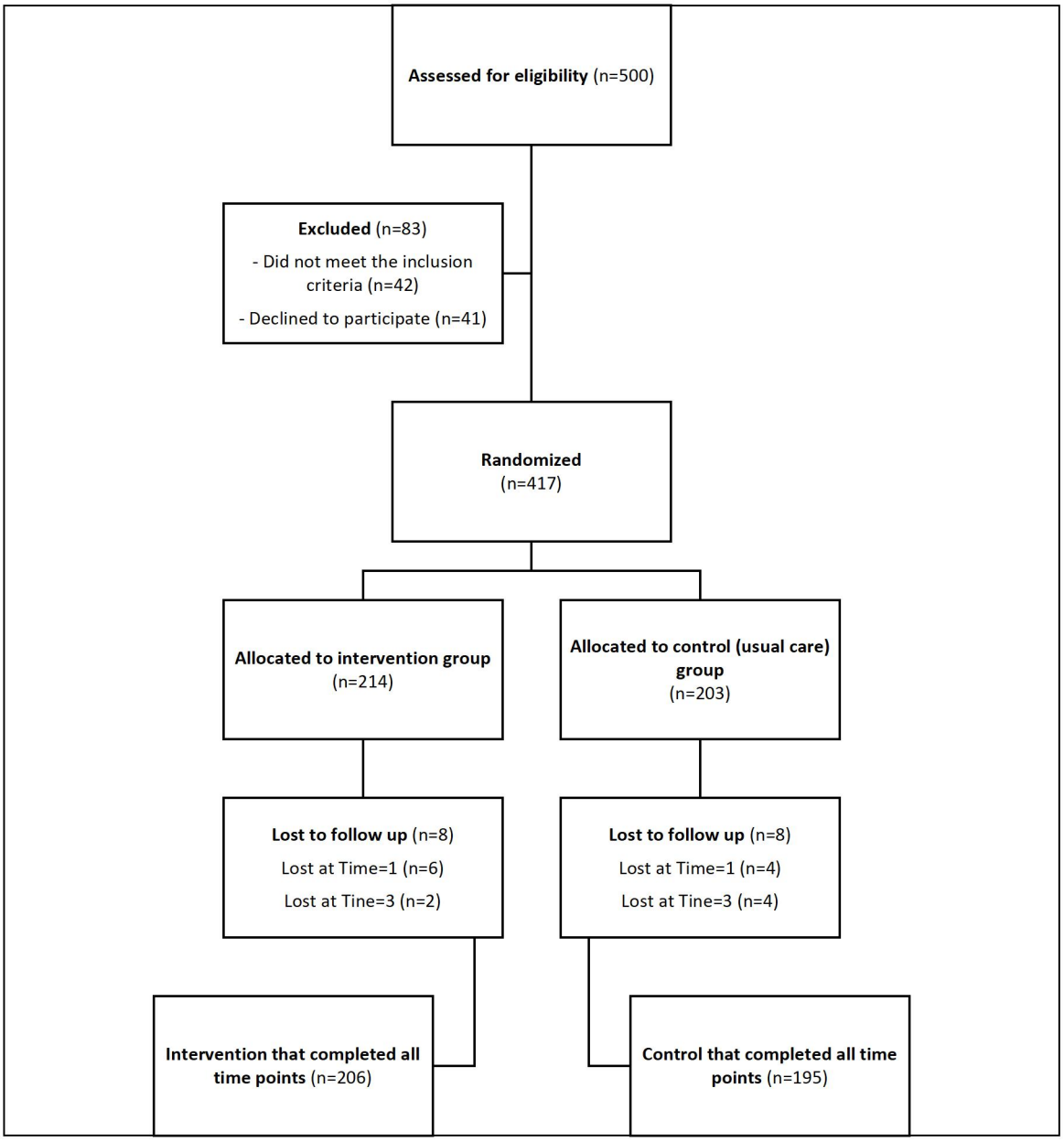


Figure 14: Flow diagram showing patient recruitment and follow up

The mean age of patients was 57.36 $\pm$ 11.11 years, height was 154.65 $\pm$ 9.79 cm, weight was 62.15 $\pm$ 21.29 Kg and BMI was 26.05 $\pm$ 4.94. A two-sample T test was performed to determine if there were significant differences between the two groups. The result showed that at baseline there were no significant differences in age, height, weight, and BMI as seen in Table 12. There were 131 (31.64%) males and 283 (68.36%) females in the sampled population; Pearson's chi-squared indicates a significant difference between groups (p=0.025), with more females assigned to the control group and more males assigned to the intervention group.

The majority of participants, 25.42 percent, completed Upper Secondary Education (Senior High School, NC I and NC II), followed by 22.30 percent of Primary Education (Elementary) and 22.06 percent of Bachelor Level Education (Baccalaureate degree). According to Table 12, there is no significant difference between groups in all categories based on Pearson's chi-squared test. The same can be said for employment status, with 50.60 percent of people being retired or unemployed.

The majority of participants (73.86 percent) are classified as poor, with an average monthly income of PHP 9,520. Following that are 19.18 percent who are low-income (but not poor) and only 6.47 percent who are lower middle-income or higher. As seen in Table 12, there was no significant difference between groups. There is also no significant difference between groups in terms of financial health risk, as seen in Table 12 where the majority, at 91.06 percent, are at high financial health risk.

In terms of other factors that may affect hypertension, the majority of patients have not consumed alcohol in the last 7 days (90.36%), have not smoked in the last 7 days (91.08%), have a family history of hypertension (86.02%), have consumed salty food in the last 7 days (53.98%), are engaged in daily physical activity (59.04%), and are receiving functional support (70.29%). As shown in Table 12, there was no significant difference between the two groups.

Table 12: Baseline Demographic and Clinical Characteristics of Study Population

Domains		All patients (n=417)	%	Intervention Group (n=214)	%	Control Group (n=203)	%	P Value
Age	Mean	57.36		58.18		56.5		0.1242
	SD	11.11		10.65		11.54		
Height	Mean	154.65		155.05		154.23		0.3950
	SD	9.79		9.81		9.78		
Weight	Mean	62.15		62.18		62.11		0.9534

Domains		All patients (n=417)	%	Intervention Group (n=214)	%	Control Group (n=203)	%	P Value
	SD	21.29		12.44		12.17		
BMI	Mean	26.05		25.87		26.23		0.4463
	SD	4.94		4.66		5.22		
Sex	Male	131	31.64	78	36.28	53	26.37	0.025*
	Female	283	68.36	137	63.72	148	73.63	
Education (Highest attainment)	Primary Education (Elementary)	93	22.30	47	21.96	46	22.66	0.879
	Lower Secondary education (Junior High School)	76	18.23	42	19.63	34	16.75	0.447
	Upper Secondary Education (Senior High School, NC I and NC II)	106	25.42	57	26.64	49	24.14	0.559
	Post-secondary 0n tertiary education (TESDA- NC III)	19	4.56	9	4.21	10	4.93	0.724
	Short-Cycle Tertiary Education (TESDA- NC IV)	19	4.56	8	3.74	11	5.42	0.410
	Bachelor Level Education	92	22.06	45	21.003	47	23.15	0.600

Domains		All patients (n=417)	%	Intervention Group (n=214)	%	Control Group (n=203)	%	P Value
	(Baccalaureate degree)							
Currently employed	Yes	205	49.40	106	49.77	99	49.01	0.878
	No	210	50.60	107	50.23	103	50.99	
Average monthly income (in PHP)	< PHP 9,520	308	73.86	162	75.70	146	71.92	0.379
	PHP 9,520 to PHP 19,040	80	19.18	37	17.29	43	21.18	0.312
	>19,040	27	6.47	14	6.54	13	6.40	0.995
Financial Health Risk	Yes	377	91.06	192	90.57	185	91.58	0.717
	No	37	8.94	20	9.43	17	8.42	
Alcohol	Yes	40	9.64	17	7.98	23	11.39	0.240
	No	375	90.36	196	92.02	179	88.61	
Smoking	Yes	37	8.92	22	10.33	15	7.43	0.300
	No	378	91.08	191	89.67	187	92.57	
Family History	Yes	357	86.02	180	84.51	177	87.62	0.360
	No	58	13.98	33	15.49	25	12.38	
Salt	Yes	224	53.98	111	52.11	113	55.94	0.434
	No	191	46.02	102	47.89	89	44.06	
Physical activity	Yes	245	59.04	127	59.62	118	58.42	0.802
	No	170	40.96	86	40.38	84	41.58	
Functional Support	Yes	291	70.29	147	69.34	144	71.29	0.665
	No	123	29.71	65	30.66	58	28.71	
Medication	Losartan 50mg	289	69.30	143	66.82	146	71.92	0.225
	Losartan	37	8.87	24	11.21	13	6.40	0.084

Domains		All patients (n=417)	%	Intervention Group (n=214)	%	Control Group (n=203)	%	P Value
	100mg							
	Amlodipine 5mg	140	33.57	68	31.78	72	35.47	0.423
	Amlodipine 10mg	48	11.51	24	11.21	24	11.82	0.845
	Metoprolol 50mg	9	2.16	3	1.40	6	2.96	0.275
	Taking other Medications	55	13.19	31	14.49	24	11.82	0.422
Taken more than once a day	Yes	23	5.54	11	5.16	12	5.94	0.730
	No	392	94.46	202	94.84	190	94.06	
Self-perceived adherence	Yes	349	84.10	175	82.16	174	86.14	0.268
	No	66	15.90	38	17.84	28	13.86	

*P value<0.05 considered significant in Two-sample T test

The majority of patients (69.30%) were given 50mg Losartan and 5mg Amlodipine as medications (33.57%). In terms of medication administration, there was no significant difference between the two groups. Other medications are taken by 13.19% of the study population, with no significant difference between the two groups. As shown in Table 12, the majority of participants (94.46%) follow the once-daily regimen with no significant differences between groups. The majority of patients, 84.10 percent, believed they were medication adherent; there was no significant difference between the two groups.

Patients were then asked if they understood various aspects of their medication and condition. At baseline, the mean self-perceived knowledge score is 6.50 out of 9

points, with no significant difference between the two groups. Reasons for taking the medication (93.00%), how long to take the medication (65.54%), how to monitor treatment (65.54%), the proper lifestyle (84.82%), important precautions (87.7%), how to handle a missed dose (54.46%), and how to properly store medication (65.70%) were the topics that were considered clear by the majority of the patients. While the patient was unsure about certain topics, such as possible side effects (50.84%), Table 13 shows that there was no statistically significant difference between the two groups.

Table 13: Baseline Patient perception on Hypertension and Medication

Domains		All patients (n=417)	%	Intervention Group (n=214)	%	Control Group (n=203)	%	P value
Self- Perceived Knowledge		Mean	6.50		6.51		6.49	0.9451
		SD	2.46		2.45		2.47	
It was clearly explained to me the:								
Reason why I need to take the medicine	Yes	385	93.00	197	92.92	188	93.07	0.954
	No	29	7.00	15	7.08	14	6.93	
What hypertension means	Yes	329	79.28	167	78.40	162	80.20	0.652
	No	86	20.72	46	21.60	40	19.80	
How long I need to take this medicine	Yes	295	71.08	154	72.30	141	69.80	0.575
	No	120	28.92	59	27.70	61	30.20	
Possible side effects of taking the medication	Yes	204	49.16	104	48.83	100	49.50	0.890
	No	211	50.84	109	51.17	102	50.50	
How to monitor my condition to see if the treatment is working	Yes	272	65.54	140	65.73	132	65.35	0.935
	No	143	34.46	73	34.27	70	34.65	
Lifestyle for patients with hypertension	Yes	352	84.82	179	84.04	173	85.64	0.649
	No	63	15.18	34	15.96	29	14.36	
Important precautions for hypertension	Yes	364	87.71	187	87.79	177	87.62	0.958
	No	51	12.29	26	12.21	25	12.38	

Domains		All patients (n=417)	%	Intervention Group (n=214)	%	Control Group (n=203)	%	P value
What to do if I miss the dose	Yes	226	54.46	116	54.46	110	54.46	0.999
	No	189	45.54	97	45.54	92	45.54	
How to properly store my medication	Yes	272	65.70	143	67.14	129	64.18	0.526
	No	142	34.30	70	32.86	72	35.82	

* P value<0.05 considered significant in Pearson's Chi2 test

MEDICATION ADHERENCE

As shown in Table 14, statistically significant differences in MPR and medication adherence are observed after the introduction of the intervention at Time 1, 3, and 6, all with p values less than 0.0001 in favor of the intervention group. This result is consistent with the repeated measures ANOVA result, where the F Value = 60.99 (p = 0.000), indicating a significant difference in the time points. As shown in Table 14, the repeated measures ANOVA for the intervention group is significant, whereas for the control group is not. When Pearson chi2 was used in Table 14 for medication adherence in all time points a similar result was obtained, see Appendix T and Appendix U.

A random effects GLS panel data analysis was performed to validate the findings and remove biases. Other factors included in the model included age, sex, highest educational attainment, employment, average monthly income, financial health risk, functional support, medication regimen, self-perceived adherence, and self-perceived knowledge.

The Wald chi2 value for the MPR model in Table 15 is 99.40 (p value = 0.000), indicating that the model significantly improves the ability to predict the medication possession ratio in hypertensive patients. The results indicate that the intervention, pharmacist-led expert system, significantly improves the MPR by 0.1141 (p = 0.000) with a constant of 0.6367 (p = 0.000) in Table 15. Self-Perceived Knowledge about Hypertension and Medication (p = 0.044) is another factor that significantly predicts

MPR from the model, with every point increase in score increasing MPR by 0.0033. The sigma u, or error due to differences between units (individuals), is 0.1028, while the sigma e, or error due to differences within units, is 0.1029. (idiosyncratic) is 0.1399, and the rho (proportion of variance due to unit effects) is.3507.

The created Model for MPR is 0.6367 + 0.1141(Intervention) + 0.0002(Age) - 0.0105(Sex_Male) - 0.0123(Primary) – (0.02) Lower Secondary + 0.0102(Upper Secondary) - 0.01227(Postsecondary on tertiary) + 0.004(Short Cycle Tertiary) - 0.0217 (Bachelor Level) + 0.0028(Employed) + 0.444(PHP9520) + 0.634(PHP9520toPHP19040) - 0.0258(Financial health risk) + 0.0128(Support) + 0.0193(Taken more than once a day) + 0.0128(Perceived Adherence) + 0.0043(Perceived Knowledge) see Appendix R and Appendix S.

Table 14: Comparison of Outcome Parameters of Medication Adherence among groups and across time

	Time		All patients (n=417)	%	Intervention Group (n=214)	%	Control Group (n=203)	%	P Value
Medicine possession Ratio (MPR)	0	Mean	0.70		0.69		0.71		0.2374
		SD	0.18		0.17		0.19		
	1	Mean	0.78		0.84		0.71		0.000*
		SD	0.17		0.14		0.18		
	3	Mean	0.81		0.89		0.73		0.000*
		SD	0.17		0.12		0.17		
	6	Mean	0.82		0.90		0.72		0.000*
		SD	0.18		0.14		0.17		
ANOVA	F P Value		60.99 (0.000*[3])		166.20 (0.0000*[3])		0.27 (0.8444)		
Medication Adherent	0	Yes	158	37.89	72	33.64	86	42.36	0.122
		No	259	62.11	142	66.36	117	57.64	
	1	Yes	249	59.71	163	76.17	87	42.86	0.000*[2]
		No	168	40.29	51	23.83	116	57.14	
	3	Yes	277	66.43	186	86.92	91	44.83	0.000*[2]

	Time		All patients (n=417)	%	Intervention Group (n=214)	%	Control Group (n=203)	%	P Value
		No	140	33.57	28	13.08	112	55.17	
	6	Yes	273	65.47	185	86.45	88	43.35	0.000*2
		No	144	34.53	29	13.55	115	56.65	
Pearson chi2	Chi2 (3) P Value		106.52 (0.000*2)		228.44 (0.000*2)		0.7949 (0.851)		

**P value<0.05 considered significant in Two-sample t test*

**2 P value<0.05 considered significant in Pearson's Chi2 test*

**3 P value<0.05 considered significant in Repeated Measures ANOVA*

Table 15: Summary of Panel Data Analysis for Medicine Possession ratio

Medicine Possession Ratio (MPR)	Coef.	z	P>|z|
Intervention	0.1141	9.12	0.000*
Age	0.0002	0.45	0.656
Sex (Male)	-0.0105	-0.78	0.513
Highest Educational Attainment			
Primary	-.0123	-.20	0.845
Lower Secondary	-.0200	-.32	0.752
Upper Secondary	.0102	0.16	0.871
Postsecondary on tertiary	-.01227	-0.19	0.850
Short Cycle Tertiary	.0040	0.06	0.952
Bachelor Level	-.0217	-0.35	0.729
Constant (>Bachelor Level)			
Employment			
Employed	0.0028	0.23	0.815
Average Monthly Income			
PHP9520	0.444	1.31	0.189
PHP9520toPHP19040	0.634	1.89	0.058
Constant (>19,040)			

Financial health risk	-.0258	-0.85	0.397
Support	0.0128	1.17	0.240
Taken more than once a day	0.0193	0.83	0.406
Perceived Adherence (yes)	0.0128	0.84	0.403
Perceived Knowledge	0.0043	2.02	0.044*
_cons	0.6367	8.34	0.000*
sigma_u	0.1028		
sigma_e	0.1399		
rho	.3507 (fraction of variance due to u_i)		

*p<0.05 considered significant in GLS Random Effects

A random effects logistic regression was also run to calculate the odds ratio of being medication adherent (MPR > 0.8) versus not when intervention is introduced. The medication adherence model has a Wald chi2 of 78.43 (p value = 0.000), indicating that it significantly improves the ability to predict hypertensive patients' medication adherence. With a constant of 0.2810 (p = 0.292), the intervention odds ratio is 5.3040, implying that patients who received the intervention are 430.4 percent (p = 0.000) more likely to be adherent than patients who did not receive the intervention. As shown in Table 16, no other factors significantly predicted medication adherence. The log of the variance is 0.7164, the standard deviation is 1.4307, and rho is 0.3835, which represents the proportion of total variance contributed by the panel-level variance component. The result of the Likelihood-ratio test indicates including the predictor variables improved the model significantly (see Table 16, Appendix R and Appendix S).

Table 16: Summary of Panel Data Analysis for Medication Adherence

Medication Adherence (1=Yes, 0=No)	**OR**	**z**	**P>|z|**
Intervention	5.3040	8.42	0.000*
Age	1.0040	0.43	0.668
Sex (Male)	0.8332	-0.86	0.388
Highest Educational Attainment			
Primary	0.5751	-0.56	0.573

Medication Adherence (1=Yes, 0=No)	OR	z	P>|z|
Lower Secondary	0.5503	-0.60	0.545
Upper Secondary	0.8617	-0.15	0.879
Postsecondary on tertiary	0.7717	-0.25	0.806
Short Cycle Tertiary	1.0187	0.02	0.986
Bachelor Level	0.4927	-0.73	0.468
Constant (>Bachelor Level)			
Employment			
Employed	1.1136	0.55	0.585
Average Monthly Income			
PHP9520	1.1166	0.20	0.845
PHP9520toPHP19040	1.0626	0.11	0.913
Constant (>19,040)			
Financial health risk	1.2421	0.42	0.672
Functional Support	1.2667	1.28	0.200
Taken more than once a day	1.2052	0.49	0.624
Perceived Adherence	1.3421	1.13	0.257
Perceived Knowledge	1.0569	1.54	0.123
_cons	.2810	-1.05	0.292
/lnsig2u	.7164		
sigma_u	1.4307		
Rho	0.3835		

*p<0.05 considered significant in Logistic Random Effects Test

BLOOD PRESSURE

The data in Table 17 suggests that SBP is lower in the control group when compared to the intervention group, but when tested using the two-sample t test to compare the means at all time points, no significant difference was found, as shown in Table 17. In terms of DBP, the control group demonstrated a significantly higher baseline at time 0 (p = 0.0015) and a lower result at time 6 (p = 0.0011), as shown in Table 17. This result is consistent with the results of repeated measures ANOVA, which show

that the F Value for SBP is 24.51 (p=0.000) and the F Value for DBP is 13.42 (p=0.000), indicating that there is a significant difference in the time points. As shown in Table 17, the ANOVA for the control group is significant, whereas the ANOVA for the intervention group is not for DBP. When Pearson chi2 was used in Table 17, Appendix T, and Appendix U, similar results were obtained.

Table 17: Comparison of Outcome Parameters of Blood Pressure among groups and across time

	Time		All patients (n=417)	%	Intervention Group (n=214)	%	Control Group (n=203)	%	Two-sample t test/ Chi2 diff=0 P Value
SBP	0	Mean	140.79		139.05		142.62		0.0754
		SD	20.36		19.78		20.80		
	1	Mean	136.98		136.24		137.73		0.4498
		SD	20.16		16.62		23.12		
	3	Mean	134.50		135.70		133.24		0.2304
		SD	20.54		19.68		21.33		
	6	Mean	133.66		135.05		132.20		0.1131
		SD	17.93		17.17		18.58		
ANOVA	F		24.51		4.23		25.60		
	P Value		(0.000*[3])		(0.0057*[3])		(0.000*[3])		
DBP	0	Mean	88.19		86.41		90.07		0.0015*
		SD	11.74		11.20		12.00		
	1	Mean	86.63		86.68		86.59		0.9246
		SD	11.08		10.64		11.47		
	3	Mean	85.38		86.04		84.69		0.1916
		SD	10.31		10.20		10.38		
	6	Mean	85.20		86.79		83.52		0.0011*
		SD	10.01		10.53		9.14		
ANOVA	F		13.42		0.43		25.83		
	P Value		(0.000*[3])		(0.7296)		(0.000*[3])		
Controlled Hypertensi	0	Yes	132	31.65	85	39.72	47	23.15	0.000*[2]
		No	285	68.35	129	60.28	156	76.85	

	Time		All patients (n=417)	%	Intervention Group (n=214)	%	Control Group (n=203)	%	Two-sample t test/ Chi2 diff=0 P Value
on	1	Yes	178	42.69	90	42.06	90	44.33	0.811
		No	239	57.31	124	57.94	113	55.67	
	3	Yes	216	51.80	97	45.33	119	58.62	0.005*2
		No	201	48.20	117	54.67	84	41.38	
	6	Yes	228	54.68	99	46.26	129	63.55	0.000*2
		No	189	45.32	115	53.74	74	36.45	
Pearson chi2	Chi2 (3) P Value		63.21 (0.000*2)		3.5610 (0.313)		89.38 (0.000*2)		

*P value<0.05 considered significant in Two-sample t test

*2 P value<0.05 considered significant in Pearson's Chi2 test

*3 P value<0.05 considered significant in Repeated Measures ANOVA

When patients with controlled hypertension are compared, a significant difference between the two groups is found. At baseline, the control group has a higher proportion that is not controlled (p 0.0001). As shown in Table 17, the control group controls a significantly higher proportion at time 3 (p = 0.005) and time 6 (p = 0.000). To validate the result, a random effects GLS regression was run on both the SBP and the DBP. Other blood pressure-related factors, such as MPR, age, sex, BMI, financial health risk, alcohol, smoking, family history, salt, physical activity, and functional support, are shown in Tables 18 and 19.

The SBP model has a Wald chi2 of 51.83 (p value = 0.000), indicating that it significantly improves the ability to predict SBP in hypertensive patients. For SBP, the results indicate that the intervention does not significantly predict SBP (p = 0.911), with an estimated "direct" effect of intervention on SBP of 0.1810. MPR (p = 0.001) significantly predicts SBP, lowering it by -8.6600 per unit of MPR with a constant of 143.2674 (p = 0.000). Patients engaged in physical activity also significantly increased their SBP (p = 0.001), increasing it by 4.0015. SBP is significantly reduced by self-perceived knowledge score; for every point increase in knowledge, SBP decreases by

0.7566 (p = 0.003). The sigma_u, or error due to differences between units (individuals), is 14.3498, as is the sigma_e, or error due to differences within units. 13.3938 and the proportion of variance due to unit effects or rho is 0.5344, as seen in Table 18, Appendix R and Appendix S.

The created model for SBP is SBP **=** 143.2674 + 0.181(Intervention) - 8.66(MPR) + 0.1276(Age) - 0.2605(Sex_Male) - 0.0435(BMI) - 1.678(Financial Health Risk) + 2.2597(Alcohol) + 3.4949(Smoking) - 1.7554(Family History) - 0.9049(Salt) + 3.5645(Physical activity) - 1.0888(Functional Support) -0.6263(Self-Perceived Knowledge) see Appendix R and Appendix S.

Table 18: Summary of Panel Data Analysis for Systolic Blood Pressure

SBP	Coef.	z	P>|z|
Intervention	0.1810	0.11	0.911
MPR	-8.6600	-3.39	0.001*
Age	0.1276	1.76	0.078
Sex (Male)	-0.2605	-0.16	0.877
BMI	-0.0435	-0.75	0.452
Financial Health Risk	-1.6780	-0.73	0.467
Alcohol	2.2597	1.21	0.226
Smoking	3.4949	1.40	0.137
Family History	-1.7554	-1.20	0.229
Salt	-0.9049	-0.91	0.361
Physical activity	3.5645	3.36	0.001*
Functional Support	-1.0888	-0.95	0.342
Self-Perceived Knowledge	-0.6263	-2.99	0.003*
_cons	143.2674	24.82	0.000*
sigma_u	14.3498		
sigma_e	13.3938		
Rho	.5344 (fraction of variance due to u_i)		

*p<0.05 considered significant in GLS Random Effects

The DBP model has a Wald chi2 of 37.24 (p value = 0.0004), indicating that the model significantly improves the ability to predict the DBP of hypertensive patients. The results also indicate that the intervention does not significantly predict the DBP (p = 0.618), with an estimated direct effect of 0.4159. Age (p = 0.000) significantly predicts DBP, lowering the value by -0.15932 per year with a constant of 96.8344 (p = 0.000). The sigma u, or error due to differences between units (individuals), is 7.101235, while the sigma e, or error due to differences within units, is also 7.101235. 7.840028, and the proportion of variance due to unit effects (rho) is.45067412, as shown in Table 19, Appendix R, and Appendix S.

The created model is DBP = 98.5268 + 0.3171(Intervention) - 2.011(MPR) - 0.1576(Age) + 1.4031(Sex_Male) + 0.0154(BMI) + 0.1514(Financial Health Risk) + 1.5215(Alcohol) – 0.4935(Smoking) - 0.5368(Family History) + 0.2825(Salt) - 0.6196(Physical activity) - 0.3017(Functional Support) -0.2647(Self-Perceived Knowledge) see Appendix R and Appendix S

Table 19: Summary of Panel Data Analysis for Diastolic Blood Pressure

DBP	Coef.	z	P>|z|
Intervention	.3171	0.38	0.702
MPR	-2.011	-1.37	0.169
Age	-.1576	-4.25	0.000*
Sex (Male)	1.4031	1.61	0.108
BMI	0.0154	0.47	0.641
FHRHigh100	0.1514	0.12	0.903
Alcohol	1.5215	1.45	0.147
Smoking	-0.4935	-0.39	0.697
Family History	-0.5368	-0.65	0.515
Salt	0.2825	0.50	0.615
Physical activity	-.6196	-1.04	0.297
Functional Support	-.3017	-0.47	0.640

DBP	Coef.	z	P>|z|
Self-Perceived Knowledge	-.2647	-2.22	0.026
_cons	98.5268	31.73	0.000
sigma_u	7.0338		
sigma_e	7.8419		
Rho	0.4458 (fraction of variance due to u_i)		

*p<0.05 considered significant in GLS Random Effects

In addition, a random effects logistic regression was used to calculate the odds ratio of controlled hypertension when intervention is introduced. The blood pressure control model has a Wald chi2 of 56.09 (p value = 0.000), indicating that it significantly improves the ability to predict hypertensive patients' blood pressure control. According to the findings, intervention does not significantly predict the odds of having controlled hypertension (p = 0.174). Medication adherence (p = 0.000) has been found to significantly predict it, implying that one patient who is medication adherent has increased the odds of having controlled hypertension by 2.53 (153.29%) at a constant of 1.36 (p = 0.810). Another factor is BMI (p = 0.016), which reduces the likelihood of hypertension control by 6.06 percent (OR = 0.939) for each unit increase in BMI. Self-Perceived Knowledge, on the other hand, increases the likelihood of controlled hypertension by 20.76 percent (OR = 1.2076) (p = 0.000). The variance log is 1.76, the standard deviation is 2.41, and rho is 0.64, indicating that the panel-level variance component accounts for 0.64 percent of the total variance. The Likelihood-ratio test result indicates that including the predictor variables significantly improved the model, as shown in Table 20, Appendix R, and Appendix S.

Table 20: Summary of Logistic Regression Panel Data Analysis for Controlled Blood Pressure

Controlled Hypertension	OR	z	P>|z|
Intervention	.6694416	-1.36	0.174
Medication Adherent	2.532933	4.89	0.000*

Controlled Hypertension	OR	z	P>|z|
Age	.9981974	-0.14	0.892
Sex Male	.6144109	-1.57	0.116
BMI	.9399201	-2.40	0.016*
FHRHigh100	1.259467	0.51	0.608
Alcohol	.8251853	-0.50	0.617
Smoking	.5223923	-1.42	0.157
Family History	.6700768	-1.34	0.179
Salt	.9485555	-0.27	0.790
Physical activity	.7883364	-1.12	0.262
Functional Support	.8724095	-0.60	0.546
Self-Perceived Knowledge	1.207647	4.32	0.000*
_cons	1.363759	0.24	0.810
/lnsig2u	1.758533		
sigma_u	2.409132		
Rho	.6382289		

*p<0.05 considered significant in Logistic Random Effects

A correlation between the outcome variables was performed on Table 21 to validate whether MPR and Self-Perceived Knowledge are a partial mediator for intervention and blood pressure. According to the findings, MPR has a weak negative correlation with SBP and DBP. Self-perceived knowledge, on the other hand, has a weak negative correlation with SBP and DBP and a weak positive correlation with MPR. Because both factors are potential confounders, they must be controlled in order to remove bias.

Table 21: Correlation of Outcome variables

	SBP	DBP	MPR	Self-Perceived Knowledge
SBP	1.000			
DBP	0.4746	1.000		
MPR	-0.0671	-0.0480	1.000	
Self-Perceived	-0.0832	-0.0872	0.0085	1.000

Knowledge				

CHAPTER V

DISCUSSION

CHARACTERISTICS OF FILIPINO HYPERTENSIVE PATIENTS

According to the study, the mean SBP of the 417 Filipino sampled population is 140.79±20.36 and a DBP of 88.19±11.74, which is consistent with the WHO definition of diagnosed and uncontrolled blood pressure. (110, 111). The mean MPR is at 0.70 ± 0.18 which means that on the average at baseline patient are not medication adherent (42, 43). However, the majority of patients (84.10%) believed they were medication adherent, emphasizing the importance of objective measurement of medication adherence via MPR. Overall, the majority of the patients had uncontrolled hypertension and were not taking their medication as prescribed, which is consistent with a 2013 national survey.(9)

The age of the patients is one possible factor. The mean age of the patients in the study was 57.36 ±11.11 years; previous research has shown that people over the age of 65 are more likely to develop hypertension, and younger Filipino hypertensive individuals (40 years of age or younger) appeared to have lower adherence rates than older hypertensive individuals. (3, 23-27). Another possible factor is BMI, which in the study has a mean of 26.05±4.94. Overweight and/or obese patients have a BMI of 25 kg/m2 or higher, which is a known risk factor for hypertension.(30)

In the latest data on the prevalence of hypertension, the result is 28%, which is equal for males and females.(112) However, there were more females in the sampled population (68.36 percent) than males (31.64 percent), because the study was enrolled on a weekday through the monthly PhilPEN meeting, and more men work at this time in the Philippines, which may have influenced enrollment in the study. This is also reflected in the sampled participants' employment status, with 50.60 percent retired or unemployed. It should be noted that enrollment and data collection took place during the COVID 19 pandemic, when the Philippines' unemployment rate reached 17.7 percent in the second quarter of 2020.(113)

The majority of participants have the highest educational attainment in upper secondary education (Senior High School, NC I and NC II) at 25.42 percent, while 73.86 percent are considered poor based on the Philippines Statistics Authority's monthly family income indicative scale (family of 5) in the Philippines for the year 2017.(32) This means that 91.06 percent of the population is at high financial risk. This demographic is to be expected given that all participants are part of the PhilPEN program, a national initiative that prioritizes cost-effective approaches in resource-limited settings.(17) According to studies in Filipino hypertensive patients, higher educational attainment and having a job improved adherence, making it a potential confounder. (27)(35)

In terms of risk factors that may affect hypertension, the majority of patients stated that they had not consumed alcohol, smoked, consumed salty foods, or sedentary in the previous 7 days. The majority have a family history of hypertension and have received functional support. The findings suggest that patients have all of the WHO-listed risk factors for hypertension, with the exception of tobacco and alcohol consumption, which is plausible given that these are modifiable risk factors.(3)

In terms of medication, the majority of patients were given Losartan and Amlodipine, which is to be expected given that these are the covered antihypertensive drugs under the ComPack medicine access program for low-income families. (42) It is worth noting that only 2.16 percent of the population uses 50mg Metoprolol, indicating a low utilization rate. Other medications are taken by 13.19% of the study population in addition to the ComPack medications. As a result, the Philippine government should reconsider including Metoprolol in the access program and consider other medications with a higher utilization rate in the community.

The mean score for the patient's perceived knowledge of hypertension and medication is 6.50±2.46 out of 9 points. The majority of patients thought that the topics that were unclear were possible side effects of the medications (50.84%). This

is to be expected given that PhilPEN has a free medicine component but no standardized pharmacist-led patient education program.(17)

EFFECT OF THE PHARMACIST LED EXPERT SYSTEM INTERVENTION

To determine the effect of the pharmacist-led expert system intervention on medication adherence and blood pressure control in patients, 417 patients were randomly assigned to one of two groups: 203 in the control group and 214 in the intervention group. Levene's test for equality variance in all outcome variables reveals that both groups have the same variance, which is consistent with randomization. This also means that no assumptions for parametric tests were violated, indicating that the statistical analysis used in the study was appropriate. This also means that there were no assumptions violated for parametric tests, indicating that the statistical analysis used in the study was appropriate. At baseline, there was no significant difference between the two groups in all factors except two: sex ($p = 0.025$), where more females were assigned to the control group and more males were assigned to the intervention group; and DBP ($p = 0.0015$), where the mean DBP of the control group was 90.07 ± 12.20 compared to only 86.41 ± 11.20 of the intervention group. Despite the best efforts to prevent it through randomization, the significant difference occurred at baseline. The researcher addressed this by using random effects panel data analysis to account for the impact of confounding factors. In both MPR and Medication Adherence, a significant difference is observed after the introduction of the intervention at Time 1, 3, and 6, all at p values 0.000 in favor of the intervention group, as shown in Figures 15 and 16. These findings are consistent with repeated measures ANOVA and Pearson chi2 tests for all time points, which emphasizes the sustained improvement in medication adherence across time points.

A random effects GLS panel data analysis was performed to validate the findings and remove biases. The findings indicate that the intervention, a pharmacist-led expert system, improves MPR by 0.1141 ($p = 0.000$) with a constant of 0.6367 ($p = 0.000$). Self-Perceived Knowledge about Hypertension and Medication ($p = 0.044$) is another factor that significantly predicts MPR from the model, with each point increase

resulting in an increase of MPR by 0.0033. These findings are consistent with the random effects logistic regression results, which were also used to calculate the odds ratio of medication adherence (MPR > 0.8). Patients who received the intervention were 430.40 percent (OR = 5.30, p = 0.000) more likely to be adherent than those who did not. This statistically proves the effect of the Pharmalasakit expert system intervention on medication adherence. This is due to the fact that the intervention specifically targets both intentional and unintentional noncompliance in improving the patient's knowledge. Previous research has found that patients' beliefs and ideas about medicines and how to use them have an impact on treatment adherence. (56)

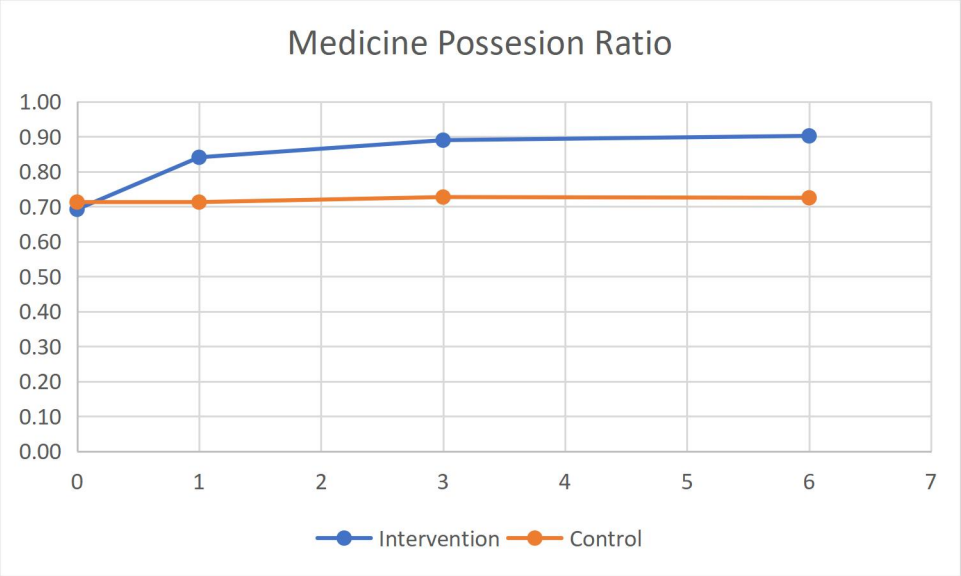


Figure 15: Comparison of Medicine Possession ratio between groups across time

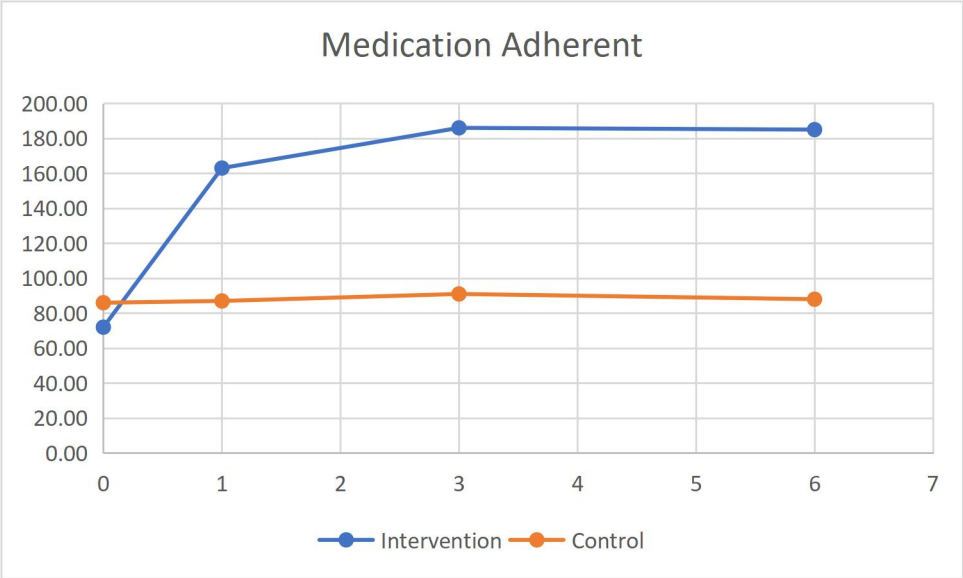


Figure 16: Comparison of Medication Adherence between groups across time

For blood pressure, the intervention has no statistically significant direct effect on SBP (p = 0.911), DBP (p = 0.618) and likelihood of control of hypertension (p = 0.174). For the SBP model, the statistically significant predictors are MPR (p = 0.001), which lowers the SBP by -8.6600 per one unit of MPR with a constant of 143.2674 (p = 0.000) and self-perceived knowledge score, which decreases the SBP by 0.7566 per one point increase in score (p = 0.003). Using a random effects logistic regression to determine the likelihood of controlled hypertension, the factors that are found to significantly predict it are medication adherence, which has increased the odds of having controlled hypertension by 2.53 (153.29%) and self-perceived knowledge, which increases the likelihood of controlled hypertension by 20.76% (OR = 1.2076) (p = 0.000). It should be noted that the intervention affects these two factors in the findings above. Simply put, the intervention has an indirect effect on hypertension control, as shown in Figure 17. This is consistent with the findings of the correlation test, which revealed that MPR and Self-Perceived Knowledge are partial mediators of intervention and blood pressure. Simply put, one cannot decrease blood pressure by using the expert system alone. There should be a significant improvement in the medication adherence, knowledge of the patients, and BMI through lifestyle change in order to observe a significant impact.

The likelihood of control of blood pressure is also significantly affected by another factor: BMI (p = 0.016), where for every one unit increase in BMI, the likelihood that hypertension is controlled decreases by 6.06% (OR = 0.9394). This relationship between BMI and hypertension is consistent with the findings of WHO.(3)

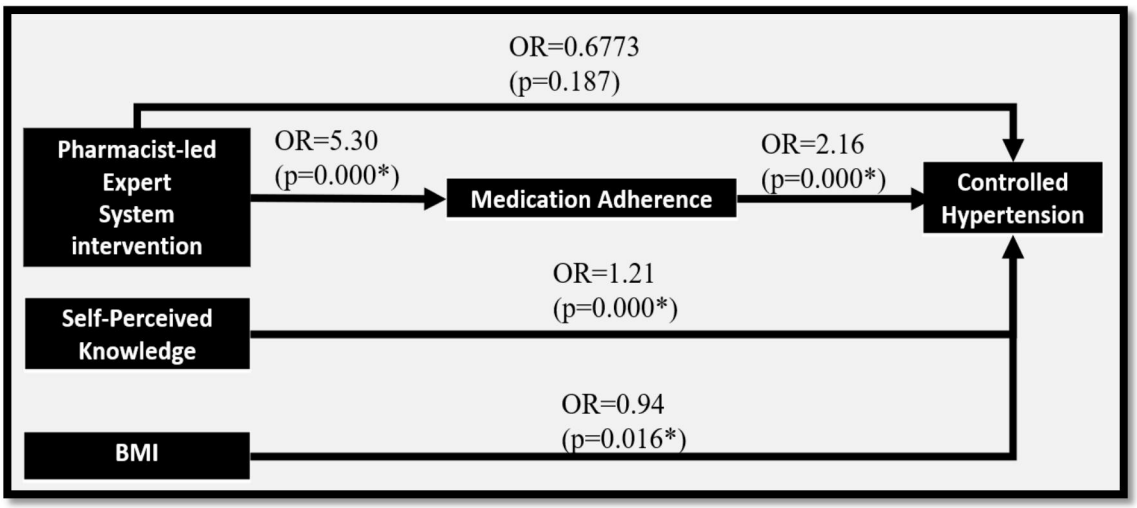


Figure 17: Diagram showing the relationship of the variables

The other factor that significantly increased the SBP is patients engaged in physical activity (p = 0.001) which increases the SBP by 4.0015. This finding is not consistent with the findings of Arroll and Beaglehole (114) where they determined that blood pressure was reduced by physical activity in both hypertensive and normotensive persons.

For the DBP model, the factor that significantly predicts DBP is age (p = 0.000), which lowers the value by -0.15932 per year with a constant of 96.8344 (p = 0.000). The findings of the study are consistent with the risk factors for hypertension as listed by the WHO except for age.(3)

CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Three objectives of the study include to describe the baseline characteristics of the participants in terms of their sociodemographic and clinical characteristics, to create an expert system intervention for hypertensive patients that addresses both intentional and unintentional adherence, and to determine whether and to what extent the expert system intervention improves medication adherence and blood pressure control in patients when confounders are controlled. To answer to the study objectives, Expert system has been created and RCT has been conducted with 417 patients recruited to participate in the study. The study completed with 206 patients in the intervention and 195 in the control groups.

According to the findings of the study, the majority of the patients have uncontrolled hypertension and are not taking their medications as prescribed. The socio-demographic characteristics are consistent with the PhilPEN program's target population, which is poor, unemployed, and with an upper secondary education as the highest educational attainment. The WHO list of risk factors for hypertension includes being older, overweight or obese, having a family history of hypertension, and receiving functional support. The exemption, however, is for the use of tobacco, alcohol, and physical activity. The level of self-perceived adherence and knowledge is high, emphasizing the importance of objective measures. The majority of patients were confused about the potential side effects of the medications at baseline. The Philippine government should reconsider Metoprolol in the access program because the findings of this study suggest that it has a low utilization rate in the community. The study found that a pharmacist-led expert system intervention significantly improved patients' medication adherence and self-perceived knowledge of hypertension and medication that was sustained from month 1 to month 6. However, the direct effect of the intervention on blood pressure was not statistically significant. It should be noted, however, that in the Likelihood of Control of Blood Pressure,

Medication Adherence and Self-Perceived Knowledge are both statistically significant predictors. Therefore, the intervention may have indirectly affected the blood pressure through these two factors. Simply put, one cannot decrease blood pressure by using the expert system alone. There should be a significant improvement in the medication adherence, knowledge of the patients, and BMI through lifestyle change in order to observe a significant impact.

The other factors that significantly predict blood pressure are physical activity, which increases the SBP, and age, which lowers the DBP. For the likelihood of control of blood pressure, another factor that showed a significant effect is BMI. The result shows that in order to improve blood pressure, patients must have a lower BMI and more physical activity.

LIMITATIONS OF THE STUDY

The empirical results presented here should be viewed with some caution due to some limitations. In terms of methodological limitations, it should be noted that the data was collected during the COVID-19 Pandemic, which lasted from 2020 to 2022. As a result, only a few local government units permitted the study to be conducted in their area. The inability to gain access to a demographic group (for example, senior citizens are not permitted to go out to data collection areas) and/or the geographic scope of participants may have resulted in sample bias. Patients in both the intervention and control groups are members of the same hypertension club, and information diffusion is possible because blinding was not possible. Despite our request, patients in the intervention group may have shared their information sheet with patients in the control group. Even with the use of standardized methods, blood pressure is a highly variable parameter for which collection at four separate time points may not be sufficient to accurately capture the actual status of the patient.

The model's effect estimates are based on interventional and prospective observational studies using subjective measures. As a result, models are vulnerable

to biases and confounding that may have influenced the estimates. Furthermore, the study design restricted factors such as patient medicine access, comorbidities, type of medication, access to the internet, smart phone, and technology literacy. Because of the study's design, our baseline scenario is an ideal setting in which patients have access to a consistent supply of medication, internet access, smart phones, and adequate information technology literacy. This may not be the case for large-scale population implementation and in other geographic areas of the Philippines, particularly in rural areas. As a result, if not provided by the government or another funding source, these could be potential barriers to nationwide implementation.

RECOMMENDATIONS FOR FUTURE RESEARCH

For future researchers, to ensure fair distribution across research arms, the authors recommend that future researchers stratify the population based on gender and blood pressure. They may also employ objective measures of knowledge and other risk factors in order to reduce bias and improve the models. Because blood pressure is a highly variable parameter, it may be recommended that it be monitored on a daily basis to account for fluctuations. If possible, repeat the study with larger population and in a normal circumstance (not in a pandemic). To avoid information diffusion, it is recommended that they sample the intervention and control groups from different barangays. A pilot study of the system in a larger population may also provide an opportunity to measure and study pharmacists' willingness to adopt the system in actual practice.

POLICY RECOMMENDATIONS

Clinicians and pharmacists, according to the findings, should screen for blood pressure-related factors such as medication adherence, self-perceived knowledge, age, BMI, and physical activity and adjust counseling techniques accordingly. The use of a pharmacist-led expert system was determined to be an effective option for improving medication adherence and patient knowledge in the Philippines.

The government should consider reviewing its policy to include a standardized patient education component, such as this system, to improve the implementation. Among other things, the government may decide to adopt and scale up the Pharmalasakit Expert System. They can then conduct budget analysis and health-care system acceptance studies.

APPENDICES

Appendix A: Socio-demographic characteristics and risk factors questionnaire

Filled up by the Research Assistant

1. Patient Code number: _____
2. Date (month/date/year): _____
3. Data collection time point: □ Baseline □ Month 1 □ Month 3 □ Month 6

Measured by the Research Assistant

1. Height (in cm): _____
2. Weight (in Kg): _____
3. Systolic Blood pressure (in mmHG)
   _____ 1st Read (right arm) _____ 2nd Read (left arm) _____ 3rd Read (right arm)
4. Diastolic Blood pressure (in mmHG)
   _____ 1st Read (right arm) _____ 2nd Read (left arm) _____ 3rd Read (right arm)
5. Medication for Hypertension on Hand at Baseline (Day 1):
   _____ tablets
6. Medication for Hypertension on Hand after 30 days (Day 30):
   _____ tablets

Answered by the Patient (Recorded by the Research Assistant)

1. Edad (*Age in years*): _____
2. Kasarian (*Biological Sex*):
   □ Lalaki (*Male*)
   □ Babae (*Female*)
3. Pinakamataas na natapos sa paaralan (*Highest Educational Attainment*):
   - □ 0 - Early Childhood Education (Kindergarten)
   - □ 1 - Primary Education (Elementary)
   - □ 2 - Lower Secondary education (Junior High School)
   - □ 3 - Upper Secondary Education (Senior High School, NC I and NC II)
   - □ 4 - Post-secondary non tertiary education (TESDA- NC III)
   - □ 5 - Short-Cycle Tertiary Education (TESDA- NC IV)
   - □ 6 – Bachelor Level Education (Baccalaureate degree)
   - □ 7 – Master Level Education (Post-Baccalaureate degree)
   - □ 8 - Doctoral Level Education (Doctorate and Post Doctorate degree)
4. Kasalukuyang hanap buhay (Current Occupation)
   - □ Managers *(government, organizations, corporations)*
   - □ Professionals *(PRC Board passer of any profession)*
   - □ Technicians and associate professionals *(TESDA Technicians)*
   - □ Clerical support workers (*Office clerks)*

- ☐ Service and sales workers *(Shop and market sales)*
- ☐ Skilled agricultural, forestry and fishery workers *(Farmers, forestry workers and fishermen)*
- ☐ Craft and related trades workers *(Skilled trades and related workers)*
- ☐ Plant and machine operators and assemblers (*Factory worker)*
- ☐ Elementary occupations *(Laborers and domestic workers)*
- ☐ Armed forces occupations *(government special occupations)*
- ☐ Others: _____

5. Karaniwang kinikita ng pamilya sa isang buwan (in Peso) *(Average monthly family income)*:
   - ☐ < PHP 9,520
   - ☐ PHP 9,520 to PHP 19,040
   - ☐ PHP 19,040 to PHP 38,080
   - ☐ PHP 38,080 to PHP 66,640
   - ☐ PHP 66,640 to PHP 114,240
   - ☐ PHP 114,240 to PHP 190,400
   - ☐ > PHP 190,400
6. Karaniwang Gastusin ng pamilya na para sa kalusugan sa isang buwan (in Peso) *(Average monthly medical expenses)*: _____ PHP

Sumagot lamang ng OO or HINDI sa pamamagitan ng pag lagay ng X sa ☐
(Place an X in the ☐ to indicate whether your answer is YES or NO)

OO (YES)	HINDI (NO)	QUESTIONS
Ako ay.. *(I..)*		
☐	☐	Uninom ng alak sa nakaraang pitong araw *(Consumed alcoholic beverage in the last seven days)*
☐	☐	Nanigarilyo sa nakaraang pitong araw (*Smoked tobacco or cigarette in the last seven days)*
☐	☐	May kamaganak or kapamilya na may altapresyon (*Have a family history of hypertension)*
☐	☐	Kumain ng maalat sa nakaraang pitong araw (*Consumed salty food in the last seven days)*
☐	☐	Nag ehersisyo o gumagawa ng pisikal na aktibidad sa loob ng 30 minutes kada araw *(Engage in atleast 30mins of physical activity per day)*
☐	☐	Nakakakuha ng suporta (pinansyal, social, emotional at mental) mula sa pamilya o sa mga kaibigan. *(Get functional support (resources, emotional support, companionship or information) from family and friends)*
☐	☐	Regular na umiinom ng aking gamot pang altapresyon ayon sa sabi ng doctor sa loob ng anim na buwan *(consistently take medication according to doctors instruction in the last 6 months)*
☐	☐	*Nagpplanong umiinom ng aking gamot pang altapresyon ayon sa sabi ng*

		doctor sa susunod na 30 araw. *(intend to take your medicine consistently in the next 30 days according to doctors instruction)*

Appendix B: Outcome Measures summary table

Blood Pressure

Time points	Systolic Blood Pressure (average of 3 reading)	Diastolic Blood Pressure (average of 3 reading)
Baseline		
Month 1		
Month 3		
Month 6		

Medication Possession Ratio

Time points	Medicine Supplied	Medicine on hand	Medicine Possession ratio
Baseline			
Month 1			
Month 3			
Month 6			

Appendix C: Expert system Questionnaire

Filled up by the Data collector

1. Patient Code number: _____
2. Patient name: _____
3. Site of data collection: Barangay _____
4. Date of data collection (month/date/year): _____
5. Data Collection time point: ☐ Baseline ☐ Month 1 ☐ Month 3 ☐ Month 6

Filled up by the Pharmacist (Cross referenced with prescription and/or doctors order)

1. Medication for hypertension: ☐ Amlodipine☐ Losartan ☐ Metoprolol
2. Number of tablet per dosing: ☐ ½ tablet ☐ 1 tablet ☐ 2 tablets ☐ others:_____
3. Dosage strength: ☐ 10mg ☐ 25mg ☐ 50mg ☐ others:_____
4. Frequency of dosing per day: ☐ once per day ☐ twice per day ☐ three times a day ☐ others:_____
5. Other medications (if any): _____

Answered by the Patient (Recorder by the Pharmacist)

1. Patient Email Address: _____
2. Time of Patients First meal: ☐ 5:00AM ☐ 6:00AM ☐ 7:00AM ☐ 8:00AM ☐ others:_____

Place an X in the ☐ to indicate whether your answer is YES or NO

(*Sumagot lamang ng OO or HINDI sa pamamagitan ng pag lagay ng X sa ☐)*

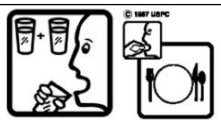
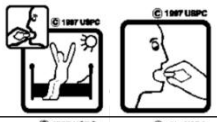
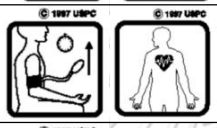
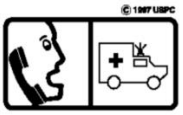
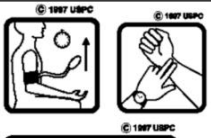
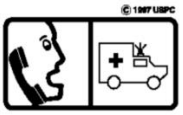
OO (YES)	HINDI (NO)	FILIPINO QUESTIONS
Ako ay.. *(I..)*		
☐	☐	1. regular na umiinom ng aking gamot pang altapresyon ayon sa sabi ng doctor sa loob ng anim na buwan *(consistently take medication according to doctors instruction in the last 6 months)*
☐	☐	*2. nagpplanong umiinom ng aking gamot pang altapresyon ayon sa sabi ng doctor sa susunod na 30 araw.* *(intend to take your medicine consistently in the next 30 days according to doctors instruction)*

Naipaliwanag sa akin ng mabuti.. (*It was clearly explained to me..*)		
☐	☐	3. ang dahilan kung bakit ko kailangan uminom ng gamot. *(the reason why I need to take the medicine)*
☐	☐	4. kung ano ang altapresyon. *(what hypertension means)*
☐	☐	5. kung gaano katagal dapat inumin ang gamot *(how long I need to take this medicine)*
☐	☐	6. ang possibleng side effects ng pag inom ng gamot *(the possible side effects of taking the medication)*
☐	☐	7. kung paano ko malalaman kung may bisa at gumagana ang gamot *(how I should monitor my condition to see if the intervention is working)*
☐	☐	8. ang tamang pamumuhay pag may altapresyon *(the recommended lifestyle for patients with hypertension)*
☐	☐	9. ang mga dapat na pag-ingatan pag may altapresyon *(the important precautions for hypertension)*
☐	☐	10. ano ang dapat gawin kung makalimot ako ng inom ng gamot *(what to do if I miss the dose)*
☐	☐	11. paano ang tamang pagimbak ng gamot *(how to properly store my medication)*

Ibang katanungan sa iyong pharmasyutiko *(Other questions to the pharmacist)*:

_____
_____
_____
_____

Appendix D: Expert system output template

KAALAMAN UKOL SA GAMOT PATIENT INFORMATION SHEET		
		AMLODIPINE 10mg Tablet
PANGALAN	<NAME>	
DOSIS NG GAMOT		Unimon ng <isa (1)> <tablet>, <isa (1)> beses sa isang araw. Sundan ito ng 1-2 baso ng tubig pagkatapos mag almusal.
PARAAN NG PAGINOM NG GAMOT		Inumin sa parehong oras araw-araw sa umaga, <TIME>
PARA SAAN ANG GAMOT		Makakatulong sa pagkontrol ng altapresyon at sakit sa puso (angina)
KAALAMAN UKOL SA SAKIT		Ang altapresyon ay ang pagkakaroon ng mataas na bugso ng dugo sa ugat, ang taong may “High blood” ay may systolic blood pressure na ≥140 mmHg at diastolic blood pressure na ≥90 mmHg matapos kuhanan ng dalawang magkaibang araw.
KAALAMAN UKOL SA TAGAL NG PAG INOM NG GAMOT		Regular na pag-inom ng gamot kahit normal na ang presyon ng dugo. Huwag basta ititigil ang pag-inom nang hindi alam ng inyong doktor.
MAAARING SIDE-EFFECTS	 	Pamamanas, Pagbilis ng tibok ng puso, Pagkahilo at pananakit ng ulo, Hirap sa pagdumi, Pagbaba ng presyon ng dugo. I-report sa doktor kung may iba pang side effects na mararanasan. HINDI PANGKARANIWAN NA SIDE-EFFECTS: Maaaring itigil muna ang pag-inom ng amlodipine at ipaalam sa doktor kung makaranas ng biglaan at sobrang hirap na paghinga at pamamanas ng kamay, paa at mukha.
TAMANG PAG MONITOR NG KARAMDAMAN	 	Regular na i-monitor at i-record ang blood pressure o presyon ng dugo. I-report ito sa sa susunod na check-up. Alamin ang normal na BP para sa inyo mula sa I-tsek ang pulso kada bago iinom ng amlodipine. Maaaring itigil muna ang pag-inom at ipaalam agad sa kung mas mababa ang pulso sa 50 beats kada minute

		Regular na pagpapacheck-up sa inyong doktor.
WASTONG PAMUMUHAY		Pag-iwas sa mamantika at maaalat na pagkain at sawsawan. wastong diet (kagaya ng gulay at prutas). Pagbabawas ng timbang sa tulong ng regular na pageehersisyo. Iwasang uminom ng alak o iba pang depressants. Pagtigil sa paninigarilyo at pag-iwas sa pag-inom ng alak.
IMPORTANTENG BABALA		Iwasan ang biglaang pagpalit ng posisyon upang maiwasan ang pagkahilo dulot ng pagbaba ng presyon. Maaaring maupo o humiga kung biglaang mahilo.
PAALALA UKOL SA NALIMUTANG DOSIS		Huwag doblehin ang dosis sa susunod na pag-inom.
TAMANG PAG IIMBAK NG GAMOT		Itago ang gamot sa lugar na hindi maaarawan o maiinitan ngunit huwag itong ilagay sa loob ng ref o sa basang lugar.

TANDAAN: KUMONSULTA SA DOKTOR O PHARMACIST KUNG MAY KATANUNGAN TUNGKOL SA INYONG GAMOT

MY BLOOD PRESSURE DIARY

Date	Time	Systolic BP	Diastolic BP	Pulse

PHARMACIST NOTES		
STAGE OF MEDICINE ADHERENCE		PRECONTEMPLATION
RECOMMENDED PATIENT COUNSELLING	Somatic and emotional	Use active listening techniques to gather the cause of anxiety of the patient and address them. The key in this stage is the reassurance that the patient is capable of

STRATEGIES		making the necessary changes in the lifestyle.
	Mastery of experience	Demonstrate how to check the pulse and how to use the patient information materials and BP monitoring. demonstrate physical exercise techniques and how to properly intake the medication.
	Vicarious experience	Share an anecdotal story of a model adherent patient with favorable patient outcomes
	Verbal persuasion	Give positive reinforcement to the patient and the primary care takers

Appendix E: Expert system Algorithm

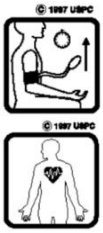
DESIGN RULE

INPUT (Google Sheet)	OUTPUT (TEMPLATE)
COLUMN B	Insert in <Column B> of Box B of Template
COLUMN C	Send a Printable Output in this email
COLUMN D	Dictates which of the Three template to be used Insert in <Column D> of Box EFDG of Template
COLUMN E	Insert in <Column E> of Box EFDG of Template
COLUMN F	Insert in <Column F> of Box EFDG of Template
COLUMN G	Insert in <Column G> of Box EFDG of Template
COLUMN H	Insert in <Column H> of Box H of Template
COLUMN I	Insert in <Column I> of Box I of Template
COLUMN J	Insert Picture in <Column J> of Box J of Template
COLUMN K	IF Column K = NO and Column L = NO then insert "PRECONTEMPLATION STAGE" on <COLUMN KL1> of Box KL1 of Template AND PRINT Box M-V, Ignore the rules for Column M-U, Answer assumed to be all NO IF Column K = NO and Column L = YES then insert "CONTEMPLATION/PREPARATION STAGE" on <COLUMN KL1> of Box KL1 of Template AND DELETE Box KL2 of Template IF Column K = YES and Column L = YES then insert "ACTION/MAINTENANCE STAGE" on <COLUMN KL1> of Box KL1 of Template AND DELETE Box KL2 and KL3 of Template
COLUMN L	
COLUMN M	IF YES, Delete box M of Template
COLUMN N	IF YES, Delete box N of Template
COLUMN O	IF YES, Delete box O of Template
COLUMN P	IF YES, Delete box P of Template
COLUMN Q	IF YES, Delete box Q of Template
COLUMN R	IF YES, Delete box R of Template
COLUMN S	IF YES, Delete box S of Template
COLUMN T	IF YES, Delete box T of Template
COLUMN U	IF YES, Delete box U of Template
COLUMN V	Insert in <Column V> of Box V of Template
COLUMN W	Send a Printable Output in this email

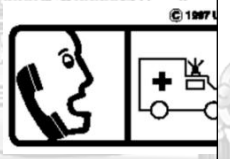
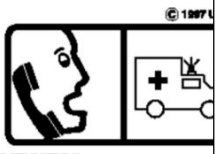
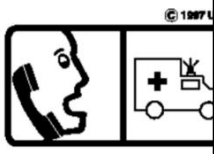
CONTENT TEMPLATE

Theoretical Foundation	Question	Category	AMLODIPINE	LOSARTAN	METOPROLOL
Minimum Patient informati	1. Name of patie	NAME OF PATIENT	<Name>	<Name>	<Name>

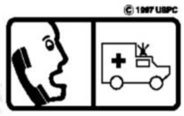
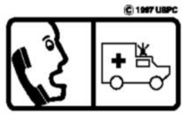
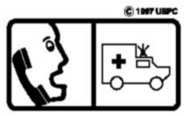
on needed related to medicine use	nt				
	2. Name of medicine	NAME OF MEDICINE	Amlodipine 10 mg Tablet	Losartan 50 mg tablet	Metoprolol 50 mg tablet
	3. Number of tablet per dosing 4. Dosage form 5. Frequency of dosing per day	DOSIS NG GAMOT	Unimon ng <isa (1)> <tablet>, <isa (1)> beses sa isang araw. Sundan ito ng 1-2 baso ng tubig 	Unimon ng <isa (1)> <tablet>, <isa (1)> beses sa isang araw. Sundan ito ng 1-2 baso ng tubig 	Unimon ng <isa (1)> <tablet>, <isa (1)> beses sa isang araw. Sundan ito ng 1-2 baso ng tubig 
	6. Oras ng almusal ng pasyente	PARAAN NG PAGINOM NG GAMOT	Inumin sa parehong oras araw-araw sa umaga, Inumin sa oras pagkatapos mag almusal. <TIME> 	Inumin sa parehong oras araw-araw sa umaga, Inumin sa oras pagkatapos mag almusal <TIME> 	Inumin sa parehong oras araw-araw sa umaga, Inumin sa oras pagkatapos mag almusal <TIME> 
Trans-theoretical Model	7. Do you consistently take medi	STAGE OF MEDICINE ADHERENCE	<STAGE> 1. Active stage (Yes, Yes) – 2. Preparation stage (No,Yes)	<STAGE> 1. Active stage (Yes, Yes) – 2. Preparation stage (No,Yes)	<STAGE> 1. Active stage (Yes, Yes) – 2. Preparation stage (No,Yes)

	cation according to doctors instruction in the last 6 months? 8. Are you going to take your medicine consistently in the next 30 days?		3. Precontemplation (No, No)	3. Precontemplation (No, No)	3. Precontemplation (No, No)
Common sense model Cause domain	9. It was clearly explained to me the reason why I need to take the medicine	**Para saan ang gamot**	Makakatulong sa pagkontrol ng altapresyon at sakit sa puso (angina) 	Makakatulong upang mapabagal ang pagkasira ng kidney ng isang diabetic. Para maiwasan ang stroke sa mga taong may hypertension o sakit sa puso 	Makakatulong sa pagkontrol ng hypertension t sakit sa puso (angina, heart failure, heart attack) 

Common sense model Identity domain	10. It was clearly explained to me what hypertension means	**Kaalaman ukol sa sakit**	Ang altapresyon ay ang pagkakaroon ng mataas na bugso ng dugo sa ugat, ng taong may "High blood" ay may systolic blood pressure na ≥140 mmHg at diastolic blood pressure na ≥90 mmHg matapos kuhanan ng dalawang magkaibang araw. 	Ang altapresyon ay ang pagkakaroon ng mataas na bugso ng dugo sa ugat, ng taong may "High blood" ay may systolic blood pressure na ≥140 mmHg at diastolic blood pressure na ≥90 mmHg matapos kuhanan ng dalawang magkaibang araw. 	Ang altapresyon ay ang pagkakaroon ng mataas na bugso ng dugo sa ugat, ng taong may "High blood" ay may systolic blood pressure na ≥140 mmHg at diastolic blood pressure na ≥90 mmHg matapos kuhanan ng dalawang magkaibang araw. 
Common sense model Timeline domain	11. It was clearly explained to me how long I need to take this medicine	**Kaalaman ukol sa tagal ng pag inom ng gamot**	Regular na pag-inom ng gamot kahit normal na ang presyon ng dugo. Huwag basta ititigil ang pag-inom nang hindi alam ng inyong doktor. 	Regular na pag-inom ng gamot kahit normal na ang presyon ng dugo o mabuti na ang pakiramdam. Huwag basta ititigil ang pag-inom nang hindi alam ng inyong doktor. Maaaring bumuti ang pakiramdam pagkatapos pa ng 3 hanggang 6 na linggo. 	Regular na pag-inom ng gamot kahit normal na ang presyon ng dugo. Huwag basta ititigil ang pag-inom nang hindi alam ng inyong doctor 
Common sense	12. It was clearly	**Maaaring side-**	1. Pamamanas	**1.** Pagbabang	1. Pagbaba ng

model Consequences and Identity domains	explained to me the possible side effects of taking the medication	**effects**	2. Pagbilis ng tibok ng puso 3. Pagkahilo at pananakit ng ulo 4. Hirap sa pagdumi 5. Pagbaba ng presyon ng dugo I-report sa doktor kung may iba pang side effects na mararanasan.  **HINDI PANGKARANIWAN NA SIDE-EFFECTS:** Maaaring itigil muna ang pag-inom ng amlodipine at ipaalam sa doktor kung makaranas ng biglaan at sobrang hirap na paghinga at pamamanas ng kamay, paa at mukha.	presyon ng dugo 2. Pagkahilo 3. Pananakit ng dibdib 4. Pagkapagod 5. Panghihina 6. Pagbaba ng sugar level (sa mga may diabetes) 7. Pagtatae 8. Anemia 9. Pag-ubo (dry cough) I-report sa doktor kung may iba pang side effects na mararanasan.  **HINDI PANGKARANIWAN NA SIDE-EFFECTS:** Maaaring itigil muna ang pag-inom ng losartan at ipaalam sa doktor kung makaranas ng pamamaga ng mukha, labi o dila, hirap na paghinga o paglunok,	presyon ng dugo 2. Pagbagal ng tibok ng puso 3. Pagkahilo at pananakit ng ulo 4. Pagkapagod at depresyon 5. Pangangati at rashes 6. Pagtatae o hirap sa pagdumi 7. Pagkaantok 8. Kawalan ng gana sa pakikipagtalik I-report sa doctor kung may iba pang side effects na mararanasan.  **HINDI PANGKARANIWAN NA SIDE-EFFECTS:**

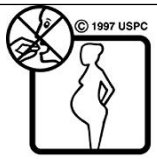
				sobrang pagbaba ang presyon ng dugo, sobrang pagbilis o pagbagal ng tibok ng puso. 	Maaaring itigil muna ang pag-inom ng metorprolol at ipaalam agad sa doktor kung makaranas ng hirap na paghinga, pag-ubo lalo na sa gabi, matinding pagod, o pamamaga ng kamay, paa, mukha, labi o dila. 
Common sense model Identity and Control; identity provides the target for control	13. It was clearly explained to me how I should monitor my condition to see if the intervention is working	**Tamang pag monitor ng karamdaman**	Regular na i-monitor at i-record ang blood pressure o presyon ng dugo. I-report ito sa sa susunod na check-up. Alamin ang normal na BP para sa inyo mula sa  I-tsek ang pulso kada bago iinom ng amlodipine. Maaaring itigil muna ang pag-inom at ipaalam agad sa kung mas mababa ang pulso sa 50	Regular na i-monitor at i-record ang blood pressure o presyon. I-report ito sa doktor sa susunod na check-up. Alamin ang normal na BP para sa inyo mula sa doktor.  Kung may diabetes: regular na i-monitor ang blood sugar, ipaalam sa doktor kung pabago-bago ang resulta. Regular na	Regular na i-monitor at i-record ang blood pressure o presyon ng dugo. I-report ito sa doktor sa susunod na check-up. Alamin ang normal na BP para sa inyo mula sa doktor.  I-tsek ang pulso kada bago iinom ng metoprolol. Maaaring itigil muna ang pag-inom at ipaalam agad sa doktor kung mas mababa ang

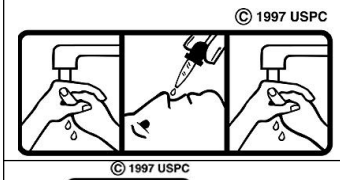
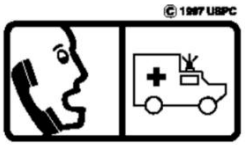
			beats kada minuto  Regular na pagpapacheck-up sa inyong doktor. 	pagpapacheck-up sa inyong doktor. 	pulso sa 50 beats kada minuto.  Kung may diabetes: regular na i-monitor ang blood sugar, ipaalam sa doktor kung pabago-bago ang resulta. Regular na pagpapacheck-up sa inyong doktor. 
Common sense model Control Domain	14. It was clearly explained to me the lifestyle for patients with hypertension	**Wastong Pamumuhay**	Pag-iwas sa mamantika at maaalat na pagkain at sawsawan. wastong diet (kagaya ng gulay at prutas). Pagbabawas ng timbang sa tulong ng regular na pageehersisyo   Iwasang	Pag-iwas sa mamantika at maaalat na pagkain at sawsawan. wastong diet (kagaya ng gulay at prutas). Pagbabawas ng timbang sa tulong ng regular na pageehersisyo   Iwasang	Pag-iwas sa mamantika at maaalat na pagkain at sawsawan. wastong diet (kagaya ng gulay at prutas). Pagbabawas ng timbang sa tulong ng regular na pageehersisyo   Iwasang

			uminom ng alak o iba pang depressants. Pagtigil sa paninigarilyo at pag-iwas sa pag-inom ng alak. 	uminom ng alak o iba pang depressants. Pagtigil sa paninigarilyo at pag-iwas sa pag-inom ng alak. 	uminom ng alak o iba pang depressants. Pagtigil sa paninigarilyo at pag-iwas sa pag-inom ng alak. 
Common sense model Control Domain	15. It was clearly explained to me the important precautions for hypertension	Importanteng babala	Iwasan ang biglaang pagpalit ng posisyon upang maiwasan ang pagkahilo dulot ng pagbaba ng presyon. Maaaring maupo o humiga kung biglaang mahilo. 	Iwasan ang biglaang pagtayo mula sa pagkakaupo o pagkakahiga upang maiwasan ang pagkahilo.  Bawal inumin ang losartan habang buntis. Ipaalam sa doktor kung may balak magbuntis. 	Iwasan ang biglaang pagtayo mula sa pagkakaupo o pagkakahiga upang maiwasan ang pagkahilo. 
Common Sense model Control Domain	16. It was clearly explained to me what to do if I miss the dose	**Paalala ukol sa nalimutang dosis**	huwag doblehin ang dosis sa susunod na pag-inom.	huwag doblehin ang dosis sa susunod na pag-inom.	huwag doblehin ang dosis sa susunod na pag-inom.
Common Sense	17. It was clearly	**Tamang pag**	Itago ang gamot sa lugar na hindi	Itago ang gamot sa lugar na hindi	Itago ang gamot sa lugar na hindi

model Control Domain	explained to me how to properly store my medicatio n	iimbak ng gamot	maaarawan o maiinitan ngunit huwag itong ilagay sa loob ng ref o sa basang lugar. 	maaarawan o maiinitan ngunit huwag itong ilagay sa loob ng ref o sa basang lugar. 	maaarawan o maiinitan ngunit huwag itong ilagay sa loob ng ref o sa basang lugar. 

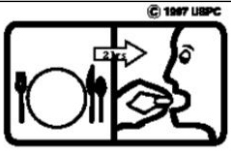
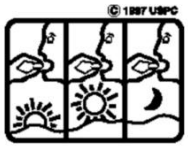
Appendix F: Pictograms that passed the Pilot test

Pictogram ID # and Image	Meaning	Category	Source	Correct Answer (%)	Average Time (secs)
11. 	For headaches	Indication	USP	88.46	2.69
13. 	Do not smoke	Warning	USP	88.46	2.96
14. 	Check your pulse	Etc.	USP	96.15	3.63
20. 	Take 2 times a day	Regimen	USP	92.31	3.60
21. 	Place drops in lower eyelid	Administration	USP	86.54	3.27
27. 	Do not give medicine to babies	Warning	USP	75.00	5.71
33. 	Do not take if pregnant	Pregnancy & Breastfeeding	USP	94.23	3.42
42. 	Do not store medicine where children can get it	Storage	USP	92.31	4.25

Pictogram ID # and Image	Meaning	Category	Source	Correct Answer (%)	Average Time (secs)
50. 	Take at bedtime	Regimen	USP	88.46	3.56
52. 	For headache	Indication	FIP	98.08	2.53
53. 	Wash hands/Place drops in nose/Wash hands again	Administration	USP	88.46	3.92
56. 	Wash hands	Instruction before/after administer	USP	100	2.42
64. 	For headache	Indication	USP	90.38	2.88
65. 	Get emergency help	Etc.	USP	96.15	3.23
89. 	Do not freeze	Storage	USP	90.38	4.02
90. 	Take with meal	Regimen	USP	92.31	4.00
103. 	Drink additional water	Instruction before/after administer	USP	86.54	4.10

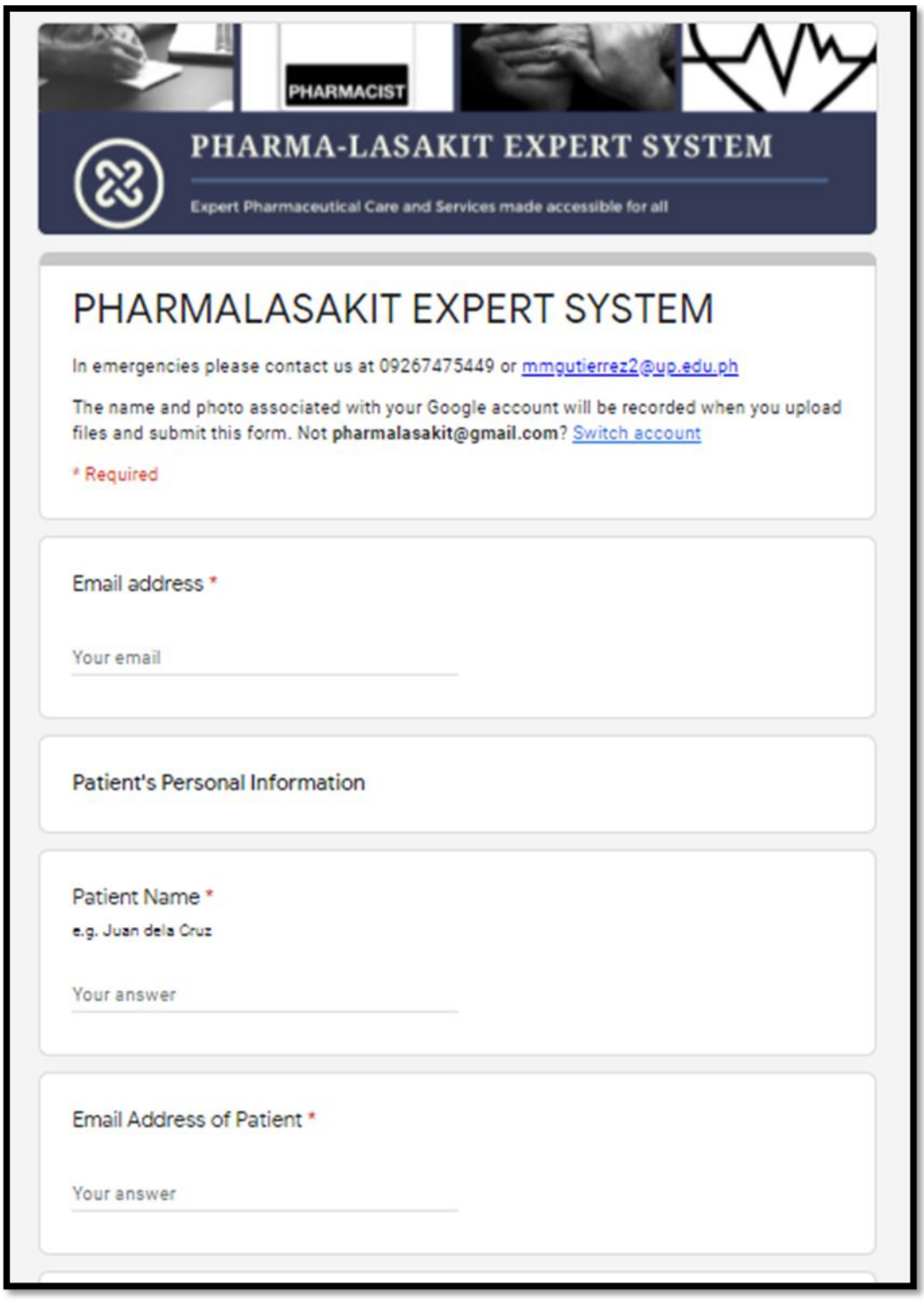
Pictogram ID # and Image	Meaning	Category	Source	Correct Answer (%)	Average Time (secs)
105. 	For injection	Administration	USP	86.54	3.15

Pictograms that may be used but with text (upper quartile)

Pictogram ID # and Image	Meaning	Category	Source	Correct Answer (%)	Average Time (secs)
28. 	Take 2 hours after meals	Regimen	USP	80.77	3.65
34. 	Do not drink alcohol while taking this medicine	Warning	FIP	80.77	3.83
46. 	Poison	Warning	USP	82.69	3.58
57. 	Do not take if breast-feeding	Pregnancy & Breastfeeding	USP	80.77	3.40
73. 	Take 3 times a day	Regimen	USP	84.62	3.63
84. 	Take with milk	Regimen	USP	78.85	4.42
92. 	Do not take if breast-	Pregnancy & Breastfeeding	FIP	82.69	3.73

Pictogram ID # and Image	Meaning	Category	Source	Correct Answer (%)	Average Time (secs)
	feeding				
95. 	Take in the morning	Regimen	USP	78.85	4.17

Appendix G: Expert System Google Form



Medication for Hypertension *

- ◯ Amlodipine
- ◯ Losartan
- ◯ Metoprolol

Number of Tablets per dosing *

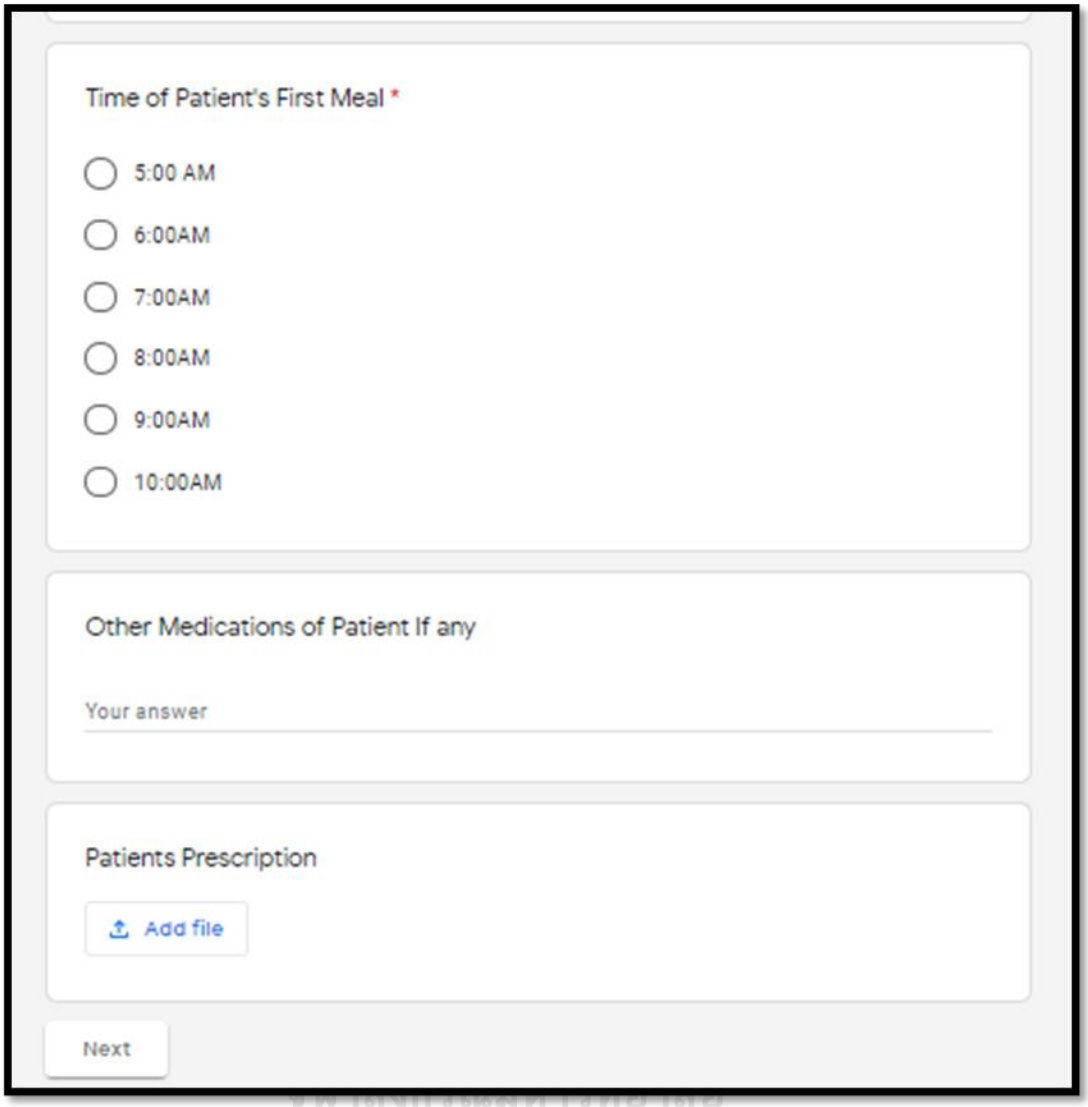
- ◯ 1/2 tablet
- ◯ 1 tablet
- ◯ 2 tablets
- ◯ Other: _____

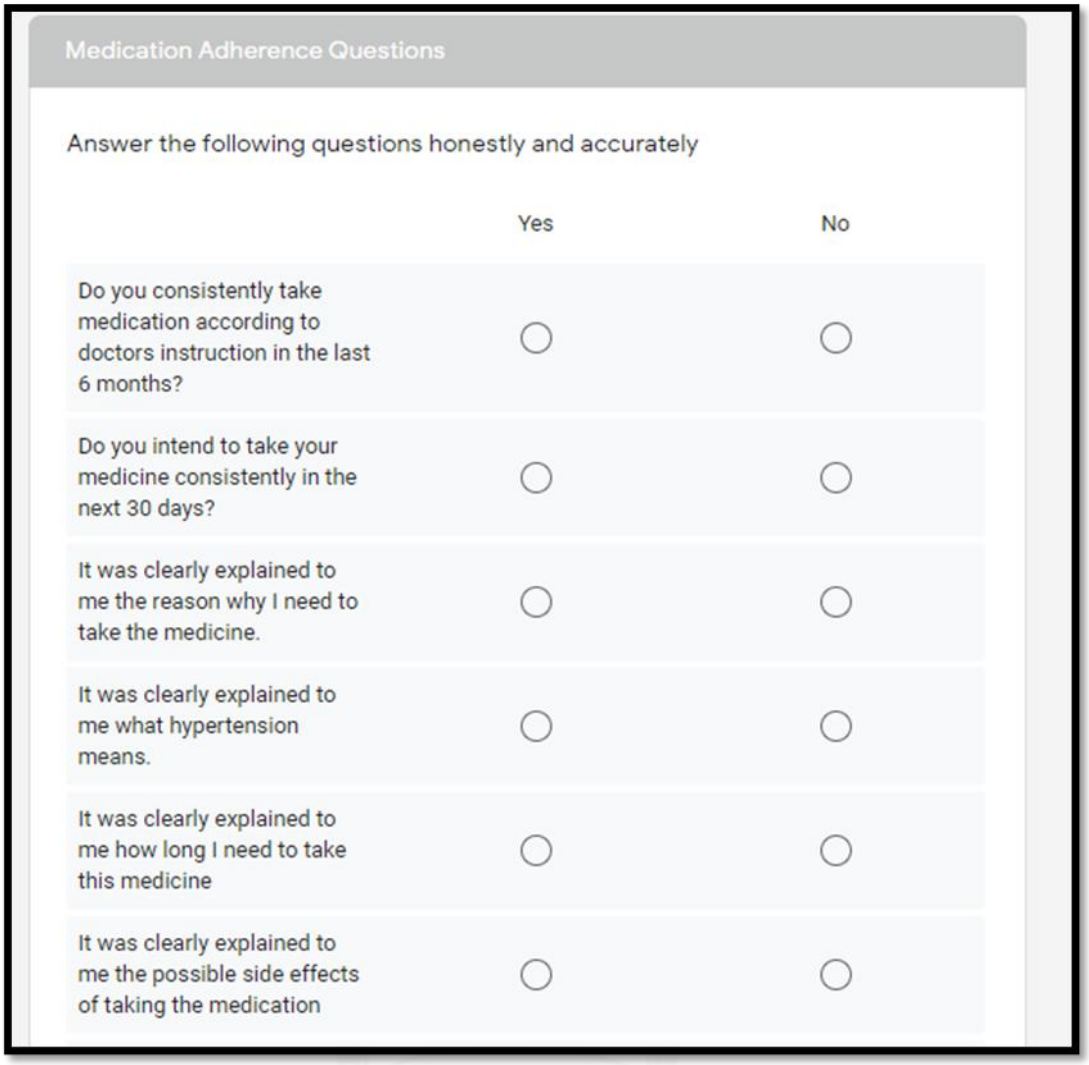
Dosage Strength *

- ◯ 10mg
- ◯ 15mg
- ◯ 50mg
- ◯ Other: _____

Frequency of Dosing *

- ◯ Once a day
- ◯ Twice a day
- ◯ Three times a day

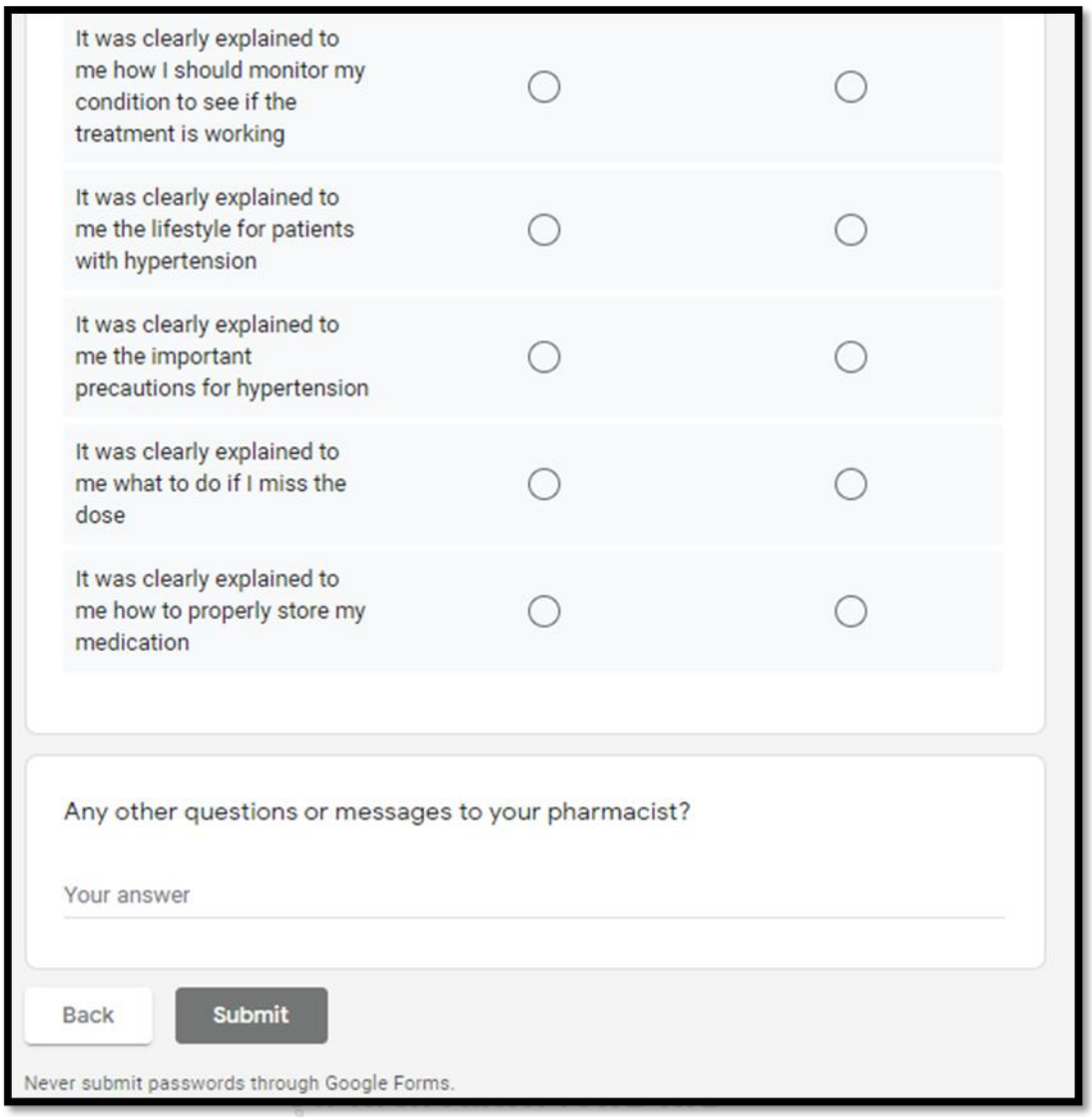




Medication Adherence Questions

Answer the following questions honestly and accurately

	Yes	No
Do you consistently take medication according to doctors instruction in the last 6 months?	○	○
Do you intend to take your medicine consistently in the next 30 days?	○	○
It was clearly explained to me the reason why I need to take the medicine.	○	○
It was clearly explained to me what hypertension means.	○	○
It was clearly explained to me how long I need to take this medicine	○	○
It was clearly explained to me the possible side effects of taking the medication	○	○



It was clearly explained to me how I should monitor my condition to see if the treatment is working	○	○
It was clearly explained to me the lifestyle for patients with hypertension	○	○
It was clearly explained to me the important precautions for hypertension	○	○
It was clearly explained to me what to do if I miss the dose	○	○
It was clearly explained to me how to properly store my medication	○	○

Any other questions or messages to your pharmacist?

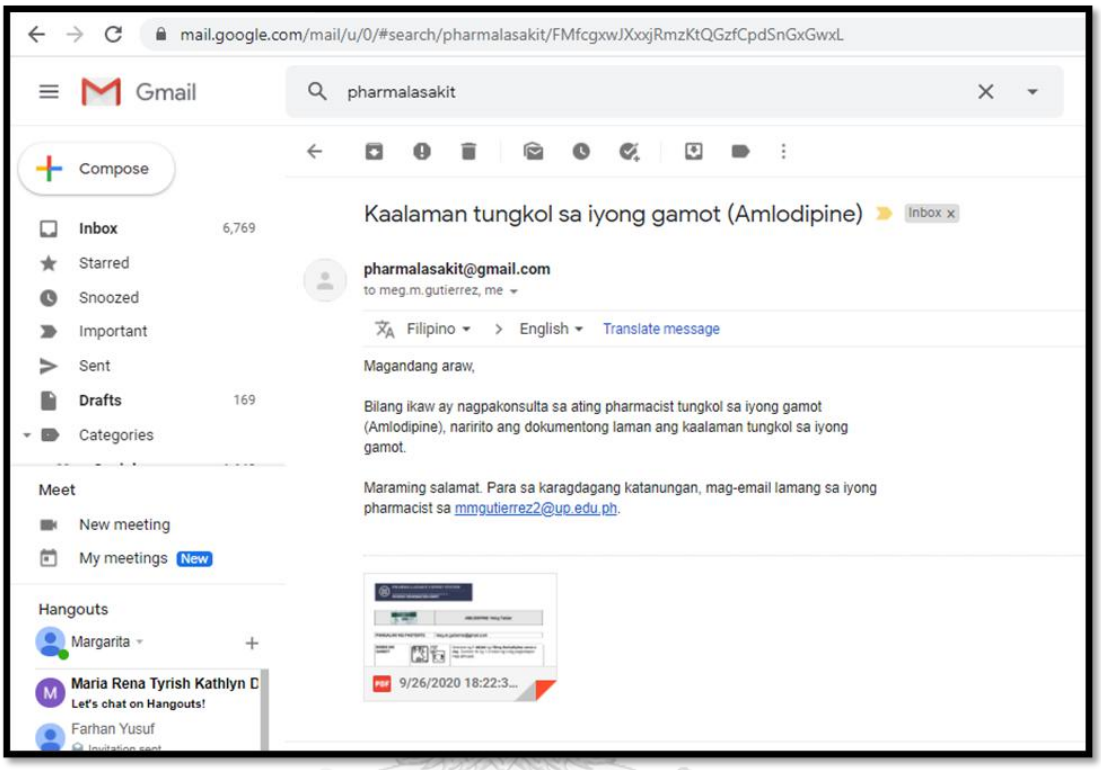
Your answer

Back Submit

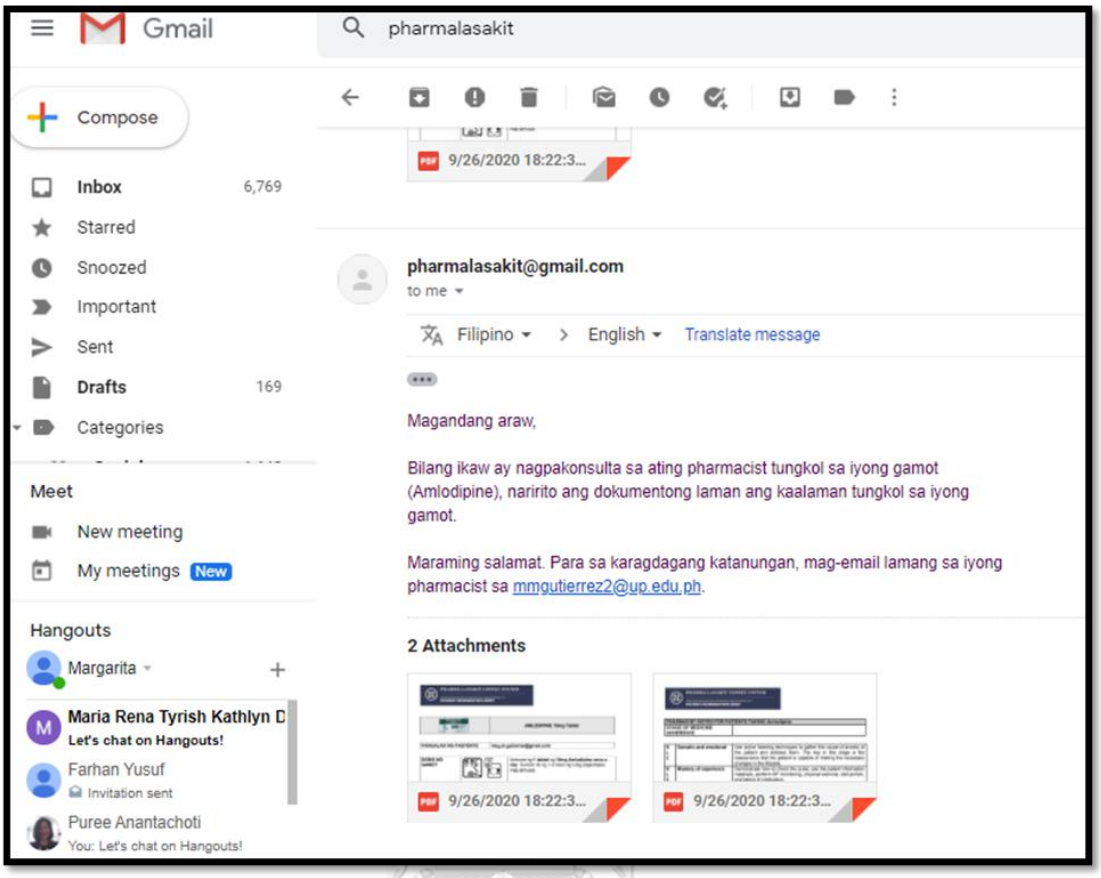
Never submit passwords through Google Forms.

Appendix H: Sample Output in Gmail

For the patient



For the Pharmacist



For the Google Calendar


2:01
October
S M T W T F S
27 28 29 30 1 2 3
clinical hy
two incom
Whats App
Family hol
For westla
A global a
watsons a
start pilot
examine e
mentoring
pay BDO c
Feedback
email Enzi
abigail Old
Seminar
4 5 6 7 8 9 10
pilot test
meta anal
REB requi
mamas in
12noon br
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18 19 20 21 22 23 24
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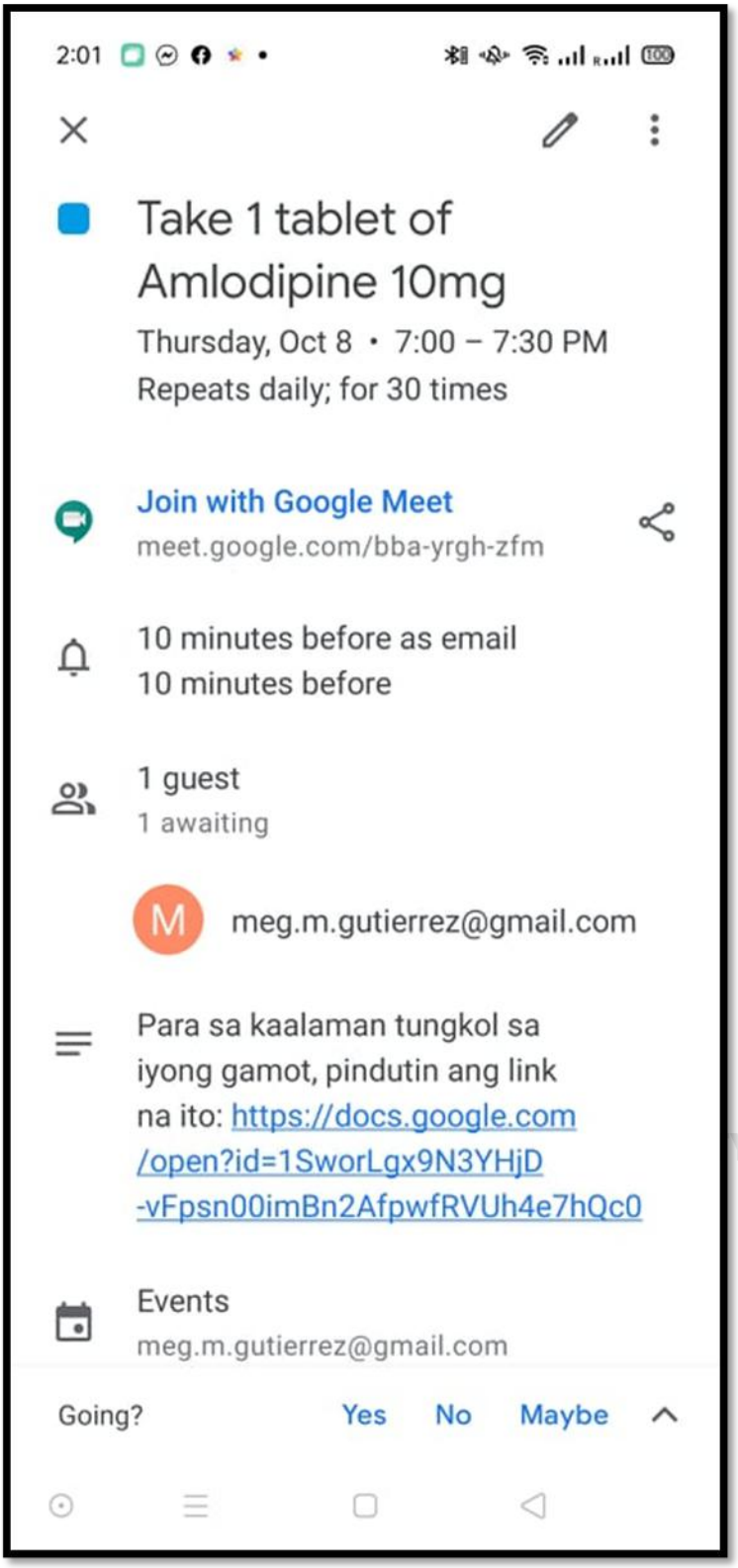
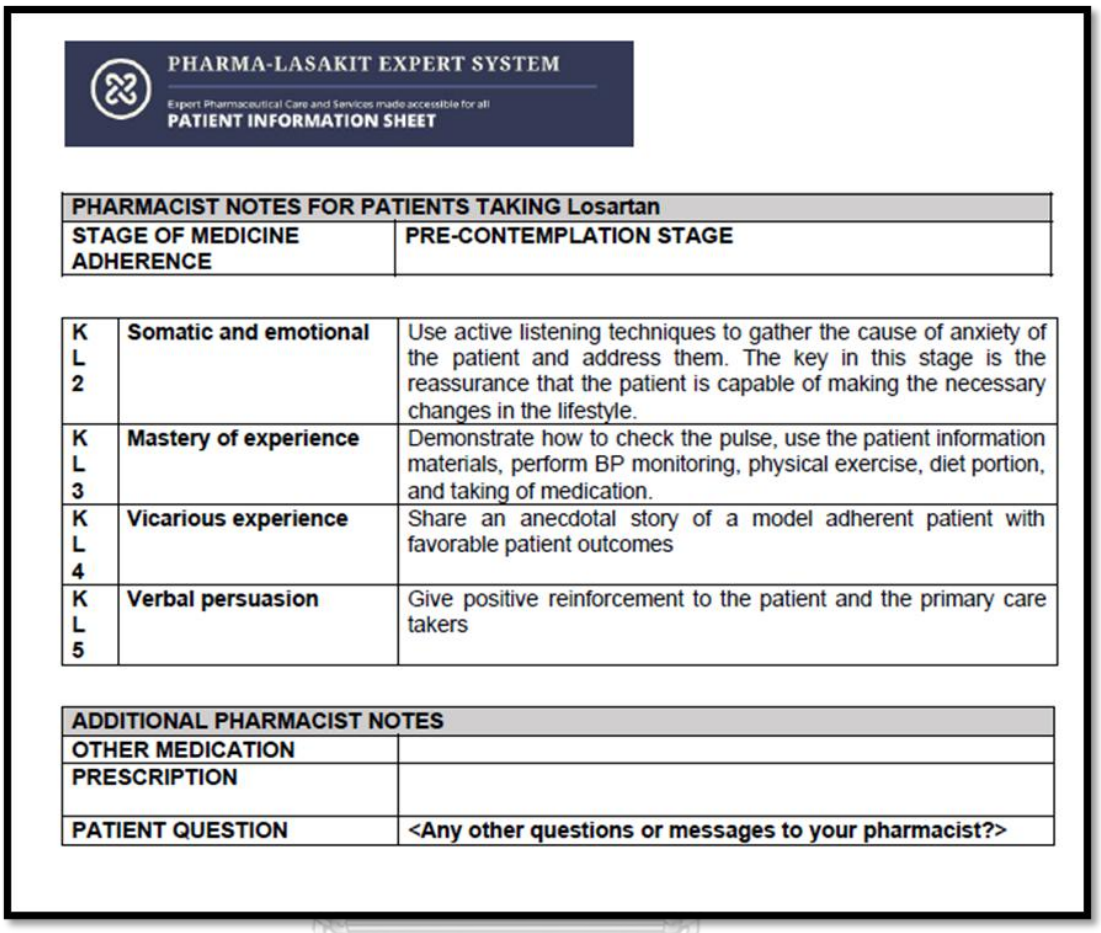

2:01
Take 1 tablet of Amlodipine 10mg
Thursday, Oct 8 • 7:00 – 7:30 PM
Repeats daily; for 30 times
Join with Google Meet
meet.google.com/bba-yrgh-zfm
10 minutes before as email
10 minutes before
1 guest
1 awaiting
M
meg.m.gutierrez@gmail.com
Para sa kaalaman tungkol sa iyong gamot, pindutin ang link na ito: https://docs.google.com/open?id=1SworLgx9N3YHjD-vFpsn00imBn2AfpwfRVUh4e7hQc0
Events
meg.m.gutierrez@gmail.com
Going?
Yes
No
Maybe

Appendix I: Sample Pharmacist Notes



PHARMA-LASAKIT EXPERT SYSTEM

Expert Pharmaceutical Care and Services made accessible for all

PATIENT INFORMATION SHEET

PHARMACIST NOTES FOR PATIENTS TAKING Losartan	
STAGE OF MEDICINE ADHERENCE	**PRE-CONTEMPLATION STAGE**

KL2	**Somatic and emotional**	Use active listening techniques to gather the cause of anxiety of the patient and address them. The key in this stage is the reassurance that the patient is capable of making the necessary changes in the lifestyle.
KL3	**Mastery of experience**	Demonstrate how to check the pulse, use the patient information materials, perform BP monitoring, physical exercise, diet portion, and taking of medication.
KL4	**Vicarious experience**	Share an anecdotal story of a model adherent patient with favorable patient outcomes
KL5	**Verbal persuasion**	Give positive reinforcement to the patient and the primary care takers

ADDITIONAL PHARMACIST NOTES	
OTHER MEDICATION	
PRESCRIPTION	
PATIENT QUESTION	**<Any other questions or messages to your pharmacist?>**

Appendix J: Sample Output Patient Information Sheet

PHARMA-LASAKIT EXPERT SYSTEM

PATIENT INFORMATION SHEET

LOSARTAN 25mg Tablet

PANGALAN NG PASYENTE	**Meg Gutierrez**

DOSIS NG GAMOT		Unimon ng **2 tablets ng 25mg Losartan three times a day**.Sundan ito ng 1-2 baso ng tubig pagkatapos mag almusal.
PARAAN NG PAG-INOM NG GAMOT		Inumin sa parehong oras araw-araw sa umaga, **7:00 AM**
PARA SAAN ANG GAMOT		Makakatulong upang mapabagal ang pagkasira ng kidney ng isang diabetic. Para maiwasan ang stroke sa mga taong may hypertension o sakit sa puso
KAALAMAN UKOL SA SAKIT		Ang altapresyon ay ang pagkakaroon ng mataas na bugso ng dugo sa ugat, ang taong may "High blood" ay may systolic blood pressure na ≥140 mmHg at diastolic blood pressure na ≥90 mmHg matapos kuhanan ng dalawang magkaibang araw.
KAALAMAN UKOL SA TAGAL NG PAG INOM NG GAMOT		Regular na pag-inom ng gamot kahit normal na ang presyon ng dugo. Huwag basta ititigil ang pag-inom nang hindi alam ng inyong doktor. Maaaring bumuti ang pakiramdam pagkatapos pa ng 3 hanggang 6 na linggo.
MAAARING SIDE-EFFECTS		Pagbaba ng presyon ng dugo, Pagkahilo, Pananakit ng dibdib, Pagkapagod, Panghihina, Pagbaba ng sugar level sa may diabetes Pagtatae, Anemia, Pag-ubo (dry cough). I-report sa doktor kung may iba pang side effects na mararanasan.

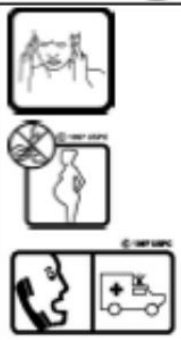
TANDAAN: KUMONSULTA SA DOKTOR O PHARMACIST KUNG MAY KATANUNGAN TUNGKOL SA INYONG GAMOT

Page 1 of 3

PHARMA-LASAKIT EXPERT SYSTEM

Expert Pharmaceutical Care and Services made accessible for all

PATIENT INFORMATION SHEET

TAMANG PAG MONITOR NG KARAMDAMAN		Regular na i-monitor at i-record ang blood pressure o presyon ng dugo. I-report ito sa sa susunod na check-up. Alamin ang normal na BP para sa inyo mula sa Kung may diabetes: regular na i-monitor ang blood sugar, ipaalam sa doktor kung pabago-bago ang resulta. Regular na pagpapacheck-up sa inyong doktor.
WASTONG PAMUMUHAY		Pag-iwas sa mamantika at maaalat na pagkain at sawsawan. wastong diet (kagaya ng gulay at prutas). Pagbabawas ng timbang sa tulong ng regular na pageehersisyo. Iwasang uminom ng alak o iba pang depressants. Pagtigil sa paninigarilyo at pag-iwas sa pag-inom ng alak.
IMPORTANTENG BABALA		Iwasan ang biglaang pagpalit ng posisyon upang maiwasan ang pagkahilo dulot ng pagbaba ng presyon. Maaaring maupo o humiga kung biglaang mahilo. Bawal inumin ang losartan habang buntis. Ipaalam sa doktor kung may balak magbuntis. **HINDI PANGKARANIWAN NA SIDE-EFFECTS:** Maaaring itigil muna ang pag-inom ng losartan at ipaalam sa doktor kung makaranas ng pamamaga ng mukha, labi o dila, hirap na paghinga o paglunok, sobrang pagbaba ang presyon ng dugo, sobrang pagbilis o pagbagal ng tibok ng puso.
PAALALA UKOL SA NALIMUTANG DOSIS		Huwag doblehin ang dosis sa susunod na pag-inom.
TAMANG PAG IIMBAK NG GAMOT		Itago ang gamot sa lugar na hindi maaarawan o maiinitan ngunit huwag itong ilagay sa loob ng ref o sa basang lugar.

TANDAAN: KUMONSULTA SA DOKTOR O PHARMACIST KUNG MAY KATANUNGAN TUNGKOL SA INYONG GAMOT

PHARMA-LASAKIT EXPERT SYSTEM

PATIENT INFORMATION SHEET

	MY BLOOD PRESSURE DIARY				
	Date	Time	Systolic BP	Diastolic BP	Pulse

TANDAAN: KUMONSULTA SA DOKTOR O PHARMACIST KUNG MAY KATANUNGAN TUNGKOL SA INYONG GAMOT

Appendix K: Informed Consent

This informed consent form is for individuals who wish to participate in a research entitled “Effectiveness of a Pharmacist-led Expert System Intervention for Medication Adherence of adults with hypertension in the Philippines: A Randomized Controlled Trial”. Please read the consent form carefully. Before you decide to participate in the research study, you can raise questions. You are free to ask questions before or after taking part in the research.

Introduction of the study

You are invited to participate in the study that aims to: 1.) To describe the characteristics of the Filipino hypertensive patients. 2.) To create an expert system intervention that is designed to address both intentional and non-intentional adherence of hypertensive patients. 3.) To determine if the expert system intervention significantly improve medication adherence and blood pressure control of patients when confounders are controlled, and to what extent. This research will then serve as a basis for recommendation for public health programs and policies to contribute in the decrease of cardiovascular related death in the Philippines.

The researcher will obtain data from 400 adult hypertensive patients, 200 were randomized to the control group and 200 were randomized to the intervention group. The experimental element of the study is the testing of a pharmacist led by an expert method intervention on adherence to your prescription and blood pressure.

Participant’s role

Should you decide to participate in the research study you were asked to answer a baseline survey form and participate in an interview. You may be randomly assigned to control group or intervention group based on a computer generated code.

Patients who will receive the intervention were given a patient counselling session with the pharmacist regarding their medication, a tailored patient information sheet and medicine reminder app through their smart phone. For patients assigned to control group, you were given an option to receive the intervention after the conduct of the research if you wish (after 6 months). No placebo is administered to patients in the control group. Patients in the control group will receive the standard quality of treatment and care from the government's PhilPEN / COMPACK program.

For both groups, the researcher will monitor your Blood pressure, Medication possession ratio (medication adherence), BMI and risk factors for 6 months. Data were collected at baseline, month 1, month 3 and month 6. Your responsibility as a participant to is to give an accurate response to survey questions and follow the standard protocol during objective data collection procedures (measurement of height, weight blood pressure and MPR).

All documents or data collected as a result of your involvement in this study were used exclusively for research purposes and were kept confidential. There are no conceivable

conditions and/or explanations for termination of involvement in the research and no alternative approaches available to the participant.

Possible risk and discomforts

There are no identified physical, psychological, and social risks that may arose during the conduct of the study that is outside the normal risk of being a part of the PhilPEN program. The intervention will serve as just an “add on” to the existing program.

One possible risk you may experience is anxiety when sharing personal or confidential details. We wouldn't want that to happen. You don't have to answer any questions that make you uncomfortable.

If you are assigned in the intervention group, the medication alarm reminder may lead to discomfort or inconvenience as it will give you daily alarm notifications through your smart phone. You may turn off the alarm or change the setting of the reminder at any point during the conduct of the study.

The anticipated expenses related to the intervention is the fees related to the access to the internet or mobile data that is essential to receive the intervention.

Benefits of the study

Patients designated to the intervention group were provided with an expert system that aims to improve adherence to medications and regulation of blood pressure as an enhancement to the government's current drug access program. This will give you tailored information about medication and a daily medication reminder. Patients in the control group will also receive this benefit if they so wish after the conduct of the study (after 6 months of participation). In both groups your Blood pressure, Medication possession ratio (medication adherence), BMI and risk factors were monitored for free.

After completing each survey, you were given 50 PHP (1 USD) per data collection day, to cover your food or transportation expenses. In the duration of the study (4 data collection points) you will receive a total of 200PHP (4 USD). For patients who will decide to discontinue their participation, they will no longer receive the compensation. No compensation shall be granted to the family or dependents of the participant in the event of disability or death resulting from study-related injuries.

For long term benefits, your participation will contribute to a research that will recommend health systems reform and health program recommendation that will give long term advantages for Filipino patients. Post study, all participants will have access to the intervention when proven safe and effective for free. In the future the result of the study may lead to development of medication adherence related mobile application, the participant will receive benefit in the form of free subscription to the app.

Confidentiality

Your anonymity and confidentiality is guaranteed as the researcher will employ a strict protocol for patient coding. Records identifying you as a participant were kept private

and will not be made accessible to the public, to the degree allowed by law. Your identity will remain secret in the event that the findings of the analysis are released. However, any documents and data collected (not including your name) as a result of your involvement in the study may be reviewed by the applicable government agency or the institutional review board.

The data were stored using a HIPAA-compliant system. HIPAA stands for Health Insurance Portability and Accountability Act (HIPAA) Privacy Rule that ensures the protection of privacy, security, and integrity of protected health information. Only the primary researcher and qualified (registered pharmacist) researcher assistants will have access to the study-related documents. The data were stored for 20 years in an external hard drive that were secured by the principal investigator.

No genetic tests were conducted. Familial genetic information as a result of answering the survey questions were kept confidential. Precautions protocol is in effect to avoid the dissemination of results to immediate family members or others without the permission of the researcher. You have the right to deny potential data use and storage. You or your legally appropriate representative have access to your record and were contacted in a timely manner when information becomes available that may be important to your willingness to continue participating.

Voluntary participation

Your involvement in this research is absolutely voluntary. It's your preference whether to participate or not. Your preference would have no impact on your status in the government's medical access and public health program. If you change your mind about your participation in the study, you can withdraw your initial consent.

Person to contact

If you have any questions or clarifications regarding the study, please feel free to contact the principal investigator Assistant Professor Margarita Gutierrez through the contact number 09267475449 and/or email address: mmgutierrez2@up.edu.ph.

The principal investigator is serving both as an investigator and a health care provider. She is a registered Pharmacist working in the University of the Philippines Manila College of Pharmacy and a PhD student of Chulalongkorn University, Bangkok Thailand. The funding of the research is through grant application from the two academic institutions.

Certificate of consent

I have read the above information or it has been read to me. I had the opportunity to ask questions about it, and any questions I asked were answered to my satisfaction. I freely agree to be a participant in this study for a period of six (6) months and acknowledge that I have the right to withdraw from the discussion / interview / survey / monitoring at any time.

Name of participant (in Print):_____

Signature of participant: _____

Date: _____

The UPMREB Ethics Review **Panel (specify)** has approved the study, and may be reached through the following contact for information regarding rights of study participants, including grievances and complaints:

Name of UPMREB Panel Chair
Address: Room 126, Ground Floor National Institutes of Health
UP Manila 623 Pedro Gil St Ermita 1000 Manila
Email: upmreb@post.upm.edu.ph
Telephone number: +63 2 8526-434

Appendix L: Informed Consent in Filipino

Ang kasulatan na ito na nagpapahiwatig ng pagpayag ay para sa mga indibidwal na nais na lumahok sa isang pananaliksik na pinamagatang "Pagkabisa ng isang Expert system na pinamumunuan ng Parmasyutiko para sa *Medication Adherence* ng Pilipinong may Altapresyon: Isang *Randomized Controlled Trial*". Mangyaring basahin nang mabuti ang kasulatan ng pahintulot. Bago ka magpasya na lumahok sa pagsasaliksik, maaari kang magtanong. Malaya kang humingi ng paliwanag bago o pagkatapos na makilahok sa pagsasaliksik.

Panimula ng pag-aaral

Inaanyayahan kang lumahok sa pag-aaral na naglalayong: 1.) Mailalarawan ang mga katangian ng mga pasyente na may altapresyon sa pilipinas 2.) Lumikha ng expert system para sa tamang pagsunod sa paginom ng gamut at pag kontrol sa presyon ng dugo ng mga pasyente At 3.) Tukuyin kung ang interbensyon ay epektibo upang alalayan ang pagsunod sa gamot at presyon ng dugo ng mga pasyente. Ang pananaliksik na ito ay magsisilbing batayan para sa rekomendasyon para sa mga programang pangkalusugan sa publiko at mga patakaran upang magbigay ng kontribusyon sa pagbawas ng pagkamatay na kaugnay sa altapresyon at sakit sa puso sa Pilipinas.

kukuha ang mananaliksik ng data mula sa 400 mga pasyenteng may hypertensive na nasa hustong gulang, 200 ay mai-randomize sa control group at 200 ay i-randomize sa interbensyon na pangkat. Ang pang-eksperimentong elemento ng pag-aaral ay ang pagsubok ng isang expert system na pinamumunuan ng parmasyutiko bilang interbensyon sa pagpapabuti ng pagsunod ng pasyente sa kanyang nairesetang gamot at presyon ng dugo.

Papel ng kalahok

Kung magpapasya kang lumahok sa pag-aaral ng pananaliksik ay hihilingin sa iyo na sagutin ang isang kasulatan bilang pangunang survey sa pamamagitan ng pakikipag panayam. Maaari kang italaga sa pangkat ng kontrol or interbensyon batay sa isang nabuong code ng computer.

Ang mga pasyente na makakatanggap ng interbensyon ay bibigyan ng sesyon ng pagpapayo ng parmasyutiko tungkol sa kanilang gamot, isang pinasadya na lathala ng impormasyon ukol sa gamot at paalala sa pag inom ng gamot sa pamamagitan ng app sa smart phone.

Para sa mga pasyente na nakatalaga sa kontrol na pangkat, sila ay mabibigyan din ng interbensyon pagkatapos ng pagsasagawa ng pananaliksik kung iyong nais (pagkatapos ng 6 na buwan). Walang placebo na ibinibigay sa mga pasyente sa control group. Ang mga pasyente sa control group ay makakatanggap ng karaniwang kalidad ng paggamot at pangangalaga mula sa programa ng PhilPEN / COMPACK ng gobyerno.

Para sa parehong grupo, susubaybayan ng mananaliksik ang iyong presyon ng Dugo, ratio ng pagmamay-ari ng gamot (pagsunod sa gamot), BMI at mga Risk factor sa loob ng 6 na buwan. Ang data ay kokolektahin sa baseline, buwan 1, buwan 3 at buwan 6. Ang iyong responsibilidad bilang isang kalahok ay upang magbigay ng isang makatotohanang tugon sa

mga katanungan sa survey at sundin ang pamantayan ng proteksyon. Ang mga pamamaraan ng pagkolekta ng data (pagsukat ng taas, bigat ng presyon ng dugo at ratio ng pagkakaroon ng gamot) ay gagawin ng eksperto.

Ang lahat ng mga dokumento o data na nakolekta bilang isang resulta ng iyong paglahok sa pag-aaral na ito ay gagamitin ng lamang para sa mga layunin ng pananaliksik at pananatilihing kumpidensyal. Walang mga kundisyon upang ikaw ay biglang alisin sa pagsasaliksik at walang mga kahaliling ibang pamamaraan ang magagamit ng mga kalahok.

Posibleng peligro

Walang natukoy na mga peligro sa pisikal, sikolohikal, at panlipunan na maaaring lumitaw sa panahon ng pagsasagawa ng pag-aaral na wala sa normal na peligro na maging bahagi ng programa ng PhilPEN. Ang interbensyon ay magsisilbing isang "add on" lamang sa umiiral na programa.

Ang isang posibleng peligro na maaari mong maranasan ay ang pagkabalisa kapag nagbabahagi ng personal o lihim na mga detalye. Hindi namin gugustuhin na mangyari iyon. Hindi mo kailangang sagutin ang anumang mga katanungan na hindi ka komportable.

Kung ikaw ay nakatalaga sa pangkat ng interbensyon, ang paalala sa alarma ng gamot ay maaaring humantong sa kakulangan sa ginhawa o abala dahil bibigyan ka nito ng mga pang-araw-araw na alarma sa pamamagitan ng iyong smart phone. Maaari mong patayin ang alarma o baguhin ang setting ng paalala sa anumang punto sa panahon ng pagsasagawa ng pag-aaral.

Ang inaasahang gastos na nauugnay sa interbensyon ay ang mga bayarin na nauugnay sa pag-access sa internet o mobile data na mahalaga upang matanggap ang interbensyon.

Mga pakinabang ng pag-aaral

Ang mga pasyente na itinalaga sa pangkat ng interbensyon ay bibigyan ng isang dalubhasang sistema na naglalayong mapabuti ang pagsunod sa mga gamot at control ng presyon ng dugo bilang isang pagpapahusay sa kasalukuyang programa sa pag-access ng medisina ng gobyerno. Bibigyan ka nito ng pinasadyang impormasyon tungkol sa gamot at isang pang-araw-araw na paalala sa gamot. Ang mga pasyente sa control group ay makakatanggap din ng benepisyong ito kung nais nila matapos ang pagsasagawa ng pag-aaral (pagkatapos ng 6 na buwan ng pakikilahok). Sa parehong pangkat ang iyong presyon ng Dugo, Ratio ng pagmamay-ari ng gamot (pagsunod sa gamot), BMI at mga kadahilanan sa peligro ay susubaybayan nang libre.

Matapos makumpleto ang bawat survey, bibigyan ka ng 50 PHP (1 USD) bawat araw ng pagkolekta ng data, upang masakop ang iyong gastos sa pagkain o transportasyon. Sa tagal ng pag-aaral (4 na puntos ng pagkolekta ng data) makakatanggap ka ng isang kabuuang 200PHP (4 USD). Para sa mga pasyente na magpapasya na ihinto ang kanilang pakikilahok, hindi na sila makakatanggap ng bayad. Walang bayad na ibibigay sa pamilya o sa kalahok sa kaganapan ng kapansanan o kamatayan na nagreresulta mula sa mga pinsala na nauugnay sa pag-aaral.

Para sa mga pangmatagalang benepisyo, ang iyong pakikilahok ay mag-aambag sa isang pananaliksik na magrerekomenda ng mga sistema ng reporma sa kalusugan at

rekomendasyon ng programa sa kalusugan na magbibigay ng pangmatagalang benipisyo para sa mga pasyenteng Pilipino. Matapos ang pag-aaral, ang lahat ng mga kalahok ay magkakaroon ng access sa interbensyon kapag napatunayan na ligtas at epektibo nang libre. Sa hinaharap ang resulta ng pag-aaral ay maaaring humantong sa pagbuo ng expert system na mobile application, ang kalahok ay makakatanggap ng benepisyo sa anyo ng libreng subscription sa app kung magkakaroon.

Pagkumpidensyal

Sa iyong pag-lagda, aming ginagarantiya ang kumpidensyal nap ag proseso ng iyong nga tala. Ang mananaliksik ay gagamit ng isang mahigpit na proteksyon para sa pag-coding ng bawat pasyente. Ang mga talaang kinikilala ka bilang isang kalahok ay pananatilihing pribado at hindi gagawing ma-access sa publiko ayon sa nakatakda sa batas. Ang iyong pagkakakilanlan ay mananatiling lihim sa kaganapan na ang mga natuklasan ng pagtatasa ay ilalathala na. Gayunpaman, ang anumang mga dokumento at data na nakolekta (hindi kasama ang iyong pangalan) bilang isang resulta ng iyong paglahok sa pag-aaral ay maaaring suriin ng naaangkop na ahensya ng gobyerno o ng lupon ng pagsusuri ng institusyon.

Itatago ang data gamit ang isang sistemang sumusunod sa HIPAA. Ang HIPAA ay nangangahulugang Health Insurance Portability and Accountability Act (HIPAA) Privacy Rule na tinitiyak ang proteksyon ng privacy, seguridad, at integridad ng protektadong impormasyon sa kalusugan. Ang pangunahing mananaliksik lamang at kwalipikadong (rehistradong parmasyutiko) na mga katulong ng mananaliksik ang magkakaroon ng pag-access sa mga dokumento na nauugnay sa pag-aaral. Ang data ay maiimbak ng 20 taon sa isang hard drive na masisiguro ng punong tagapag-imbestiga na mananatiling nakatago.

Walang isasagawa na mga pagsusuri sa genetiko. Ang impormasyong pampamilya na resulta sa pagsagot sa mga katanungan sa survey ay pananatiling lihim. Ang pag-iingat sa proteksyon ay upang maiwasan ang pagpapakalat ng mga resulta sa mga agarang miyembro ng pamilya o iba pa nang walang pahintulot ng mananaliksik. May karapatan kang tanggihan ang potensyal na paggamit ng data at pag-iimbak. Ikaw o ang iyong naaangkop na representatnte ayon sa batas lamang ang may access sa iyong talaan. Kami ay agarang makikipag-ugnay sa iyo kapag may bagong magagamit na impormasyon na makakatulong sa sa pagpapasya kung dapat ituloy ang pakikilahok.

Boluntaryong pakikilahok

Ang iyong paglahok sa pananaliksik na ito ay ganap na kusang-loob. Ang iyong kagustuhan ay walang epekto sa iyong katayuan sa medikal na pag-access ng gobyerno at programa sa kalusugan ng publiko. Kung binago mo ang iyong isip tungkol sa iyong pakikilahok sa pag-aaral, maaari mong bawiin ang iyong paunang pahintulot.

Taong makikipag-ugnay

Kung mayroon kang anumang mga katanungan o mga paglilinaw hinggil sa pag-aaral, mangyaring huwag mag-atubiling makipag-ugnay sa punong-guro tagapagsiyasat Assistant Professor Margarita Gutierrez sa pamamagitan ng contact number 09267475449 at / o email address: mmgutierrez2@up.edu.ph

Ang punong investigator ay nagsisilbi pareho bilang isang investigator at isang tagapagbigay ng pangangalagang pangkalusugan. Siya ay rehistradong Parmasyutiko na nagtatrabaho sa University of the Philippines Manila College of Pharmacy at isang estudyante

ng PhD ng Chulalongkorn University, Bangkok Thailand. Ang pagpopondo ng pananaliksik ay sa pamamagitan ng aplikasyon ng pagbibigay mula sa dalawang institusyong pang-akademiko.

Sertipiko ng pahintulot

Nabasa ko na ang impormasyon sa itaas o nabasa ito para sa akin. Nagkaroon ako ng pagkakataong magtanong tungkol dito, at ang anumang mga katanungan na tinanong ko ay nasagot ng sapat. Malaya akong sumasang-ayon na maging kalahok sa pag-aaral na ito sa loob ng anim (6) na buwan at kinikilala na may karapatang akong umalis mula sa talakayan / panayam / survey / pagsubaybay sa anumang oras.

Pangalan ng kalahok (sa I-print) :_____

Lagda ng kalahok :_____

Petsa: _____

Inaprubahan ng UPMREB Ethics Review Panel (tukuyin) ang pag-aaral, at maaaring maabot sa pamamagitan ng sumusunod na pakikipag-ugnay para sa impormasyon tungkol sa mga karapatan ng mga kalahok sa pag-aaral, kabilang ang mga hinaing at reklamo:

Pangalan ng UPMREB Panel Chair

Address: Room 126, Ground Floor National Institutes of Health

UP Manila 623 Pedro Gil St Ermita 1000 Manila

Email: upmreb@post.upm.edu.ph

Telephone number: +63 2 8526-434

Appendix M: Curriculum Vitae of Researchers

Curriculum Vitae of

MARGARITA M. GUTIERREZ
Assistant Professor 5
College of Pharmacy, University of the Philippines Manila
Taft Avenue corner Pedro Gil Street, Ermita 1000 Manila

EDUCATION AND LICENSURE

August 2019 to ongoing — PhD in SOCIAL AND ADMINISTRATIVE PHARMACY
Faculty of Pharmaceutical Science
Chulalongkorn University- Bangkok Thailand

November 2011 to May 2015 — MASTERS IN HEALTH PROFESSIONS EDUCATION
National Teacher's Training Center
University of the Philippines - Manila

January 2011 — PHARMACIST LICENSURE EXAMINATION
Passed

June 2005 to May 2010 — BACHELOR IN SCIENCE IN INDUSTRIAL PHARMACY
College of Pharmacy
University of the Philippines – Manila

TEACHING EXPERIENCE

May 2010 to Present — ASSISTANT PROFESSOR
Full-time, Tenured
Department of Pharmacy
College of Pharmacy, University of the Philippines-Manila

Courses handled:
Ph 105: Pharmacy Informatics
Ph Ch 128: Medicinal Chemistry 1
Ph 100: Perspectives in Pharmacy
IP121: Pharmaceutical Calculations
IP141: Pharmaceutical Dosage forms and Drug Delivery Systems
IP142: Physical Pharmacy
Ph 111: Human Anatomy and Physiology I
Ph 112: Human Anatomy and Physiology II
Ph 135: Pharmaceutical Microbiology Laboratory
Ph 197: Pharmacy Seminar
Ph 125: Pharmaceutical Accounting
Ph 127: Pharmaceutical Management
Ph 137: Complementary and Alternative Medicine

January 2011 to Present — PHARMACY REVIEW SENIOR LECTURER
Part – time

Pharmacy Review
Centro Escolar University Makati
Centro Escolar University Manila
Centro Escolar University Malolos
University of San Carlos- Cebu
Our Lady of Fatima University
Southwestern University- Cebu
University of Zamboanga
San Agustin University- Iloilo
Manila Central University
National University - Manila
University of LaSallete, Santiago Isabella
Virgen Milagrosa University foundation-San Carlos
Pangasinan
San Pedro University- Davao
University of Immaculate Concepcion- Davao
Mariano Marcos State University- Laoag, Ilocos
Saint Louise University- Baguio
University of Luzon- Dagupan
University of Perpetual Help Binan
Angeles University- Pampanga
Mindanao Medical Foundation- University
Lorma University – La Union
Saint Louis University
St. Dominic College Cavite
Medical Colleges of Northern Philippines
Tagum Doctors College
Brex Pharmacy Review

Topics handled:
Module 3: Pharmaceutical Calculation
Module 3: Adverse drug reaction
Module 3: Hospital Pharmacy
Module 3: Clinical Pharmacy
Module 4: Biopharmkinetics
Module 5: Dosage forms and drug delivery system
Module 5: Pharmaceutical Manufacturing
Module 5: Physical Pharmacy
Module 5: Ethics and Jurisprudence

RESEARCH PUBLICATIONS

Evaluation of the Hepatoprotective activity of Citrus microcarpa Bunge (Family Rutaceae) fruit peel against acetaminophen-induced liver damage in male BFAD- Sprague Dawley rat
Co-investigator
International Journal of Chemical and Environmental Engineerin, Volume 1, No.2, pg 127-132, ISSN:2078-0737
December 2010

Pharmacy students' perceptions and experiences of the Community Health and Development Program—Interprofessional education in the University of the Philippines Manila
Co-Investigator

Journal of Asian Association of Schools of Pharmacy 2020; 9: 10–18 The Asian Association of Schools of Pharmacy

Effectiveness of Junior Faculty Mentoring Relationships in the Colleges of Pharmacy in Metro Manila, Philippines
Principal Investigator
Journal of Asian Association of Schools of Pharmacy, Volume 5, No. 1, pg 367-376, ISSN: 2286-6493
January- June 2016

Factors Associated with Parental Self-medication of Antibiotics in Health Centers of Manila
Co investigator
KnE Social Sciences | 4th International Research Conference on Higher Education | pages: 891–910
DOI: 10.18502/kss.v3i6.2427 ISSN: 2518-668

AWARDS AND GRANTS

- FIP Ton Hoek Scholarship for Young Leaders 2019, September 2019
- One UP Professorial Chair and Faculty Grant, June 2019
- *Doctoral Fellowship Program UP OVPAA Scholarship Grant,* September 2019
- *Gawad dekana for outstanding faculty – Extension Services, 2017-2018*
- *Gawad dekana for outstanding faculty, 2014-2015*
- *Gawad dekana for outstanding faculty, 2013-2014*
- *Gawad dekana for outstanding faculty, 2012-2013*
- *Gawad dekana for outstanding faculty, 2011-2012*
- *Caffeine Boost Faculty award UPPhA, 2016*
- *Gandhi Award UPPhA, 2014*
- *Luz Oliveros Faculty grant, 2013*

SPEAKING ENGAGEMENTS

- *Speaker and Organizer, Collaborate for Health: Developing competencies through interprofessional education*
  College of Nursing auditorium, University of the Philippines Manila
  May 25-26, 2019

- *Speaker and Session Chair, International Research Conference on Higher Education.*
  Inna Grand Bali, Sanur Bali Indonesia
  January 24-27, 2018

- *Speaker, International Journal of Chemical and Environmental Engineering,*
  Piccolo Hotel, Kuala Lumpur, Malaysia
  November 25-27, 2010

- *Speaker, 1st International Conference on Pharmacy Education and Research network of ASEAN*
  Bangkok, Thailand
  December 1-4, 2015

- *Speaker, Philippine Pharmacist Association National Convention*
  SMX Bacolod

July, 2015

- ***Speaker,*** *USC 360 symposium*
  Plenary UP-PGH Science Hall
  30 March 2016

- ***Speaker,*** FAPA 2016 Oral Presentation
  BITEC Thailand
  November 2016

- ***Speaker*** Lectures to professionals St Jude University
  Manila
  2015

- ***Speaker*** Lectures to professionals San Carlos
  Manila
  2015

- ***Speaker*** YPG Faculty development program Young Pharmacist group participants
  Manila
  2014

- ***Speaker*** AYPG Pharmacy practice in the Philippines Cambodian Young Pharmacist group
  Cambodia
  2016

- ***Speaker*** UP College of Pharmacy teaching philosophy workshop
  Manila
  2016

- ***Speaker*** Preceptorship Training Program
  UP Manila
  November 2016

- ***Speaker*** orientation- workshop for the UP College of Pharmacy Delegates to the International Exchange Program with Mahasarakam University (Thailand)
  UP Manila
  December 2016

- ***Research Judge, consultant***, Centro Escolar University Manila
  CEU Manila
  2014

- ***Research Judge, consultant***, Centro Escolar University Manila
  CEU Manila
  2016

- ***Speaker*** Pharmacy seminar: Drug delivery system and manufacturing
  Manila central university
  January 6-7, 2017

- ***Speaker*** Pharmacy enhancement program
  Virgen Milagrosa university foundation
  January 29, 2017

- ***Speaker*** 5th Philippine Pharmacy Summit
  Bayanihan Center, Pioneer Street, Mandaluyong city
  February 5, 2017

- ***Speaker*** Pharmacy seminar: Biopharmaceutics and Pharmacokinetics
  Manila central university
  March 4, 2017

- ***Speaker*** Teaching strategies to Promote Outcome Based Education: Symposium on Inter-professional Education
  NTTC-HP Auditorium, Dr. Joaquin Gonzales Hall, UP Manila
  March 27, 2017

- ***Host and organizer,*** UP College of Pharmacy Graduate Research colloquim
  Valenzuela Hall, University of the Philippines Manila
  March 29, 2017

- ***Organizer*** Inter-professional education for Mahasarakham University exchange students
  CHDP- AMIGA Cavite
  April 7, 2017

- ***Organizer*** Community pharmacy practice in the Philippines for Mahasarakham University exchange students
  Medgrocer, Binondo and Generika, Taguig
  April 12, 2017

- ***Research Judge,*** Health Profession Education expo 2017
  NTTC HP auditorium, Dr. Joaquin Gonzales Hall
  University of the Philippines Manila
  April 25, 2017

- ***Speaker*** UP-YPG Junior Faculty Mentoring and Enhancement workshop
  University of San Carlos Cebu
  January 3-4, 2017

- ***Speaker*** Pharmacy seminar: Pharmaceutical Calculations, Biopharmaceutics and Pharmacokinetics
  University of San Agustin Iloilo
  July 1 and 2, 2017

- ***Speaker, Facilitator and Organizer*** Workshop on Inter-professional education
  Philippine General Hospital
  August 26, 2017

- ***Speaker*** UP-YPG Junior Faculty Mentoring and Enhancement workshop
  Hotel Kimberly Manila
  September 2-3, 2017

- ***Speaker*** UP-YPG Junior Faculty Mentoring and Enhancement workshop

Saint Louis University of Baguio
September 9-10, 2017

- ***Speaker*** Inter-Professional Education in National Service Training Program
  College of Dentistry, University of the Philippines Manila
  November 8, 2017

- ***Session Chair*** Pharmaceutical, Medical and health sciences session of the 4th International research conference for higher education
  Inna Grand Bali Hotel
  January 24-27, 2018

- ***Speaker*** Pharmacy enhancement program
  Virgen Milagrosa university foundation
  February 24, 2018

- ***Speaker*** Pharmacy enhancement program
  Virgen Milagrosa university foundation
  March 23-26, 2018

- ***Speaker*** 28th Commencement Exercise
  Casa del Nino Elementary School
  March 25, 2014

- ***Speaker*** Guest of honor and speaker
  Casa del Nino Science High School
  March 21, 2015

- ***Speaker*** Philippine Pharmacy Association Pharmacy Based Immunization Training program for Filipino Pharmacists
  San Pedro College Davao City
  April 14, 2018

- ***Speaker*** Mind Meld 2018
  UP PGH Emergency Room Complex
  April 21, 2018

- ***Preceptor*** International Student exchange week with Mahasarakham University
  UP College of Pharmacy
  April 16-27, 2018

- ***Speaker*** Mind Meld 2018
  UP PGH Emergency Room Complex
  April 21, 2018

- ***Speaker*** Mind Meld 2018
  UP PGH Emergency Room Complex
  April 21, 2018

- ***Speaker, Facilitator and Organizer*** Pharmacy Based Asthma Services: Pharmacists as partners in optimizing health outcomes
  Ma Cruz Tancino Audiovisual room, College of Pharmacy University of the Philippines Manila
  May 31, 2018

- ***Speaker*** Federation of Junior Chapters of the Philippine Pharmacists Association General Assembly
  University of Perpetual Help Performing Arts theater
  August 7, 2018

- ***Speaker, Facilitator and Organizer*** Pharmacy Based Asthma Services: Pharmacists as partners in optimizing health outcomes
  Ma Cruz Tancino Audiovisual room, College of Pharmacy University of the Philippines Manila
  September 1, 2018

- ***Speaker,*** Philippine Pharmacist Association Asthma Training Workshop
  Bayleaf Hotel Intramuros Manila
  September 8, 2018

- ***Speaker and Organizer, YPG Philippines General Assembly: Pharmacovigilance***
  City State Hotel Manila
  September 22, 2018

- ***Speaker,*** National University White coat ceremony
  Annex Building, National University
  September 27, 2018

- ***Speaker and Organizer, YPG Philippines General Assembly: Disaster Preparedness***
  Venus Parkview Hotel, Baguio City
  September 29-30, 2018

- ***Oral Presenter and Organizer,*** 27th Federation of Asian Pharmaceutical Associations (FAPA) Congress
  Philippine International Convention Center, Manila
  24-27 October 2018

- ***Speaker***: White Coat ceremony of arellano university
  PICC
  29th November

- ***Speaker:*** Information Technology Enhancement for operational Efficiency and creativity
  College of Pharmacy Computer room
  December 3, 2018

- **Judge**, Poster/Oral research paper presentation 7th Philippine Pharmacy Summit
  De La Salle Medical and Health Sciences Institute Compound, Dasmarinas Cavite
  February 17, 2019

- ***Speaker***, 4th annual Pharmacy White Coat Ceremony University of Santo Tomas Faculty of Pharmacy
  University of Sto, Tomas
  February 8, 2019

- **Secretariat,** 2019 PPHA National Convention Davao city
  SMX Davao Convention Center

- **Judge,** Digital poster-slogan making contest and video making contest

World Pharmacist day, Mindanao Alliance of Pharmacy Schools
September 25, 2020

SEMINARS, WORKSHOPS & TRAININGS ATTENDED

Trainings and Certifications

- *6th Good Pharmacy Practice (GPP) International Training Program*
  Taipei, Taiwan
  July 21 and 25th , 2017

- *Global Health Course the Finnish medical society duodecim and Institue of Medicine*
  Nepal Institute of Medicine Kathmandu Nepal
  August 3-22, 2015

- *National Certificate III in Pharmacy Services Technical Education and Skills Development Authority*
  TESDA Taguig
  June 29-30

- *COC 2 Trainers Methodology Technical Education and Skills Development Authority*
  PSAA International Skills academy
  September 2016

- *COC 1 Trainers Methodology Technical Education and Skills Development Authority*
  PSAA International Skills academy
  December 2016

- *BLS for Healthcare Providers course*
  UST-FMS life Support Training Center
  April 22, 2017

Seminar workshops

- *Department of Health Training workshop on economic evaluation*
  Hotel Jen, Pasay City
  January 14-18, 2019

- *International Journal of Chemical and Environmental Engineering, World of Publication*
  Piccolo Hotel, Kuala Lumpur, Malaysia
  November 25-27, 2010

- *Refresher course training on emergency preparedness and response Committee on disaster preparedness*
  Emilio T Yap auditorium
  January 2011

- *Seminar on the implementation of AO 56 on Drug establishments*
  Philippine FDA
  June 2011

- *Seminar on the implementation of AO 56 on Drug Outlets*
  Philippine FDA
  June 2011

- *Asian Conference on Clinical Pharmacy*
  PICC,
  June 2011

- *Seminar workshop instructional design and test construction*
  NTTC-HP auditorium
  July 2011

- *Faculty development for Biopharmaceutics and pharmacokinetics*
  Philippine association of colleges of pharmacy UPCP
  May 2012

- *training on emergency preparedness and response I- Committee on disaster preparedness*
  Emilio T Yap auditorium
  June 2011

- *training on emergency preparedness and response II- Committee on disaster preparedness*
  Emilio T Yap auditorium
  September 2011

- *7th national conference on health professions education NTTC-HP*
  Pan Pacific Hotel
  January 2013

- *Seminar on 7S- UPCP*
  UPCP AVR
  Fabruary 2013

- *Pharmacy Based Health Screening program for Hypertension and Diabetes Mellitus*
  UPCP Conference room
  October 2013

- *Pharmacy Based Health Screening program for Hypertension and Diabetes Mellitus II*
  UPCP Conference room
  November 2013

- *Trainers on engaging the pharmacy in the control of tuberculosis IMPACT-PPHA*
  Fersal Hotel
  April 2014

- *UP Manila Faculty conference : moving towards outcome based education*
  Century Park hotel
  June 2014

- *Laboratory equipment user awareness seminar*
  UPCP AVR,
  July, 2014

- *CPE on Wound care beyond sceen deep*
  Max Taguig,
  September 2014

- *Kababaihan sa kontekstong Pilipino - Center for gender and women studies UP manila*
  UPCP AVR,
  March 2015

- *Leadership CAMP- Young Pharmacist Group*
  Philips sanctuary,
  March 2016

- *Orientation and workshop for Pharmacy services NC III*
  Hygeian Institute for education, research and training, TESDA women's center,
  April 2016

- *2015 PPHA National convention*
  Bacolod SMX,
  May 2015

- *1st International Conference on Pharmacy Education and Research network of ASEAN in ASEAN Pharmanet*
  Bangkok, Thailand
  December 1-4, 2015

- *2016 PPHA National convention*
  Waterfront hotel
  May 2016

- *UPMLE as the Primary Online Leaning Management system for blended learning*
  UPCP conference room,
  May 2015

- *Capability Building program for Regional Lead Assessors for Pharmacy Services NCIII- TESDA*
  TESDA womens center,
  June 2016

- *Plan training session trainer's methodology 1*
  TESDA- PSAA International Academy
  July 2016

- *Facilitate learning session trainer's methodology 1*
  TESDA PSAA International Academy,
  August 2016

- *Utilize electronic media trainer's methodology 1*
  PSAA International Academy,
  August 2016

- *Supervise work based learning trainer's methodology 1*
  PSAA International Academy,
  August 2016

- *Maintain Training Facilities session trainer's methodology 1*
  PSAA International Academy,
  August 2016

- *Conduct competency assessment session trainer's methodology 1*
  PSAA International Academy,
  August 2016

- *teaching portfolio workshop I*
  UP Manila
  September 2016

- *teaching portfolio workshop II*
  UP Manila
  September 2016

- *teaching portfolio workshop III*
  UP Manila
  September 2016

- *teaching portfolio workshop IV*
  UP Manila
  September 2016

- *teaching portfolio workshop V*
  UP Manila
  October 2016

- *FIP YPG Young Leader's Summit 2016*
  Crimson's hotel
  September 2016

- *Interprofessional Workshop series: Pharmacist as Key Players in the Management of Infectious Diseases*
  Andrew Gonzales Hall, DLSU
  January 2017

- *Lectures on conflicts in Academic Institutions and Resolutions*
  Maria Cruz Tancino Audio Visual Room
  March 13, 2017

- *Nanodelivery of Herbal products*
  Maria Cruz Tancino Audio Visual Room
  March 13, 2017

- *Refresher course emergency preparedness and response: Firedrill*
  Emilio T. Yap Auditorium
  March 23, 2017

- *2017 UP Manila New General education (GE) planning workshop*
  Diamond Hotel Philippines
  September 2016

- *2017 UP Pharmacy Alumni homecoming and reunion with CPD seminar on Quality management system*
  Emilio T. Yap Auditorium
  17 June 2017

- *National Public Hearing/Consultation on the proposed guidelines on the proposed guidelines on accreditation of health facilities utilized by pharmacy intern*
  Bayview Park Hotel Roxas Boulevard Manila
  11 October, 2017

- *International Research Conference on Higher Education.*
  Inna Grand Bali, Sanur Bali Indonesia
  January 24-27, 2018

- *Seminar: Understanding your graduates through research : first destinations and career paths.*
  Inna Grand Bali, Sanur Bali Indonesia
  January 23, 2018

- *Seminar: 4th Basic Asthma Education Certifying Workshop*
  EDSA Shangri-la, Mandaluyong Philippines
  March 11, 2018

- *Seminar: Biologics in Clinical Practice and Regulatory Considerations*
  Citadines Millenium Ortigas Manila
  July 3, 2018

- *Seminar: YPG Regulatory Compliance Workshop*
  Valenzuela Hall, UP College of Pharmacy
  September 1, 2018

- Seminar workshop: Quality Assurance Mechanism of UP College of Pharmacy Bayleaf Hotel Intramuros
  November 28-29, 2018

- Seminar workshop: Training workshop on responsible conduct of research National Institute of health
  February 13-15, 2019

  2019 Philippine Pharmacist Association National Convention
  SMX Davao Convention Center
  April 30-May 4, 2019

LEADERSHIP

University

- Committee Member, Community Health Development Program, 2011 to Present
- College Focal Person to the UP Manila – CHDP, December 2018

College

- Committee chair, Inhouse review committee, 2011-2016
- Committee chair, Teaching, learning and mentoring, 2016-present
- Internship coordinator, 2015- present

Outside the University

- Professional Team Development Officer, FIP YPG Subcommittee, 2020
- President, Young Pharmacist Group Philippines, 2018-2020
- Section chair for Academe Business Manager, Young Pharmacist Group Philippines, 2016-2018
- Business Manager, Young Pharmacist Group Philippines, 2013-2015
- Treasurer, Young Pharmacist Group Philippines, 2015-2016

PROFESSIONAL AFFILIATIONS

- Professional Team Development Officer, FIP YPG Subcommittee, 2020
- President, Young Pharmacist Group Philippines, 2018-2019
- Board member, Asian Young Pharmacist Group, 2018-2019
- Member, Philippine Pharmacists Association, 2011 - Present
- Organization Adviser, Industrial Pharmacy Honor Society, 2012 - Present
- Business Manager, Young Pharmacist Group Philippines, 2013-2015
- Treasurer, Young Pharmacist Group Philippines, 2015-2016
- Section chair for Academics, Young Pharmacist Group Philippines, 2015-2016

PERSONAL DATA

Age	:	31
Date of Birth	:	December, 22, 1988
Religion	:	Roman Catholic
Civil Status	:	Single
TOEFL score	:	103/120
		Reading HIGH 24/30
		Listening HIGH 30/30
		Speaking GOOD 25/30
		Writing GOOD 24/30

CURRICULUM VITAE

RUNGPETCH (CHAROENVISUTHIWONGS) SAKULBUMRUNGSIL
Home:176/2 Sukhumvit Rd. Soi 16 Bangkok 10110, Thailand
Phone: (662) 258-1779, (662) 229-4544-6
FAX: (662) 229-4813 Phone: (662) 218-8386-90

Office: Department of Social and Administrative Pharmacy
Faculty of Pharmaceutical Sciences, Chulalongkorn University
FAX: (662) 218-8391
Email: rungpetch.c@pharm.chula.ac.th

EDUCATION

August 1987 to August 1993 University of Iowa, Iowa City, Iowa, U.S.A.
Ph.D. in Pharmaceutical Socioeconomics, August 1993
June 1979 to March 1984 Chulalongkorn University, Bangkok, Thailand
B.S. in Pharmaceutical Science, March 1984

EXPERIENCES

October 93 to present Chulalongkorn University

Faculty of Pharmaceutical Science
Faculty Staff
March 84 to June 87 Bumrungrad Hospital, Bangkok, Thailand
Pharmacy Department
Worked as a hospital pharmacist in the 200-bed private hospital which
arranging a new drug distribution system in the hospital.

ADMINISTRATIVE POSITIONS

October 2013 to present Dean of Faculty of Pharmaceutical Sciences, Chulalongkorn University
January 2006 to September 2009 Associate Dean for Research
February 2002 to December 2005 Chair of Continuing Education Unit
October 1999 to January 2002 Director of International Doctoral Program in Social and Administrative Pharmacy
March 1998 to October 1999 Chair of Committee on Graduate Program Development on Social and Administrative Pharmacy
October 1993 to July 2000 Head of Pharmacy Administration Unit
1994 to 2000 Chair of Community Pharmacy and Pharmacy Administration Subspecialty

PUBLICATION

1. Saerekul, P., Limsakun, T., Anantachoti, P., & Sakulbumrungsil, R. (2018). Access to medicines for breast,colorectal, and lung cancer in Thailand. Thai Journal of Pharmaceutical Sciences, in press.

2. Tangcharoensathien, V., Sommanustweechai, A., Chanthong, B., Sumpradit, N., Sakulbumrungsil, R., Jaroenpoj, S., & Sermsinsiri, V. (2017). Surveillance of antimicrobial consumption: methodological review for systems development in Thailand. Journal of Global Health, 7(1), 010307. Doi: 10.7189/jogh.07.010307.
Last updated November 4, 2020 Rungpetch C. Sakulbumrungsil CV page 2/4

3. Noparatayaporn, P., Sakulbumrungsil, R., Thaweethamcharoen, T., Sangseenil, W. (2016). Comparison of unit cost of pharmacy service using automatic and manual dispensing system. Thai Journal of Pharmaceutical Sciences, 40(supplement), 168-171.

4. Nilanon, K., Sakulbumrungsil, R., Phattanarudee, S., Tan-khum, T. (2015). Factors affecting methylphenidate adherence in children and adolescent with attention deficit hyperactivity disorder. Journal of Mental Health of Thailand, 23(1), 1-11.

5. Nerapusee, O., Chinthammit, C., Romyen, C., Pangjunhom, M., Malone, D.C., Sakulbumrungsil, R. (2015). Long-acting injectable antipsychotics in patients with schizophrenia: systematic review and mixed treatment metaanalysis. Asian Biomedicine, 9(6), 741-750.

6. Thongprasert, S., Chaiyakunapruk, N., Crawford, B., Petcharapiruch, S., Learsakulpanich, J., Sakulbumrungsil, R., Permsuwan, U. (2015). Willingness to pay for lung cancer treatment: Patient versus general public values. International Journal of Technology Assessment in Health Care, 31(4), 1-7.

7. Chancheochai, S., Sakulbumrungsil, R., Ngorsurachet, S. (2015). Preference on medication therapy management (MTM) service: Results from discrete choice experiment. Thai Journal of Pharmaceutical Sciences, 39(3), 119-126.

8. Sakthong, P., Suksanga, P., Sakulbumrungsil, R.,& Winit-Wajana, W. (2014). Development of patient-reported outcomes measure of pharmaceutical therapy for quality of life (PROMPT-QoL): A novel instrument for medication management. Research in Social and Administrative Pharmacy, 10, 1-24.

9. Thaweethamcharoen, T., Sakulbumrungsil, R., Nopmaneejumruslers, C. & Vauvattakul, S. (2014). Cost-utility analysis of erythropoietin for anemia treatment in Thai end-stage renal disease patients with hemodialysis. Value in Health (International), 3, 44-49.

10. Sakulbumrungsil, R., Kessomboon, N., Kanchanapiboon, I., Udomaksorn, S., Jitraknatee, A. (2014). Development of data standards for national drug account. Medicinal and Health Product Bulletin, 17(1), 5-12.

11. Sakthong, P. Sakulbumrungsil, R. & Winit-Watjana, W. (2013). Medication-Therapy-Related quality of life measurement using Thai patient-generated index: A pilot study. Journal of Pharmacy and Pharmaceutical Sciences, 5(Supple3), 153-156.

12. Kessomboon, N., Sakulbumrungsil, R., & Udomaksorn, S. (2012). National drug accounts: Thailand's experience. Research in Social and Administrative Pharmacy, 8(6), e5-e6.

13. Thaveesri, M.B., Sakubumrungsil, R.C., Thongnopnua, N., Theeraroungchaisri, A., Sooksriwong, C., & Tongrod, W. (2012). Willingness to smoking among college students: A modification of theory of Planned Behavior. Journal of Health Research, 26(6), 297-303.

14. Tunpitchart, S., Sakulbumrungsil, R., Somrongthong, R., & Hongsamoot, D. (2012). Chronic care model for diabetics by pharmacist home health in Bangkok Metropolitan: A community based. International Journal of Medicine and Medical Sciences, 4(4), 90-96. (International)

15. Phungnil, P., Tantipidok, R., Sakulbumrungsil, R. (2011). System analysis and strategic development for medicinal products importation. FDA Journal, 18(3), 37-45.

16. Thaweethamcharoen, T., Sakulbumrungsil, R., Vasuvattakul, S., & Nopmaneejumruslers, C. (2011). Quality of life and hemoglobin levels of hemodialysis patient at Siriraj Hospital. Siriraj Medical Journal, 63, 12-16. (National)

17. Puanpune, K. & Sakulbumrungsil, R.* (2010). An analysis of Diploma of Public Health Program (Technical Pharmacy) based on professional competence. Journal of Health Research, 24(4), 187-194. (National)

18. Sriwarakorn, S., Srittiyanunt, S. & Sakulbumrungsil. R.* (2010). Sensivity and specificity of Thai-version brief medication questionnaire. Journal of Health Research, 24(3), 129-134. (National)

19. Thaweethamcharoen, T., Sakulbumrungsil, R., Vasuvattakul, S., & Nopmaneejumruslers, C. (2010). Comparison of SF-6D, EQ-5D and VAS in hemodialysis Thai patient. Value in Health, 13 (7), A567. (Impact factor = 21.3, Scopus) Last updated November 4, 2020 Rungpetch C. Sakulbumrungsil CV page 3/4

20. Plodkratoke, W., Kittisopee, T., & Sakulbumrungsil, R. (2010). Cost saving and cost avoidance of the pharmacy automation system. Thai Journal of Hospital Pharmacy, 20(1), 43-54. (National)

21. Sakthong, S., Chabunthom, R., & Charoenvisuthiwongs, R. (2009). Psychometric properties of the Thai version of the 8-item Morisky Medication Adherence Scale in patients with type 2 diabetes. Annals of Pharmacotherapy, 43(5), 950-957. (Impact factor = 2.13, Scopus)

22. Leartsakulpanitch, J. & Sakulbumrungsil, R. (2009). Probabilistic analysis of budgetary impact: Glucosamine in knee osteroarthritis treatment. Value in Health, 12 (7), A435. (Impact factor = 2.19, Scopus)

23. Leartsakulpanitch, J. & Sakulbumrungsil, R.* (2009). Evidence for success in hospital formulary consideration of knee osteoarthritis treatment: Budget impact analysis of glucosamine. Thai Journal of Hospital Pharmacy, 19 (2),102-109. (National)

24. Akaleephan C., Wibulpolprasert S., Sakulbumrungsil, R., Luangruangrong, P., Jitraknathee A., Aeksaengsri, A., Udomaksorn, S., Tangcharoensathien, V. & Tantivess, S. (2009). Extension of market exclusivity and its impact on the accessibility to essential medicines, and drug expense in Thailand: Analysis of the effect of TRIPs-PLUS proposal. Health Policy, 91 (2), 174-182. (Impact factor = 1.51, Scopus)

25. Bongkotphet, K., Tassanawipas, W., Krittiyanunt, S., Songpatanasilp, T., & Sakulbumrungsil, R. (2009).
Comparative efficacy of low- and high-molecular weight intra-articular hyaluronic acids in patients with osteoarthritis. Journal of Health Research, 23 (2), 87-92. (National)

26. Sthapornnanon, N, Sakulbumrungsil, R., Theeraroungchaisri, A, & Watcharadamrongkun, S. (2009). Social constructivist learning environment in an online professional practice course. American Journal of Pharmaceutical Education, 73 (1), article 10. (Impact factor = 1.21, Scopus)

27. Sakthong, P., Schommer, J.C., Gross, C.R., Prasithsirikul, W. & Sakulbumrungsil, R. (2009). Health utilities in patients with HIV/AIDS in Thailand. Value in Health, 12(2), 377-384. (Impact factor = 2.19, Scopus)

28. Sakthong, P., Charoenvisuthiwongs, R. & Shabunthom, R. (2008). A comparison of EQ-5D index scoring using the UK, US, and Japan preference weights in a Thai sample with type 2 diabetes. Health and Quality of Life Outcomes, 6, 71. (Impact factor = 2.11, Scopus)

29. Udomaksorn, S., Sakulbumrungsil, R.C. & Luangruangrong, P. (2008). The Investigation of Pharmaceutical Price Discrimination among Public Hospitals in Thailand: A case study of Agent acting on the Renin-Angiotensin system (ACE Inhibitor). Thai Journal of Hospital Pharmacy, 18 (2), 128-138. (National)

30. Tantipidoke, R., Sakulbumrungsil, R.C. & Cheungsatiansup, K. (2008). The ties that blind: Social relationship and cultural reasoning of self-medication among the poor elderly with chronic illness in a congested community in Bangkok. Thai Journal of Hospital Pharmacy, 18(2), 139-153. (National)

31. Pornkitprasarn, S. & Sakulbumrungsil, R.C.* (2008). Development and evaluative analysis on labeling for home pregnancy test kit: Consumer testing and readability test. Thai Journal of Hospital Pharmacy, 18(2), 154-169. (National)

32. Sakthong, P., Schommer, J.C., Gross, C. R., Sakulbumrunsil, R. & Prasithsirikul, W. (2007). Psychometric properties of WHOQOL-BREF-THAI in patients with HIV/AIDS. Journal of Medical Association of Thailand, 90 (11), 2449-2460. (Impact factor = 0.447, Scopus)

33. Kittivachra, R., Sanguandeekul, R., Sakulbumrungsil, R., and Phongphanphanee, P. (2007). Factor affecting lactose quantity in raw milk. Songklanakarin Journal of Science and Technology, 29(4), 937-943. (Impact factor = 0.326, Scopus)

34. Kittivachra, R., Sanguandeekul, R., Sakulbumrungsil, R., Phongphanphanee, P., and Srisomboon, J. (2006). Determination of essential nutrients in raw milk. Songklanakarin Journal of Science and Technology, 28(1), 115- 120. (Impact factor = 0.326, Scopus)

35. Chantapasa, K., Sakulbumrungsil, R., and Sringenyaung, L. (2006). Non-adherence and shopping around behavior: The consequences of the differences of Explanatory Model between Physicians and

Patients. Thai Journal of Hospital Pharmacy, 16(2), 94-104. Last updated November 4, 2020 Rungpetch C. Sakulbumrungsil CV page 4/4

36. Loquias, M.M., Kittisopee, T., and Sakulbumrungsil, R. (2006). Factors affecting healthcare utilization: An application of the Aderson Model. Thai Journal of Hospital Pharmacy, 16 (3), 201-211.

37. Ploylearmsang, C., Pongcharoensuk, P., Sakulbumrungsil, R. (2006). Professionalism and moral reasoning of Thai pharmacists in three practice settings. Thai Journal of Hospital Pharmacy, 16 (1), 19-29.

38. Naravage, W., Vichit-Vadakan N, Sakulbumrungsil, R., Van de Putten, M. (2005). Factors affecting decision making of low-income young women with unplanned pregnancies in Bangkok, Thailand. Southeast Asian Journal of Tropical Medicine and Public Health, 36 (3), 775-782. (Impact factor ISI 2011=0.60)

39. Panyawuthikrai, P., Sakulbumrungsil, R., Wongwiwathanukit, S., and Pitaknitinan, K. (2005). Development of perceived community pharmacy service quality scale in client perspective for Thai community pharmacy accreditation. Thai Journal of Hospital Pharmacy, 15 (2), 151-161.

40. Krittiyanunt, S., Wongwiwatthananukit, S., Sakulbumrungsil, R., and Chetaboot, S. (2004). Evaluation of pharmaceutical care in hypertensive patients at primary care unit. Thai Journal of Hospital Pharmacy, 14 (2), 101-115.

41. Tongrod W, Pongcharoensuk P, Lim N.L. & Sakulbumrungsil R. (2003). An In-depth Interview of Community Pharmacists on the Thai Community Pharmacy"s Standard Practice Guidelines. Thai Journal of Hospital Pharmacy, 13(1), 8-21.

42. Krittiyanunt, S., Sakulbumrungsil, R., Wongwiwatthanukit, S., and Suthiputthanangoon, W. (2002). Risk factors of antituberculosis drugs-induced hepatotoxicity in Thai patients. Thai Journal of Pharmaceutical Sciences, 26 (3-4), 121-128.

43. Pummangura, S., Sirikulwattana, S., Premyothin, P., Sakulbumrungsil, R., and Thanaviriyakul, S. (2000). Study on allocation criteria for revenue generated from innovations. Chulalongkorn Research, Year 19, no.8, August 2000, 18-21.

BOOK

1. Sakulbumrungsil, R, Kessomboon, N., Udomaksorn, S., Kanchaphibul, I., Luengruangrong, P. (2013). PAC-DSS Pharmaceutical Acquisition Capability-Decision Support System. Nonthaburi: IHPP.
2. Kessomboon, N., Sakulbumrungsil, R., Kanchanphibul, I., Udomaksorn, S., Jitraknatee, A. (2012). Research and Systems Development for National Drug Account. Nonthaburi: IHPP.
3. Naravage, W. & Sakulbumrungsil, R. (2008). Young women with unplanned pregnancies in Bangkok, Thailand. NY: Nova Science Publishers.
4. Naravage, W. & Sakulbumrungsil, R.C. (2007). Decision making process and health seeking patterns of young women with unplanned pregnancies, Bangkok, Thailand. In Blakely, E.P. (ed.). Psycohology of Decision Making in Health Care, p 5-72. NY: Nova Science Publishers.
5. Sakulbumrungsil, R. (2000). Drug use evaluation and quality assurance in health system. In Chulawattanatol, S. and Suthisrisung, C. (eds), Evidence-based medicine for pharmacists (p 97-108). Bangkok: Chanmuang Karnpim.
6. Charoenvisuthiwongs, R. (1996). Community Pharmacist Profession. In Jaidee, S., et al. Ninty Years of Thai Pharmacy (p 153-168). Bangkok: Pimdee.

Appendix N: Diagramatic Workplan

Steps of Experiment	Description	2020			2021											2022		
		Nov	Dec	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Ethical Clearance	Research proposal were submitted to the University of the Philippines Research Grants Administration Office (RGAO) and Research Ethics Board (UPMREB) for evaluation	✓	✓	✓														
Philippine Government Permits	Establish support from government stakeholders to oversee and facilitate the objectives, scope, design and implementation of the research. Letter were sent to the 1. National Center for Pharmaceutical Access and Management (NCPAM) of the Department of Health 2. Provincial Governors of Region IV A 3. City Mayors of the National Capital Region. 4. Barangay Captains				✓	✓												
Survey planning and preparation	5. Develop an implementation plan and budget, and secure funding/ grant for the research 6. Recruit the				✓	✓												

	Pharmacists and survey personnel (survey manager, data collectors and entry/processing personnel) 7. Procure logistics including materials and transport, taking into consideration the number of sites to be visited, the number of data collection teams, etc. 8. Plan and conduct training courses for Pharmacists and research team 9. Prepare a survey schedule																	
Data collection in the field	1. Confirm appointments with health facilities 2. Visit health facilities and collect survey data 3. Collect the data from the randomly sampled patients 4. At the end of the interview, check questionnaire and resolve missing/unreliable information 5. Return completed forms and/or						✓	✓	✓	✓	✓	✓	✓	✓				

	transfer electronic files to survey manager at the conclusion of each day																	
Data entry, analysis and interpretation	1. Enter data using the Excel form 2. Edit, validate and clean data set, checking for consistency and accuracy 3. Export the data set for analysis in Stata/MP 13 4. Conduct analyses of data based on the research objective						✓	✓	✓	✓	✓	✓	✓	✓	✓			
Manuscript writing and research dissemination	1. The author will analyze and interpret survey results and to finalize recommendations 2. Prepare the final report 3. Submission to the university for checking and defense 4. Plan and implement dissemination activities.															✓	✓	✓

Appendix O: Certification to conduct clinical study research

CITI PROGRAM

Completion Date 28-Apr-2019
Expiration Date 27-Apr-2022
Record ID 31443267

This is to certify that:

Rungpetch Sakulbumrungsil

Has completed the following CITI Program course:

CITI Conflicts of Interest (Curriculum Group)
Conflicts of Interest for IRB members, Researchers, Faculty members (Course Learner Group)
1 - Stage 1 (Stage)

Under requirements set by:

Chulalongkorn University

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?w01f6782f-5a57-4511-8bb2-eb6576f59d65-31443267

University of the Philippines Manila - National Institutes of Health (UPM - NIH)
Training Center for Health Research Ethics and Good Clinical Practice
in collaboration with the
Forum for Ethical Review Committees in Asia and the Western Pacific (FERCAP)

awards this

CERTIFICATE OF ATTENDANCE

to

Margarita Gutierrez

for having completed the

Training Workshop on Responsible Conduct of Research

held at

National Institutes of Health, UP Manila
on the 13th to 15th of February 2019

CRISTINA E. TORRES, PhD
Coordinator
Forum for Ethical Review Committees
in Asia & Western Pacific Region

EVA MARIA C. CUTIONGCO–DE LA PAZ, MD, FPPS
Executive Director
National Institutes of Health

REPRINTED COPY. SIGNATURES NOT REQUIRED

Appendix P : Data collection procedure and estimated budget

The study will take place between January 2021 to January 2022. Overview of the steps of the survey and the activities to be undertaken at each stage:

1. Survey planning and preparation
    a. Develop an action plan and secure funding / research grant
    b. Establish endorsement from government stakeholders to oversee and promote the goals, scope, design and implementation of research
    c. Recruit the Pharmacists and research assistants
    d. Prepare a survey schedule
    e. Procure logistics, including supplies and transport, taking into account the number of places to be visited, the number of data collection teams, etc.
    f. Plan and conduct training courses for Pharmacists and research assistants.

2. Data collection in the field
    a. Plan the data collection visits (prepare an introduction letter, contact each location, prepare a schedule of visits)
    b. Prepare and arrange materials and equipment for data collectors;
    c. Arrangement for transport and daily contact during fieldwork
    d. Visit health facilities and gather data from team surveys
    e. Collect the data from sampled patients.
    f. Check the questionnaire at the end of the interview and address missing / unreliable details
    g. Return completed forms and/or pass electronic files to the primary researcher at the end of each day.

3. Data entry, analysis and interpretation
    a. Data were entered using the Google form
    b. Cleaning of data and processing were done in Microsoft Excel.
    c. Data were statistically analyzed in Stata/MP 13
    d. Interpretation of results were done by the primary researcher.

4. Results dissemination
    a. Draft the final report
    b. Submission to the university for checking and defense
    c. Plan and implement publication and research dissemination activities.

The full survey can usually take between 6 months and 8 months to finish, including the planning of surveys, data collection, data entry, data analysis and reporting. Further time should be allocated for dissemination and follow-up activities. This schedule should set out the time allotted for each phase of the survey process and should serve as a timetable for all survey activities.

Financial and human resources

a. Human resources

1- Primary researcher - Plans and coordinates surveys at the central (national) level. This involves planning the technological and logistical aspects of the survey, recruitment and training of survey workers, tracking data collection and data entry, performing data quality assurance and data analysis, analyzing results and preparing a survey report.

2- Research assistant_- They are responsible for visiting health facilities and gathering data with a high degree of precision. The methodology of the survey was designed to eliminate the need for a high degree of technical competence as much as possible. As far as data encoding is concerned, consistency is important to ensure the reliability of the results. Two staff members are needed because the data collector is the one responsible for entering the data and the other is responsible for re-entering the same data to verify that the entries are correct. As data is entered from paper questionnaires, double-entry is important to ensure the consistency of the data entry process.

3- Public Health Pharmacists – will provide the pharmacist led expert system intervention to patients.

b. Training and orientation of Data collectors and Pharmacists
   1. Venue
   2. Allowance and accommodation
   3. Transportation
   4. Training materials

c. Data collection
   1. Allowance and accommodation for research assistants
   2. Transportation
   3. Stationary materials (paper, pens, etc.)
   4. Photocopying
   5. Communication cost (e.g. Telephone charges)

d. Intervention
   1. Software subscriptions
   2. Software development
   3. Laptop computers
   4. Printer
   5. Ink
   6. Paper
e. Data cleaning, processing and analysis
f. Manuscript and publication fees
g. Overheads
h. Contingency and emergency funds

Technical resources

a. Laptop computers for data encoding
b. Cellphone with GPS and Internet devices
c. Back-up power bank for GPS and Internet devices
d. Data entry and analysis application
e. Pharmalasakit Expert system software
f. Printers
g. Ink
h. Paper
i. BP measurement device (Omron)
j. Tape measure
k. Weighing scale
l. Survey Forms

Estimated budget

Items	Unit Price (in THB)	Number of units	Total (in THB)
EQUIPMENTS			
Pharmacist Programmer Honoraria	6,038/project	1 project	6038
Google Workplace subscription.	129/user/month	13 users X 6 months	10062
STATA/BE 17	48USD/6months		
Intervention (printer, ink, paper)	32/patient	400	12800
MATERIALS			
Data collection tools (medical device, survey forms)	31.395/patient	400	12558
Participant token	31.395/data collection/patient	400 patients X 4 time points	50232
OTHER EXPENSES (Manpower)			

Research Assistant	9418.5/month	2 assistants X 6 months	113022
Pharmacist Honoraria	6279.665/site	10 sites	62796.65
Training allowance	313.95/person	13 participants	4081.35
Conduct of research abroad (Transportation)			
Data collection and transportation	2,512.5/trip	6 trips X 4 collection points	60,300.00
Presenting abroad			
Publication Fee, Conference Registration fee, Board and lodging and Airfare	90,000/participant	1 participant	90,000.00
Monthly expenses			
Living expenses during data collection abroad	9,000/month	8 months data collection	72,000.00
TOTAL			493,890.00 THB

Appendix Q: Ethical Clearance

SJREB FORM 6
NOTICE OF APPROVAL

Date: 14th January 2021

This is to certify that the following protocol and related documents have been granted approval by the SJREB for implementation in accordance with the International Conference on the Harmonization of Good Clinical Practice and the National Ethical Guidelines on Health and Health-related Research

SJREB Protocol No.:	SJREB-2020-92	Sponsor Protocol No.:	N/A
Coordinating Investigator:	Asst. Prof. Margarita M. Gutierrez	Sponsor:	Chulalongkorn University and University of the Philippines Research Grant
Title:	Effectiveness of A Pharmacist-Led Expert System Intervention For Medication Adherence and Blood Pressure Control of Adults With Hypertension In The Philippines: A Randomized Controlled Trial		
Protocol Version No.:	Version 1	Version Date:	December 3, 2020
ICF Version No.:	Version 1	Version Date:	December 3, 2020
Other Documents:	N/A		
Members of research team:	Dr. Rungpetch C. Sakulbumrungsil, Dean of Chulalongkorn University		
Study sites:	10 barangay health units with active hypertension clubs are targeted (5 from NCR and 5 from Region IV)		

Type of Review:	/ Expedited Full Board Meeting date: December 16, 2020	Duration of Approval From – To *(date)* January 14, 2021 to January 14, 2022	Frequency of continuing review Annual

SJREB Chair	Signature	Date
Dr. Jacinto Blas Mantaring III		18 Jan 2021

Investigator Responsibilities after Approval:

- Submit country protocol amendments to the SJREB and site REC for approval before implementing them;
- Submit site-specific amendments to site REC for approval before implementing them;
- Submit annual report for renewal of approval to SJREB;
- Submit SAE and SUSAR reports to the site REC within 7 days;
- Submit progress report every 12 months;
- Submit final report after completion of protocol procedures at the study site;
- Report protocol deviation/violation to the REC study sites;
- Comply with all relevant international and national guidelines and regulations; and
- Abide by the principles of good clinical practice and ethical research
- Informed consent will be obtained from the participants; and,
- The study will comply with the Philippine Data Privacy Act of 2012.

Appendix R: Stata Result of Models

```
Random-effects GLS regression                   Number of obs     =      1,602
Group variable: PatientCod~r                    Number of groups  =        413

R-squared:                                      Obs per group:
     Within  = 0.0087                                         min =          1
     Between = 0.1819                                         avg =        3.9
     Overall = 0.1056                                         max =          4

                                                Wald chi2(17)     =      99.49
corr(u_i, X) = 0 (assumed)                      Prob > chi2       =     0.0000
```

MPR	Coefficient	Std. err.	z	P>|z|	[95% conf.	interval]
Intervention	.1141549	.0125231	9.12	0.000	.08961	.1386997
Age	.00027	.0006052	0.45	0.656	-.0009162	.0014561
SexMale	-.0105424	.0134414	-0.78	0.433	-.036887	.0158022
Primaryeduc	-.0123171	.0631161	-0.20	0.845	-.1360224	.1113882
LowerSecondaryeducation	-.0200336	.0633379	-0.32	0.752	-.1441736	.1041065
UpperSecondaryEducation	.0102353	.0629506	0.16	0.871	-.1131455	.1336161
Postsecondaryontertiaryeduca	-.0127389	.0671942	-0.19	0.850	-.1444372	.1189593
ShortCycleTertiaryEducation	.0040347	.0672827	0.06	0.952	-.1278369	.1359063
BachelorLevelEducation	-.0217241	.0627606	-0.35	0.729	-.1447326	.1012844
EmployedMeron100	.002828	.0120657	0.23	0.815	-.0208203	.0264764
PHP9520	.0444094	.0338137	1.31	0.189	-.0218642	.1106831
PHP9520toPHP19040	.0634472	.0335166	1.89	0.058	-.0022441	.1291385
PHP9520toPHP19040	0	(omitted)				
FHRHigh100	-.0258259	.0304623	-0.85	0.397	-.085531	.0338792
Support	.0128118	.0109104	1.17	0.240	-.0085722	.0341958
Takenmorethanonceaday11	.0193854	.0233232	0.83	0.406	-.0263271	.065098
PercivedAdherenceyes1No0	.0128275	.0153276	0.84	0.403	-.0172141	.0428691
PerceivedKnowledge	.0042898	.002125	2.02	0.044	.0001249	.0084548
_cons	.6367475	.0763906	8.34	0.000	.4870247	.7864703
sigma_u	.10284859					
sigma_e	.139916					
rho	.35078998	(fraction of variance due to u_i)				

```
Fitting comparison model:

Iteration 0:   log likelihood = -1083.6607
Iteration 1:   log likelihood = -1005.2722
Iteration 2:   log likelihood =  -1004.821
Iteration 3:   log likelihood = -1004.8209
Iteration 4:   log likelihood = -1004.8209

Fitting full model:

tau =  0.0     log likelihood = -1004.8209
tau =  0.1     log likelihood = -991.64802
tau =  0.2     log likelihood = -979.64438
tau =  0.3     log likelihood = -968.95699
tau =  0.4     log likelihood = -959.82397
tau =  0.5     log likelihood = -952.67233
tau =  0.6     log likelihood = -948.32274
tau =  0.7     log likelihood = -948.52671

Iteration 0:   log likelihood = -948.32963
Iteration 1:   log likelihood = -943.83476
Iteration 2:   log likelihood = -943.81707
Iteration 3:   log likelihood = -943.81707

Random-effects logistic regression              Number of obs     =      1,602
Group variable: PatientCodeNum~r                Number of groups  =        413

Random effects u_i ~ Gaussian                   Obs per group:
                                                              min =          1
                                                              avg =        3.9
                                                              max =          4

Integration method: mvaghermite                 Integration pts.  =         12

                                                Wald chi2(17)     =      78.43
Log likelihood = -943.81707                     Prob > chi2       =     0.0000
```

MedicationAdhere~1100	Odds ratio	Std. err.	z	P>|z|	[95% conf.	interval]
Intervention	5.304087	1.073924	8.24	0.000	3.566704	7.88777
Age	1.004089	.0095581	0.43	0.668	.9855296	1.022999
SexMale	.8332416	.176256	-0.86	0.388	.5504475	1.261322
Primaryeduc	.5751791	.5643882	-0.56	0.573	.0840564	3.935821
LowerSecondaryeduca~n	.5503579	.5433855	-0.60	0.545	.0794744	3.811211
UpperSecondaryEduca~n	.8617358	.844601	-0.15	0.879	.1262112	5.883698
Postsecondaryontert~a	.7716955	.8130904	-0.25	0.806	.0978554	6.085654
ShortCycleTertiaryE~n	1.01869	1.076339	0.02	0.986	.128431	8.080049
BachelorLevelEducat~n	.4926997	.4804554	-0.73	0.468	.0728676	3.331427
EmployedMeron100	1.11363	.2197454	0.55	0.585	.7564474	1.639468
PHP9520	1.116614	.6300992	0.20	0.845	.3694659	3.374671
PHP9520toPHP19040	1.062621	.592315	0.11	0.913	.3563778	3.168445
PHP9520toPHP19040	1	(omitted)				
FHRHigh100	1.242132	.6352885	0.42	0.672	.4558485	3.384658
Support	1.266752	.2335569	1.28	0.200	.8825748	1.818157
Takenmorethanoncea~11	1.205223	.4586296	0.49	0.624	.5716834	2.540853
PercivedAdherenceye~0	1.342102	.3482161	1.13	0.257	.8071163	2.231694
PerceivedKnowledge	1.056946	.0379501	1.54	0.123	.9851216	1.134006
_cons	.2810288	.3384145	-1.05	0.292	.0265299	2.976917
/lnsig2u	.7163747	.1793557			.364844	1.067905
sigma_u	1.430734	.1283051			1.200121	1.705661
rho	.3835582	.0424071			.3044908	.4693031

```
Note: Estimates are transformed only in the first equation to odds ratios.
Note: _cons estimates baseline odds (conditional on zero random effects).
LR test of rho=0: chibar2(01) = 122.01                  Prob >= chibar2 = 0.000
```

Random-effects GLS regression — Number of obs = 1,600
Group variable: PatientCod~r — Number of groups = 413

R-squared:
Within = 0.0283
Between = 0.0416
Overall = 0.0359

Obs per group:
min = 1
avg = 3.9
max = 4

Wald chi2(13) = 51.83
corr(u_i, X) = 0 (assumed) — Prob > chi2 = 0.0000

SystolicAve	Coefficient	Std. err.	z	P>|z|	[95% conf.	interval]
Intervention	.1810237	1.61497	0.11	0.911	-2.98426	3.346308
MPR	-8.660081	2.55424	-3.39	0.001	-13.6663	-3.653863
Age	.1276072	.0723232	1.76	0.078	-.0141437	.2693581
SexMale	-.2605678	1.678054	-0.16	0.877	-3.549493	3.028358
BMI	-.0435119	.0578881	-0.75	0.452	-.1569705	.0699467
FHRHigh100	-1.678017	2.308815	-0.73	0.467	-6.20321	2.847176
Alcohol	2.259727	1.866038	1.21	0.226	-1.397641	5.917096
Smoking	3.494969	2.349369	1.49	0.137	-1.109709	8.099648
FamHis	-1.755443	1.459164	-1.20	0.229	-4.615352	1.104467
Salt	-.9048875	.9903102	-0.91	0.361	-2.84586	1.036085
Exercise	3.564536	1.059386	3.36	0.001	1.488177	5.640895
Support	-1.088833	1.145756	-0.95	0.342	-3.334474	1.156808
PerceivedKnowledge	-.6263422	.2096828	-2.99	0.003	-1.037313	-.2153715
_cons	143.2674	5.772609	24.82	0.000	131.9533	154.5816
sigma_u	14.349854					
sigma_e	13.393882					
rho	.53441637	(fraction of variance due to u_i)				

Random-effects GLS regression — Number of obs = 1,600
Group variable: PatientCod~r — Number of groups = 413

R-squared:
Within = 0.0035
Between = 0.0761
Overall = 0.0497

Obs per group:
min = 1
avg = 3.9
max = 4

Wald chi2(13) = 37.24
corr(u_i, X) = 0 (assumed) — Prob > chi2 = 0.0004

DiastolicAve	Coefficient	Std. err.	z	P>|z|	[95% conf.	interval]
Intervention	.3170533	.8293253	0.38	0.702	-1.308394	1.942501
MPR	-2.01184	1.464319	-1.37	0.169	-4.881853	.858172
Age	-.1576425	.0371109	-4.25	0.000	-.2303784	-.0849066
SexMale	1.403165	.87234	1.61	0.108	-.3065904	3.11292
BMI	.0154801	.0331782	0.47	0.641	-.0495479	.0805082
FHRHigh100	.1514887	1.24186	0.12	0.903	-2.282513	2.58549
Alcohol	1.521512	1.048759	1.45	0.147	-.5340176	3.577041
Smoking	-.4935816	1.269498	-0.39	0.697	-2.981753	1.99459
FamHis	-.5368365	.8242178	-0.65	0.515	-2.152274	1.078601
Salt	.2825449	.5623244	0.50	0.615	-.8195906	1.38468
Exercise	-.6196706	.5942236	-1.04	0.297	-1.784327	.5449862
Support	-.3017945	.6459009	-0.47	0.640	-1.567737	.964148
PerceivedKnowledge	-.2647164	.1191262	-2.22	0.026	-.4981995	-.0312334
_cons	98.5268	3.105045	31.73	0.000	92.44103	104.6126
sigma_u	7.0338773					
sigma_e	7.8419332					
rho	.44583968	(fraction of variance due to u_i)				

Fitting comparison model:

Iteration 0: log likelihood = -1105.3877
Iteration 1: log likelihood = -1066.209
Iteration 2: log likelihood = -1064.9086
Iteration 3: log likelihood = -1064.9072
Iteration 4: log likelihood = -1064.9072

Fitting full model:

tau = 0.0 log likelihood = -1064.9072
tau = 0.1 log likelihood = -1040.5447
tau = 0.2 log likelihood = -1017.1752
tau = 0.3 log likelihood = -994.75338
tau = 0.4 log likelihood = -973.28609
tau = 0.5 log likelihood = -952.8917
tau = 0.6 log likelihood = -933.92871
tau = 0.7 log likelihood = -917.33528
tau = 0.8 log likelihood = -905.79134

Iteration 0: log likelihood = -917.36192
Iteration 1: log likelihood = -898.6735
Iteration 2: log likelihood = -897.64558
Iteration 3: log likelihood = -897.64036
Iteration 4: log likelihood = -897.64035

Random-effects logistic regression Number of obs = 1,600
Group variable: PatientCodeNum~r Number of groups = 413

Random effects u_i ~ Gaussian

Obs per group:
min = 1
avg = 3.9
max = 4

Integration method: **mvaghermite**

Integration pts. = 12

Wald chi2(13) = 56.09
Log likelihood = -897.64035 Prob > chi2 = 0.0000

Controll~1100	Odds ratio	Std. err.	z	P>|z|	[95% conf.	interval]
Intervention	.6694416	.1977644	-1.36	0.174	.3751918	1.194461
Medicati~1100	2.532933	.4812462	4.89	0.000	1.745417	3.67577
Age	.9981974	.013243	-0.14	0.892	.9725761	1.024494
SexMale	.6144109	.1905546	-1.57	0.116	.3345536	1.128372
BMI	.9399201	.0242289	-2.40	0.016	.8936121	.9886279
FHRHigh100	1.259467	.566002	0.51	0.608	.5219856	3.038891
Alcohol	.8251853	.3168508	-0.50	0.617	.3887864	1.751427
Smoking	.5223923	.2395584	-1.42	0.157	.212644	1.283336
FamHis	.6700768	.1994826	-1.34	0.179	.3738703	1.200959
Salt	.9485555	.1881612	-0.27	0.790	.6430034	1.399304
Exercise	.7883364	.1670597	-1.12	0.262	.5203912	1.194245
Support	.8724095	.1974298	-0.60	0.546	.5598736	1.359411
PerceivedKn~e	1.207647	.0526971	4.32	0.000	1.108656	1.315477
_cons	1.363759	1.758252	0.24	0.810	.1089708	17.06732
/lnsig2u	1.758533	.1573274			1.450177	2.066889
sigma_u	2.409132	.1895112			2.064914	2.810731
rho	.6382289	.0363258			.5644714	.7060012

Note: Estimates are transformed only in the first equation to odds ratios.
Note: **_cons** estimates baseline odds (conditional on zero random effects).
LR test of rho=0: chibar2(01) = 334.53 Prob >= chibar2 = 0.000

Appendix S: Correlation Tables

Model 1: MPR

Correlation matrix of coefficients of **xtreg** model

e(V)	Interv~n	Age	SexMale	Primar~c	LowerS~n	UpperS~n	Postse~a	ShortC~n	Bachel~n	Empl~100	PHP9520	PH~19040	FHRH~100
Intervention	1.0000												
Age	-0.0753	1.0000											
SexMale	-0.1042	-0.1052	1.0000										
Primaryeduc	-0.0504	0.0077	0.0233	1.0000									
LowerSecon~n	-0.0652	0.0445	0.0411	0.9576	1.0000								
UpperSecon~n	-0.0609	0.0699	0.0142	0.9603	0.9605	1.0000							
Postsecond~a	-0.0367	0.0424	-0.0257	0.8963	0.8953	0.9022	1.0000						
ShortCycle~n	-0.0406	0.0663	0.0221	0.8970	0.8974	0.9033	0.8473	1.0000					
BachelorLe~n	-0.0481	0.0479	0.0133	0.9520	0.9509	0.9576	0.8990	0.9000	1.0000				
Employed~100	-0.0392	0.2120	-0.0887	0.0169	0.0027	0.0058	-0.0285	0.0140	-0.0120	1.0000			
PHP9520	0.0222	-0.0479	-0.0125	-0.0742	-0.0797	-0.0756	-0.0326	-0.0585	-0.0385	0.0696	1.0000		
PHP952~19040	0.0403	0.0227	-0.0531	-0.0740	-0.0869	-0.0809	-0.0398	-0.0743	-0.0633	0.0229	0.9061	1.0000	
FHRHigh100	0.0084	-0.0035	0.0043	-0.0446	-0.0461	-0.0398	-0.0674	-0.0398	-0.0265	0.0204	-0.7269	-0.6897	1.0000
Support	-0.0190	-0.0019	0.0191	-0.0130	-0.0205	-0.0016	0.0210	0.0043	0.0185	0.0074	0.0158	0.0258	0.0141
Takenmore~11	-0.0080	-0.0147	0.0624	-0.0244	-0.0222	-0.0132	-0.0052	-0.0025	-0.0216	-0.0011	0.0247	0.0303	-0.0310
PercivedAd~0	0.0355	-0.0578	0.0326	0.0197	0.0111	0.0141	0.0198	0.0337	0.0181	0.1153	0.0149	-0.0170	0.0191
PerceivedK~e	0.0277	0.0065	-0.0648	0.0385	0.0258	0.0181	0.0331	0.0080	0.0047	0.1952	0.1202	0.0987	-0.0751
_cons	-0.0198	-0.4710	0.0025	-0.7554	-0.7608	-0.7811	-0.7276	-0.7392	-0.7842	-0.2543	-0.0950	-0.0991	-0.0271

e(V)	Support	Taken~11	Perciv~0	Percei~e	_cons
Support	1.0000				
Takenmore~11	-0.0359	1.0000			
PercivedAd~0	-0.0026	-0.0324	1.0000		
PerceivedK~e	-0.0602	-0.0071	-0.2163	1.0000	
_cons	-0.1020	0.0147	-0.1445	-0.2113	1.0000

Model 2: Medication Adherence

Correlation matrix of coefficients of **xtlogit** model

e(V)	Med~1100 Interv~n	Age	SexMale	Primar~c	LowerS~n	UpperS~n	Postse~a	ShortC~n	Bachel~n	Empl~100	PHP9520	PH~19040	FHRH~100
Medicat~1100													
Intervention	1.0000												
Age	-0.0645	1.0000											
SexMale	-0.1232	-0.1086	1.0000										
Primaryeduc	-0.0455	0.0087	0.0224	1.0000									
LowerSecon~n	-0.0641	0.0455	0.0428	0.9559	1.0000								
UpperSecon~n	-0.0481	0.0717	0.0168	0.9591	0.9576	1.0000							
Postsecond~a	-0.0251	0.0432	-0.0274	0.8889	0.8851	0.8936	1.0000						
ShortCycle~n	-0.0260	0.0683	0.0238	0.8879	0.8862	0.8932	0.8312	1.0000					
BachelorLe~n	-0.0469	0.0489	0.0158	0.9513	0.9489	0.9560	0.8895	0.8890	1.0000				
Employed~100	-0.0379	0.2244	-0.0796	0.0196	0.0096	0.0117	-0.0254	0.0254	-0.0082	1.0000			
PHP9520	0.0277	-0.0567	-0.0054	-0.0747	-0.0809	-0.0789	-0.0300	-0.0569	-0.0426	0.0761	1.0000		
PHP952~19040	0.0497	0.0124	-0.0518	-0.0743	-0.0884	-0.0836	-0.0360	-0.0722	-0.0670	0.0271	0.9097	1.0000	
FHRHigh100	0.0121	0.0029	-0.0065	-0.0438	-0.0448	-0.0360	-0.0703	-0.0391	-0.0236	0.0113	-0.7517	-0.7141	1.0000
Support	0.0179	0.0060	0.0142	-0.0109	-0.0230	0.0039	0.0309	0.0131	0.0225	0.0043	0.0193	0.0326	0.0116
Takenmore~11	-0.0264	-0.0198	0.0753	-0.0264	-0.0249	-0.0181	-0.0120	-0.0050	-0.0248	0.0163	0.0297	0.0333	-0.0322
PercivedAd~0	0.0459	-0.0641	0.0332	0.0216	0.0151	0.0142	0.0193	0.0421	0.0188	0.1249	0.0111	-0.0237	0.0206
PerceivedK~e	0.0735	0.0091	-0.0765	0.0384	0.0232	0.0190	0.0411	0.0122	0.0006	0.1839	0.1264	0.1102	-0.0817
_cons	-0.0483	-0.4698	0.0083	-0.7439	-0.7470	-0.7699	-0.7134	-0.7269	-0.7715	-0.2716	-0.0918	-0.0958	-0.0243
/ lnsig2u	0.2524	0.0205	-0.0640	0.0061	-0.0059	0.0251	0.0344	0.0245	-0.0019	-0.0304	-0.0169	0.0088	0.0239

e(V)	Med~1100 Support	Taken~11	Perciv~0	Percei~e	_cons	/ lnsig2u
Medicat~1100						
Support	1.0000					
Takenmore~11	-0.0559	1.0000				
PercivedAd~0	0.0021	-0.0258	1.0000			
PerceivedK~e	-0.0340	-0.0053	-0.1974	1.0000		
_cons	-0.1240	0.0174	-0.1586	-0.2329	1.0000	
/ lnsig2u	0.0823	-0.0810	-0.0025	0.0974	-0.0574	1.0000

Model 3: SBP

Correlation matrix of coefficients of xtreg model

e(V)	Interv~n	MPR	Age	SexMale	BMI	FHRH~100	Alcohol	Smoking	FamHis	Salt	Exercise	Support	Percei~e
Intervention	1.0000												
MPR	-0.1786	1.0000											
Age	-0.0580	-0.0002	1.0000										
SexMale	-0.0935	0.0182	-0.0691	1.0000									
BMI	0.0101	-0.0165	0.0687	0.0108	1.0000								
FHRHigh100	0.0249	-0.0102	-0.0776	0.0156	0.0579	1.0000							
Alcohol	0.0291	-0.0008	0.0603	-0.1361	-0.0204	-0.0217	1.0000						
Smoking	-0.0413	-0.0188	-0.0225	-0.1523	-0.0089	0.0098	-0.1080	1.0000					
FamHis	0.0091	-0.0137	0.0298	0.0049	0.0001	-0.0389	-0.0453	0.0141	1.0000				
Salt	0.0334	0.0044	0.1567	-0.0732	0.0587	-0.0107	-0.0712	0.0170	0.0026	1.0000			
Exercise	0.0151	-0.0460	-0.0345	0.0041	0.0155	-0.0154	-0.0280	-0.0380	0.1140	0.0161	1.0000		
Support	-0.0157	-0.0337	-0.0188	0.0297	0.0420	0.0059	0.0666	0.0049	-0.0115	0.0164	0.0356	1.0000	
PerceivedK~e	0.0496	-0.0646	-0.0158	-0.0577	-0.0053	0.0255	0.0687	0.0726	-0.0838	0.0665	0.0787	-0.0652	1.0000
_cons	-0.0600	-0.2799	-0.7060	-0.0185	-0.3391	-0.3219	-0.0565	-0.0110	-0.2109	-0.2315	-0.1184	-0.1226	-0.2322

e(V)	_cons
_cons	1.0000

Model 4: DBP

Correlation matrix of coefficients of xtreg model

e(V)	Interv~n	MPR	Age	SexMale	BMI	FHRH~100	Alcohol	Smoking	FamHis	Salt	Exercise	Support	Percei~e
Intervention	1.0000												
MPR	-0.1993	1.0000											
Age	-0.0562	0.0005	1.0000										
SexMale	-0.0958	0.0192	-0.0720	1.0000									
BMI	0.0117	-0.0172	0.0752	0.0124	1.0000								
FHRHigh100	0.0260	-0.0115	-0.0803	0.0160	0.0686	1.0000							
Alcohol	0.0321	-0.0041	0.0649	-0.1504	-0.0195	-0.0243	1.0000						
Smoking	-0.0428	-0.0203	-0.0258	-0.1608	-0.0099	0.0154	-0.1104	1.0000					
FamHis	0.0107	-0.0138	0.0336	0.0065	-0.0004	-0.0410	-0.0420	0.0158	1.0000				
Salt	0.0368	0.0055	0.1715	-0.0736	0.0546	-0.0084	-0.0793	0.0113	0.0034	1.0000			
Exercise	0.0169	-0.0480	-0.0372	0.0014	0.0172	-0.0113	-0.0272	-0.0368	0.1113	0.0177	1.0000		
Support	-0.0175	-0.0332	-0.0201	0.0282	0.0406	0.0079	0.0749	0.0127	-0.0177	0.0111	0.0355	1.0000	
PerceivedK~e	0.0549	-0.0630	-0.0167	-0.0669	-0.0007	0.0323	0.0610	0.0773	-0.0815	0.0621	0.0766	-0.0543	1.0000
_cons	-0.0492	-0.2991	-0.6778	-0.0129	-0.3632	-0.3281	-0.0557	-0.0135	-0.2214	-0.2419	-0.1244	-0.1305	-0.2506

e(V)	_cons
_cons	1.0000

Model 5: Controlled Blood Pressure

e(V)	Con~1100 Interv~n	Med~1100	Age	SexMale	BMI	FHRH~100	Alcohol	Smoking	FamHis	Salt	Exercise	Support	Percei~e
Control~1100													
Intervention	**1.0000**												
Medicat~1100	**-0.1933**	**1.0000**											
Age	**-0.0471**	**-0.0039**	**1.0000**										
SexMale	**-0.1069**	**0.0102**	**-0.0699**	**1.0000**									
BMI	**0.0456**	**-0.0406**	**0.1430**	**0.0589**	**1.0000**								
FHRHigh100	**0.0244**	**-0.0110**	**-0.0639**	**0.0169**	**0.0788**	**1.0000**							
Alcohol	**0.0467**	**-0.0239**	**0.0469**	**-0.1481**	**-0.0395**	**-0.0187**	**1.0000**						
Smoking	**-0.0376**	**-0.0086**	**-0.0153**	**-0.1573**	**0.0407**	**0.0110**	**-0.1177**	**1.0000**					
FamHis	**0.0128**	**-0.0134**	**0.0293**	**0.0128**	**-0.0003**	**-0.0397**	**-0.0516**	**0.0096**	**1.0000**				
Salt	**0.0302**	**0.0186**	**0.1657**	**-0.0804**	**0.0125**	**-0.0052**	**-0.1031**	**0.0235**	**-0.0087**	**1.0000**			
Exercise	**0.0209**	**-0.0593**	**-0.0301**	**0.0095**	**0.0600**	**-0.0219**	**-0.0471**	**-0.0186**	**0.1257**	**0.0095**	**1.0000**		
Support	**-0.0163**	**-0.0318**	**-0.0090**	**0.0206**	**0.0227**	**0.0133**	**0.0701**	**0.0224**	**-0.0070**	**0.0128**	**0.0263**	**1.0000**	
PerceivedK~e	**0.0389**	**0.0049**	**-0.0151**	**-0.0729**	**0.0230**	**0.0586**	**0.0631**	**0.0311**	**-0.0999**	**0.0611**	**0.0409**	**-0.0669**	**1.0000**
_cons	**-0.1085**	**-0.0300**	**-0.6459**	**-0.0315**	**-0.6468**	**-0.3313**	**-0.0177**	**-0.0368**	**-0.1916**	**-0.1944**	**-0.1366**	**-0.1248**	**-0.2547**
/													
lnsig2u	**-0.0368**	**0.1603**	**0.0183**	**-0.0403**	**-0.0708**	**0.0877**	**-0.0256**	**-0.0867**	**-0.0294**	**0.0539**	**-0.1051**	**0.0010**	**0.1438**

e(V)	Con~1100 _cons	/ lnsig2u
Control~1100		
_cons	**1.0000**	
/		
lnsig2u	**-0.0425**	**1.0000**

Appendix T: Repeated Measures ANOVA

Model 1: MPR

```
. anova MPR PatientCodeNumber Datacollectiontimepoint, repeated(Datacollectiontimepoint) grouping(Intervention)

                           Number of obs =      1,623    R-squared     =  0.6055
                           Root MSE      =   .130746    Adj R-squared =  0.4689

                  Source | Partial SS         df         MS         F     Prob>F
              -----------+----------------------------------------------------
                   Model |  31.611074        417   .07580593       4.43   0.0000
                         |
              PatientCo~r |   28.21921        414   .06816234       3.99   0.0000
              Datacolle~t |  3.1279353          3  1.0426451      60.99   0.0000
                         |
                Residual |  20.598814      1,205   .01709445
              -----------+----------------------------------------------------
                   Total |  52.209888      1,622   .03218859

Between-subjects error term:  PatientCo~r
                     Levels:  415       (414 df)
    Lowest b.s.e. variable:  PatientCo~r
    Covariance pooled over:  Intervention  (for repeated variable)

Repeated variable: Datacolle~t
                                        Huynh-Feldt epsilon        =  0.8639
                                        Greenhouse-Geisser epsilon =  0.8580
                                        Box's conservative epsilon =  0.3333

                                                  ------------ Prob > F ------------
                  Source |     df       F      Regular     H-F       G-G       Box
              -----------+----------------------------------------------------------
              Datacolle~t |      3    60.99     0.0000    0.0000    0.0000    0.0000
```

```
-> Intervention = 0

                           Number of obs =       790    R-squared     =  0.5495
                           Root MSE      =   .136536    Adj R-squared =  0.3924

                  Source | Partial SS         df         MS         F     Prob>F
              -----------+----------------------------------------------------
                   Model |  13.300496        204   .06519851       3.50   0.0000
                         |
              PatientCo~r |   13.26349        201   .06598751       3.54   0.0000
              Datacolle~t |  .01530297          3   .00510099       0.27   0.8444
                         |
                Residual |  10.905641        585   .01864212
              -----------+----------------------------------------------------
                   Total |  24.206137        789   .03067951

Between-subjects error term:  PatientCo~r
                     Levels:  202       (201 df)
    Lowest b.s.e. variable:  PatientCo~r

Repeated variable: Datacolle~t
                                        Huynh-Feldt epsilon        =  0.9665
                                        Greenhouse-Geisser epsilon =  0.9513
                                        Box's conservative epsilon =  0.3333

                                                  ------------ Prob > F ------------
                  Source |     df       F      Regular     H-F       G-G       Box
              -----------+----------------------------------------------------------
              Datacolle~t |      3     0.27     0.8444    0.8379    0.8348    0.6015
```

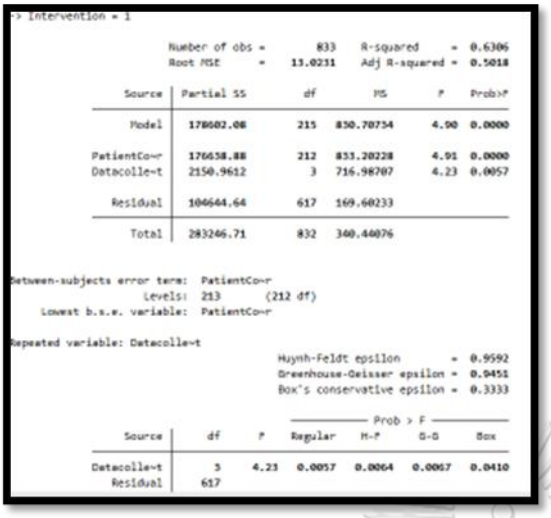
```
-> Intervention = 1

                    Number of obs =       833    R-squared     =  0.6923
                    Root MSE      =    .10714    Adj R-squared =  0.5851

------------------------------------------------------------------------------
      Source | Partial SS      df       MS          F     Prob>F
-------------+----------------------------------------------------------------
       Model |  15.938644     215  .07413323       6.46  0.0000
             |
PatientCo~r |  10.050229     212  .04740674       4.13  0.0000
Datacolle~t |  5.7233012       3  1.9077671     166.20  0.0000
             |
    Residual |  7.0825043     617  .01147894
-------------+----------------------------------------------------------------
       Total |  23.021148     832  .02766965
------------------------------------------------------------------------------

Between-subjects error term:  PatientCo~r
                     Levels:  213       (212 df)
   Lowest b.s.e. variable:  PatientCo~r

Repeated variable: Datacolle~t
                                  Huynh-Feldt epsilon        =  0.6777
                                  Greenhouse-Geisser epsilon =  0.6712
                                  Box's conservative epsilon =  0.3333

                                           ---- Prob > F ----
      Source |  df      F     Regular     H-F       G-G       Box
-------------+----------------------------------------------------------------
Datacolle~t |    3   166.20    0.0000    0.0000    0.0000    0.0000
    Residual |  617
------------------------------------------------------------------------------
```

Model 3: SBP

```
                    Number of obs =     1,625    R-squared     =  0.6807
                    Root MSE      =   13.0993    Adj R-squared =  0.5703

------------------------------------------------------------------------------
      Source | Partial SS      df       MS          F     Prob>F
-------------+----------------------------------------------------------------
       Model |  440882.57     417  1057.2723       6.16  0.0000
             |
PatientCo~r |  428341.08     414  1034.6403       6.03  0.0000
Datacolle~t |  12616.011       3  4205.337       24.51  0.0000
             |
    Residual |  206769.12   1,205  171.59263
-------------+----------------------------------------------------------------
       Total |  647651.69   1,622  399.29284
------------------------------------------------------------------------------

Between-subjects error term:  PatientCo~r
                     Levels:  415       (414 df)
   Lowest b.s.e. variable:  PatientCo~r
   Covariance pooled over:  Intervention  (for repeated variable)

Repeated variable: Datacolle~t
                                  Huynh-Feldt epsilon        =  0.9623
                                  Greenhouse-Geisser epsilon =  0.9549
                                  Box's conservative epsilon =  0.3333

                                           ---- Prob > F ----
      Source |  df      F     Regular     H-F       G-G       Box
-------------+----------------------------------------------------------------
Datacolle~t |    3    24.51    0.0000    0.0000    0.0000    0.0000
    Residual | 1205
------------------------------------------------------------------------------
```

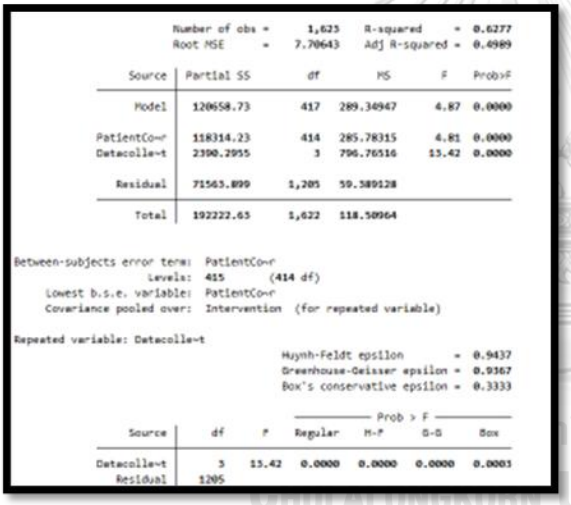


```
-> Intervention = 0

                    Number of obs =       790    R-squared     =  0.7269
                    Root MSE      =   13.0432    Adj R-squared =  0.6317

------------------------------------------------------------------------------
      Source | Partial SS      df       MS          F     Prob>F
-------------+----------------------------------------------------------------
       Model |  264881.84     204  1298.4404       7.63  0.0000
             |
PatientCo~r |  251329.75     201  1250.3967       7.35  0.0000
Datacolle~t |  13066.507       3  4355.5023      25.60  0.0000
             |
    Residual |  99523.028     585  170.12483
-------------+----------------------------------------------------------------
       Total |  364404.86     789  461.85661
------------------------------------------------------------------------------

Between-subjects error term:  PatientCo~r
                     Levels:  202       (201 df)
   Lowest b.s.e. variable:  PatientCo~r

Repeated variable: Datacolle~t
                                  Huynh-Feldt epsilon        =  0.9492
                                  Greenhouse-Geisser epsilon =  0.9346
                                  Box's conservative epsilon =  0.3333

                                           ---- Prob > F ----
      Source |  df      F     Regular     H-F       G-G       Box
-------------+----------------------------------------------------------------
Datacolle~t |    3    25.60    0.0000    0.0000    0.0000    0.0000
    Residual |  585
------------------------------------------------------------------------------
```

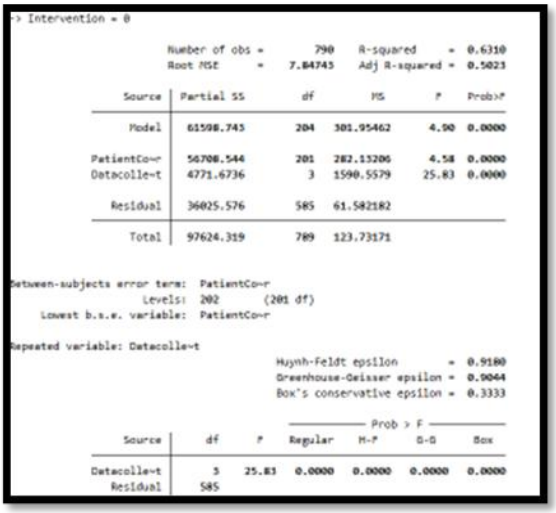


```
-> Intervention = 1

                    Number of obs =       833   R-squared     =  0.6306
                    Root MSE      =   13.0231   Adj R-squared =  0.5018

------------------------------------------------------------------------------
      Source | Partial SS      df       MS      F     Prob>F
-------------+----------------------------------------------------------------
       Model |  178602.08     215   830.70754     4.90   0.0000
             |
PatientCo~r |  176658.88     212   833.20228     4.91   0.0000
Datacolle~t |  2150.9612       3   716.98707     4.23   0.0057
             |
    Residual |  104644.64     617   169.60233
-------------+----------------------------------------------------------------
       Total |  283246.71     832   340.44076
------------------------------------------------------------------------------

Between-subjects error term:  PatientCo~r
                     Levels:  213      (212 df)
   Lowest b.s.e. variable:  PatientCo~r

Repeated variable: Datacolle~t
                                   Huynh-Feldt epsilon        =  0.9592
                                   Greenhouse-Geisser epsilon =  0.9451
                                   Box's conservative epsilon =  0.3333

                                              ---- Prob > F ----
      Source |  df      F     Regular    H-F      G-G      Box
-------------+----------------------------------------------------------------
Datacolle~t |    3    4.23    0.0057   0.0064   0.0067   0.0410
    Residual |  617
------------------------------------------------------------------------------
```

Model 4: Diastolic BP



```
                    Number of obs =     1,623   R-squared     =  0.6277
                    Root MSE      =   7.70643   Adj R-squared =  0.4989

------------------------------------------------------------------------------
      Source | Partial SS      df       MS      F     Prob>F
-------------+----------------------------------------------------------------
       Model |  120658.73     417   289.34947     4.87   0.0000
             |
PatientCo~r |  118314.23     414   285.78315     4.81   0.0000
Datacolle~t |  2390.2955       3   796.76516    13.42   0.0000
             |
    Residual |  71563.899   1,205   59.389128
-------------+----------------------------------------------------------------
       Total |  192222.63   1,622   118.50964
------------------------------------------------------------------------------

Between-subjects error term:  PatientCo~r
                     Levels:  415      (414 df)
   Lowest b.s.e. variable:  PatientCo~r
   Covariance pooled over:  Intervention  (for repeated variable)

Repeated variable: Datacolle~t
                                   Huynh-Feldt epsilon        =  0.9437
                                   Greenhouse-Geisser epsilon =  0.9367
                                   Box's conservative epsilon =  0.3333

                                              ---- Prob > F ----
      Source |  df      F     Regular    H-F      G-G      Box
-------------+----------------------------------------------------------------
Datacolle~t |    3   13.42    0.0000   0.0000   0.0000   0.0003
    Residual | 1205
------------------------------------------------------------------------------
```

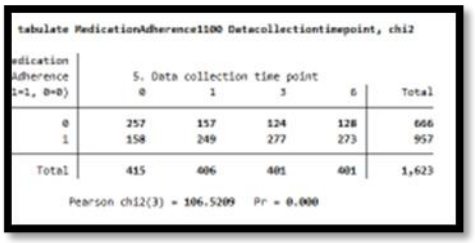


```
-> Intervention = 0

                    Number of obs =       790   R-squared     =  0.6310
                    Root MSE      =   7.84745   Adj R-squared =  0.5023

------------------------------------------------------------------------------
      Source | Partial SS      df       MS      F     Prob>F
-------------+----------------------------------------------------------------
       Model |  61598.745     204   301.95462     4.90   0.0000
             |
PatientCo~r |  56708.544     201   282.13206     4.58   0.0000
Datacolle~t |  4771.6736       3   1590.5579    25.83   0.0000
             |
    Residual |  36025.576     585   61.582182
-------------+----------------------------------------------------------------
       Total |  97624.319     789   123.73171
------------------------------------------------------------------------------

Between-subjects error term:  PatientCo~r
                     Levels:  202      (201 df)
   Lowest b.s.e. variable:  PatientCo~r

Repeated variable: Datacolle~t
                                   Huynh-Feldt epsilon        =  0.9180
                                   Greenhouse-Geisser epsilon =  0.9044
                                   Box's conservative epsilon =  0.3333

                                              ---- Prob > F ----
      Source |  df      F     Regular    H-F      G-G      Box
-------------+----------------------------------------------------------------
Datacolle~t |    3   25.83    0.0000   0.0000   0.0000   0.0000
    Residual |  585
------------------------------------------------------------------------------
```

```
-> Intervention = 1

                    Number of obs =       833   R-squared     =  0.6502
                    Root MSE      =   7.32299   Adj R-squared =  0.5282

                Source | Partial SS         df         MS        F     Prob>F
            -----------+----------------------------------------------------
                 Model |  61489.568        215    285.99799     5.33   0.0000
                       |
            PatientCo~r |  61420.567        212    289.71965     5.40   0.0000
            Datacolle~t |  69.616035          3    23.205345     0.43   0.7296
                       |
              Residual |  33087.328        617     53.62614
            -----------+----------------------------------------------------
                 Total |  94576.896        832    113.67415


Between-subjects error term:  PatientCo~r
                     Levels:  213       (212 df)
         Lowest b.s.e. variable:  PatientCo~r

Repeated variable: Datacolle~t
                                        Huynh-Feldt epsilon        =  0.9749
                                        Greenhouse-Geisser epsilon =  0.9603
                                        Box's conservative epsilon =  0.3333

                                                    ---------- Prob > F ----------
                Source |  df      F     Regular     H-F       G-G       Box
            -----------+----------------------------------------------------
            Datacolle~t |   3     0.43   0.7296     0.7247    0.7217    0.5114
                  Residual | 617
```

Appendix U: Pearson Chi2 of Time points

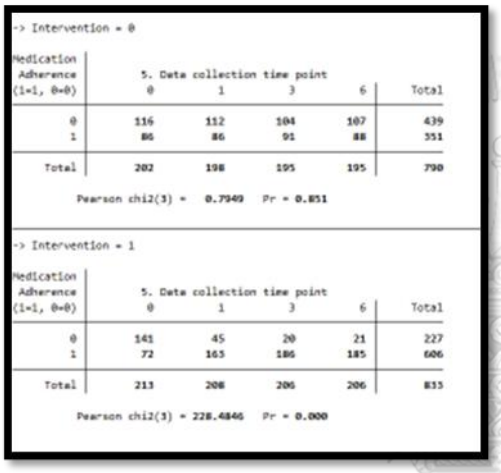
Model 2: Medication Adherence



```
. tabulate MedicationAdherence1100 Datacollectiontimepoint, chi2
```

Medication Adherence (1=1, 0=0)	5. Data collection time point				
	0	1	3	6	Total
0	257	157	124	128	666
1	158	249	277	273	957
Total	415	406	401	401	1,623

Pearson chi2(3) = 106.5209 Pr = 0.000



-> Intervention = 0

Medication Adherence (1=1, 0=0)	5. Data collection time point				
	0	1	3	6	Total
0	116	112	104	107	439
1	86	86	91	88	351
Total	202	198	195	195	790

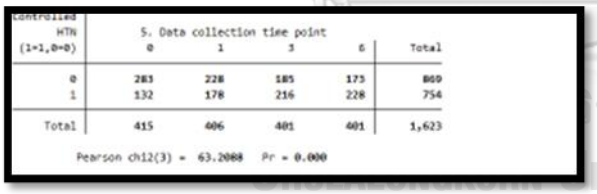
Pearson chi2(3) = 0.7949 Pr = 0.851

-> Intervention = 1

Medication Adherence (1=1, 0=0)	5. Data collection time point				
	0	1	3	6	Total
0	141	45	20	21	227
1	72	165	186	185	606
Total	213	208	206	206	833

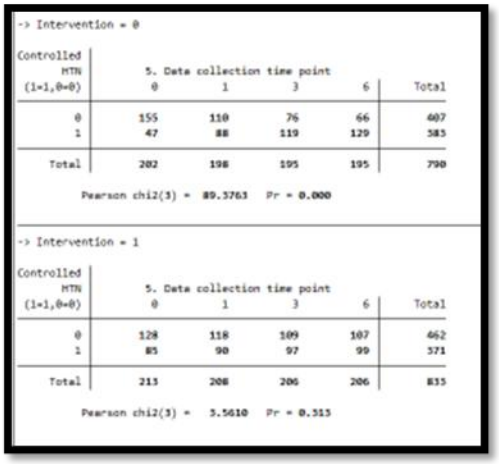
Pearson chi2(3) = 228.4846 Pr = 0.000

Model 5: Controlled Blood Pressure



Controlled HTN (1=1,0=0)	5. Data collection time point				
	0	1	3	6	Total
0	283	228	185	173	869
1	132	178	216	228	754
Total	415	406	401	401	1,623

Pearson chi2(3) = 63.2088 Pr = 0.000



-> Intervention = 0

Controlled HTN (1=1,0=0)	5. Data collection time point				
	0	1	3	6	Total
0	155	110	76	66	407
1	47	88	119	129	383
Total	202	198	195	195	790

Pearson chi2(3) = 89.3763 Pr = 0.000

-> Intervention = 1

Controlled HTN (1=1,0=0)	5. Data collection time point				
	0	1	3	6	Total
0	128	118	109	107	462
1	85	90	97	99	371
Total	213	208	206	206	833

Pearson chi2(3) = 3.5610 Pr = 0.313

REFERENCES

1. Department of Health. WHAT ARE THE LEADING CAUSES OF MORTALITY IN THE PHILIPPINES? 2020 [Available from: https://www.doh.gov.ph/node/1058.

2. Kearney PM, Whelton M, Reynolds K, Muntner P, Whelton PK, He J. Global burden of hypertension: analysis of worldwide data. The lancet. 2005;365(9455):217-23.

3. World Health Organization. Hypertension 2019 [Available from: https://www.who.int/news-room/fact-sheets/detail/hypertension.

4. Department of Health. THE PHILIPPINE HEALTH SYSTEM AT A GLANCE 2009 [Available from: https://www.doh.gov.ph/sites/default/files/basic-page/chapter-one.pdf.

5. Paje R. INVESTMENT IN NON-COMMUNICABLE DISEASES PREVENTION AND CONTROL WILL SAVE LIVES AND CONTRIBUTE TO THE PHILIPPINES SAVING UP TO 4.8% OF ANNUAL GDP. Department of Health. 2019.

6. Mobula LM, Fisher ML, Lau N, Estelle A, Wood T, Plyler W. Prevalence of Hypertension among Patients Attending Mobile Medical Clinics in the Philippines after Typhoon Haiyan. PLoS Curr. 2016;8.

7. PhILIPPINE HEALTH INSURANCE CORPORATION. IMPLEMENTING GUIDELINES FOR THE PRIMARY CARE BENEFIT 2 (PCB2) PACKAGE (OUT-PATIENT MEDICINES FOR HYPERTENSIVES. DIABETES, AND DYSLIPIDEMIA) AT SELECTED INOVATION SITES. 2014.

8. World Health organization. The Philippines Health System Review 2011 [Available from: http://www.wpro.who.int/philippines/areas/health_systems/financing/philippines_health_system_review.pdf.

9. Sison J. Philippine Heart Association––Council on Hypertension Report on Survey of Hypertension (PRESYON 3). A report on prevalence of hypertension, awareness and treatment profile. 2013. 2016.

10. Wright JM, Musini VM, Gill R. First-line drugs for hypertension. Cochrane Database of systematic reviews. 2018(4).

11. Musini VM, Tejani AM, Bassett K, Wright JM. Pharmacotherapy for hypertension in the elderly. Cochrane Database of Systematic Reviews. 2009(4).

12. Hashmi SK, Afridi MB, Abbas K, Sajwani RA, Saleheen D, Frossard PM, et al. Factors associated with adherence to anti-hypertensive treatment in Pakistan. PloS one. 2007;2(3).

13. Lehane E, McCarthy G. An examination of the intentional and unintentional aspects of medication non-adherence in patients diagnosed with hypertension. Journal of clinical nursing. 2007;16(4):698-706.

14. World Health Organization. Adherence to long-term therapies: evidence for action: World Health Organization; 2003.

15. Sison J, Arceo L, Trinidad E, Bautista A, Buan E, Chua P, et al. Philippine Heart Association-Council on hypertension report on survey of hypertension and target organ damage (PRESYON 2-TOD*) a report on prevalence of hypertension, awareness, treatment profile and control rate. Philipp J Cardiol. 2007;35:1-9.

16. World Health Organization. UHC Act in the Philippines: a new dawn for health care. 2019.

17. World Health organization. WHO Package of Essential NCD Interventions (PEN) Service delivery and program management 2018 [Available from: https://www.aiims.edu/aiims/departments_17_5_16/ccm/PEN%20training%20manual%20service%20delivery%20WHOCC.pdf.

18. Lee JK, Grace KA, Taylor AJ. Effect of a pharmacy care program on medication adherence and persistence, blood pressure, and low-density lipoprotein cholesterol: a randomized controlled trial. Jama. 2006;296(21):2563-71.

19. Loquias M, Robles Y. Pharmacy Workforce in the Philippines: Production Trends. The UP Manila Journal. 2011;14:37-44.

20. Loquias MM, Robles YR. Issues and concerns on utilization of the pharmacy workforce in the Philippines. Journal of Asian Association of Schools of Pharmacy. 2012;1(2):86-96.

21. Negoita C. Expert systems and fuzzy systems. 1985.

22. Last JM, Harris SS, Thuriaux MC, Spasoff RA. A dictionary of epidemiology: International Epidemiological Association, Inc.; 2001.

23. Juarez DT, Tan C, Davis J, Mau M. Factors affecting sustained medication adherence and its impact on healthcare utilization in patients with diabetes. Journal of Pharmaceutical Health Services Research. 2013;4(2):89-94.

24. Ku GMV, Kegels G. Knowledge, attitudes and perceptions of people with type 2 diabetes as related to self-management practices: Results of a cross-sectional study conducted in Luzon, Philippines. Chronic illness. 2015;11(2):93-107.

25. Ocampo D, editor PREVALENCE OF MEDICATION NONADHERENCE AND LEVEL OF HEALTH LITERACY AMONG DIAGNOSED HYPERTENSIVES PATIENTS IN A SELECTED BARANGAY IN MANILA, PHILIPPINES. The 6th AHLA International Health Literacy Conference: A Health Literate Asia and Beyond; 2018: Asian Society for Health Awareness.

26. Taira DA, Wong KS, Frech-Tamas F, Chung RS. Copayment level and compliance with antihypertensive medication: analysis and policy implications for managed care. American Journal of Managed Care. 2006;12(11):678-84.

27. Taira DA, Gelber RP, Davis J, Gronley K, Chung RS, Seto TB. Antihypertensive adherence and drug class among Asian Pacific Americans. Ethnicity and Health. 2007;12(3):265-81.

28. Stevenson A. Oxford dictionary of English: Oxford University Press, USA; 2010.

29. Coyoca GS, Chan CC, Jamero HJ, Teves GF, Tabil VG, editors. Barriers to therapeutic regimen adherence of type II diabetes mellitus patients in Iligan City, Philippines. Proceedings of The Annual International Conference, Syiah Kuala University-Life Sciences & Engineering Chapter; 2013.

30. Tesfaye F, Nawi N, Van Minh H, Byass P, Berhane Y, Bonita R, et al. Association between body mass index and blood pressure across three populations in Africa and Asia. Journal of human hypertension. 2007;21(1):28-37.

31. Shu Z, Han Y, Xiao J, Li J. Effect of medical insurance and family financial risk on healthcare utilisation by patients with chronic diseases in China: a cross-sectional study. BMJ open. 2019;9(11).

32. Albert JRG, Santos AGF, Vizmanos JFV. Defining and profiling the middle class. 2018.

33. Gallo LC, Fortmann AL, McCurley JL, Isasi CR, Penedo FJ, Daviglus ML, et al. Associations of structural and functional social support with diabetes prevalence in US Hispanics/Latinos: Results from the HCHS/SOL Sociocultural Ancillary Study. Journal of behavioral medicine. 2015;38(1):160-70.

34. Jimeno EP-PaC. Diabetes Care in the Philippines. Journal of the ASEAN Federation of Endocrine Societies, Vol 30, No 2. 2015.

35. Department of Health. Republic Act No. 11223 entitled “An Act Instituting Universal Health Care for All Filipinos, Prescribing Reforms in the Health Care System, and Appropriating Funds Therefor”. 2019.

36. Department of Health. Consolidated list of GIDA. 2019.

37. Department of Health. Administrative order 2012-0029. 2012.

38. Martinez RE, Quintana R, Go JJ, Villones MS, Marquez MA. Use of the WHO Package of Essential Noncommunicable Disease Interventions after Typhoon Haiyan. Western Pacific surveillance and response journal : WPSAR. 2015;6 Suppl 1:18-20.

39. Pinlac PAV, Castillo EC, Guevarra JP, Escartin IC, Caluag EI, Granada CN, et al. The status of non-communicable disease prevention and control in the philippines: A systematic review. Acta Medica Philippina. 2015;49(3):19-26.

40. Pinlac P, Castillo E, Guevarra J, Escartin I, Caluag M, Granada C, et al. The status of non-communicable disease prevention and control in the Philippines: A systematic review. 2015;49(3):19-26.

41. Department of Health. MEDICINES ACCESS PROGRAM (MAP). 2016.

42. Department of Health. Amendment to Administrative Order No. 2011-0013 dated September 12, 2011 regarding the Implementing Guidelines on the DOH Complete Treatment Pack (ComPack) to Ensure Sustainable Access to Essential Drugs and Medicines for the Marginalized Sectors. 2011.

43. Ho BLC. MAPPING OF MEDICINE ENTITLEMENT PROGRAMS OF THE NATIONAL GOVERNMENT. WHO/META. 2015.

44. Gutierrez MM, Sakulbumrungsil R. Factors associated with medication adherence of hypertensive patients in the Philippines: a systematic review. Clinical Hypertension. 2021;27(1):1-15.

45. Kim MT, Hill MN, Bone LR, Levine DM. Development and testing of the hill-bone compliance to high blood pressure therapy scale. Progress in cardiovascular nursing. 2000;15(3):90-6.

46. Morisky DE, Ang A, Krousel-Wood M, Ward HJ. Predictive validity of a medication adherence measure in an outpatient setting. The Journal of Clinical Hypertension. 2008;10(5):348-54.

47. Encabo J, Letran R, Matias C, Modina S, Payuran J, Reyes C, et al. Medication Adherence Among Adult Hypertensive Patients in a Local Community in Caloocan City, Philippines. Thai Journal of Pharmaceutical Sciences (TJPS). 2017;41(5):173-6.

48. Hays RD, Kravitz RL, Mazel RM, Sherbourne CD, DiMatteo MR, Rogers WH, et al. The impact of patient adherence on health outcomes for patients with chronic disease in the Medical Outcomes Study. Journal of behavioral medicine. 1994;17(4):347-60.

49. Palileo-Villanueva LM, Tan T, Mejia OJB, Briones Jr GM. T-006 Factors Associated With Adherence To Anti-Hypertensive Medications Among Patients At The General Medicine Outpatient Clinic, Philippine General Hospital. Journal of Hypertension. 2011;29:e52.

50. Fairman KA, Motheral B. Evaluating medication adherence: which measure is right for your program? Journal of managed care pharmacy. 2000;6(6):499-506.

51. Taira DA, Gelber RP, Davis J, Gronley K, Chung RS, Seto TB. Antihypertensive adherence and drug class among Asian Pacific Americans. Ethn Health. 2007;12(3):265-81.

52. Sabaté E, Sabaté E. Adherence to long-term therapies: evidence for action: World Health Organization; 2003.

53. Gellad WF, Grenard J, McGlynn EA. A review of barriers to medication adherence: a framework for driving policy options: RAND Santa Monica, CA; 2009.

54. Atkins L, Fallowfield L. Intentional and non-intentional non-adherence to medication amongst breast cancer patients. European Journal of Cancer. 2006;42(14):2271-6.

55. Garner JB. Problems of nonadherence in cardiology and proposals to improve outcomes. The American journal of cardiology. 2010;105(10):1495-501.

56. Blenkinsopp A, Phelan M, Bourne J, Dakhil N. Extended adherence support by community pharmacists for patients with hypertension: a randomised controlled trial. International Journal of Pharmacy Practice. 2000;8(3):165-75.

57. Unni EJ, Farris KB. Unintentional non-adherence and belief in medicines in older adults. Patient education and counseling. 2011;83(2):265-8.

58. Saha A, Poddar E, Mankad M. Effectiveness of different methods of health education: a comparative assessment in a scientific conference. BMC Public Health. 2005;5(1):88.

59. Doucette WR, Nevins J, McDonough RP. Factors affecting collaborative care between pharmacists and physicians. Research in Social and Administrative Pharmacy. 2005;1(4):565-78.

60. Ursua RA, Aguilar DE, Wyatt LC, Trinh-Shevrin C, Gamboa L, Valdellon P. A community health worker intervention to improve blood pressure among Filipino Americans with hypertension: a randomized controlled trial. Preventive medicine reports. 2018.

61. Mejia PCG, Feliciano EE, Feliciano AZ, Sadang JM, Pangandaman HK, Garcia LL, et al. The effectiveness of health education and lifestyle program in improving the blood pressure in hypertensive patients. International Journal of Advanced and Applied Sciences. 2019;6(11):21-9.

62. Ursua RA, Aguilar DE, Wyatt LC, Katigbak C, Islam NS, Tandon SD, et al. A community health worker intervention to improve management of hypertension among Filipino Americans in New York and New Jersey: a pilot study. Ethn Dis. 2014;24(1):67-76.

63. Gabiola J, Morales D, Quizon O, Cadiz RI, Feliciano K, Ruiz RL, et al. The EffectiveNess of LIfestyle with Diet and Physical Activity Education ProGram Among Prehypertensives and Stage 1 HyperTENsives in an Urban Community Setting (ENLIGHTEN) Study. J Community Health. 2019.

64. Pablo CGC, Austria KAI, Cortez HNM, Garcia KB, Julao KGP, Pulido NAV, et al. Medication Adherence of Hypertensive and Diabetic. Journal of Social Health Volume. 2018;1(1).

65. Yi SS, Wyatt LC, Patel S, Choy C, Dhar R, Zanowiak JM, et al. A Faith-Based Intervention to Reduce Blood Pressure in Underserved Metropolitan New York Immigrant Communities. Preventing Chronic Disease. 2019;16.

66. Calano BJD, Cacal MJB, Cal CB, Calletor KP, Guce F, Bongar MVV, et al. Effectiveness of a community-based health programme on the blood pressure control, adherence and knowledge of adults with hypertension: A PRECEDE-PROCEED model approach. J Clin Nurs. 2019;28(9-10):1879-88.

67. Gutierrez MM, Sakulbumrungsil RC. Effect of Patient Education Intervention on Medication Adherence and Blood Pressure of Hypertensive Filipino Patients: Systematic Review and Meta-analysis. Philippine Journal of Science. 2021;150(4):625-33.

68. Kanji L, Xu S, Cavaco A. Assessing the Understanding of Pharmaceutical Pictograms among Cultural Minorities: The Example of Hindu Individuals Communicating in European Portuguese. Pharmacy. 2018;6(1):22.

69. International Pharmaceutical Federation. What is a pictogram? [Available from: https://www.fipfoundation.org/pictogram-project/what-is-a-pictogram/.

70. Montagne M. Pharmaceutical pictograms: a model for development and testing for comprehension and utility. Research in Social and Administrative Pharmacy. 2013;9(5):609-20.

71. Tijus C, Barcenilla J, De Lavalette BC, Meunier J-G. The design, understanding and usage of pictograms. Written documents in the workplace: Brill; 2007. p. 17-31.

72. Yin HS, Dreyer BP, van Schaick L, Foltin GL, Dinglas C, Mendelsohn AL. Randomized controlled trial of a pictogram-based intervention to reduce liquid medication dosing errors and improve adherence among caregivers of young children. Archives of pediatrics & adolescent medicine. 2008;162(9):814-22.

73. Sankawulo-Knuckles JP. Improving Adherence in Adults with Hypertension using Personalized Pictogram Pill Cards. 2019.

74. The United States Pharmacopeial Convention. USP Pictograms 1997 [cited 2020 April 2]. Available from: https://www.usp.org/health-quality-safety/usp-pictograms.

75. International Pharmaceutical Federation. FIP Pictograms 2009, [Available from: https://www.fipfoundation.org/pictograms-support/development-references-and-publications/.

76. Pascuet E, Vaillancourt R, Collins MA, Moore AM, Scoular D, Gaboury I, et al. Visual Thematic Analysis of Children's Illustrations to Improve Receptiveness to Pictorial Asthma Action Plans. Journal of Pharmacy Practice and Research. 2010;40(2):92-6.

77. van Beusekom MM, Kerkhoven AH, Bos MJ, Guchelaar H-J, van den Broek JM. The extent and effects of patient involvement in pictogram design for written drug information: a short systematic review. Drug discovery today. 2018;23(6):1312-8.

78. Lee S, Dazkir SS, Paik HS, Coskun A. Comprehensibility of universal healthcare symbols for wayfinding in healthcare facilities. Applied ergonomics. 2014;45(4):878-85.

79. Kheir N, Awaisu A, Radoui A, El Badawi A, Jean L, Dowse R. Development and evaluation of pictograms on medication labels for patients with limited literacy skills in a culturally diverse multiethnic population. Research in Social and Administrative Pharmacy. 2014;10(5):720-30.

80. Brigham F. Graphical symbols for consumer products in an international context. Information design journal. 2000;10(2):115-23.

81. Katz MG, Kripalani S, Weiss BD. Use of pictorial aids in medication instructions: a review of the literature. American journal of health-system pharmacy. 2006;63(23):2391-7.

82. Dowse R, Ehlers M. Pictograms in pharmacy. International Journal of Pharmacy Practice. 1998;6(2):109-18.

83. Prochaska JO, DiClemente CC. Stages and processes of self-change of smoking: toward an integrative model of change. Journal of consulting and clinical psychology. 1983;51(3):390.

84. Prochaska JO, Redding CA, Evers KE. The transtheoretical model and stages of change. Health behavior: Theory, research, and practice. 2015:125-48.

85. Johnson SS, Driskell M-M, Johnson JL, Dyment SJ, Prochaska JO, Prochaska JM, et al. Transtheoretical model intervention for adherence to lipid-lowering drugs. Disease Management. 2006;9(2):102-14.

86. Glanz K, Rimer BK, Viswanath K. Health behavior and health education: theory, research, and practice: John Wiley & Sons; 2008.

87. Prochaska JO, DiClemente CC. Stages of change in the modification of problem behaviors. Progress in behavior modification. 1992;28:183-218.

88. Bandura A. Self-efficacy: toward a unifying theory of behavioral change. Psychological review. 1977;84(2):191.

89. Avery L, Charman SJ, Taylor L, Flynn D, Mosely K, Speight J, et al. Systematic development of a theory-informed multifaceted behavioural intervention to increase physical activity of adults with type 2 diabetes in routine primary care: Movement as Medicine for Type 2 Diabetes. Implementation Science. 2015;11(1):99.

90. Bandura A. Health promotion by social cognitive means. Health education & behavior. 2004;31(2):143-64.

91. Martos-Méndez MJ. Self-efficacy and adherence to treatment: the mediating effects of social support. Journal of Behavior, Health & Social Issues. 2015;7(2):19-29.

92. Hale ED, Treharne G, Kitas G. The Common-Sense Model of self-regulation of health and illness: how can we use it to understand and respond to our patients' needs? Rheumatology. 2007;46(6):904-6.

93. Phillips LA, Leventhal H, Leventhal EA. Physicians' communication of the common-sense self-regulation model results in greater reported adherence than physicians' use of interpersonal skills. British journal of health psychology. 2012;17(2):244-57.

94. Arora R, Parashar A, Transforming CCI. Secure user data in cloud computing using encryption algorithms. International journal of engineering research and applications. 2013;3(4):1922-6.

95. Google. Google Workspace. 2020.

96. Armstrong D, Kline-Rogers E, Jani SM, Goldman EB, Fang J, Mukherjee D, et al. Potential impact of the HIPAA privacy rule on data collection in a registry of patients with acute coronary syndrome. Archives of Internal Medicine. 2005;165(10):1125-9.

97. G Suit Learning Center. Get Started with Calendar. 2020.

98. Sanchez MJ. Most visited websites in the Philippines Q4 2019: Statistica; 2020 [Available from: https://www.statista.com/statistics/1127920/philippines-most-visited-websites-by-monthly-traffic/.

99. Internetworldstats.com. Asia Internet Stats by Country and 2019 Population Statistics. 2019 [Available from: https://www.internetworldstats.com/asia.htm#ph.

100. Martha Jean Sanchez. Smartphone users in the Philippines 2015-2025 2020 [Available from: https://www.statista.com/statistics/467186/forecast-of-smartphone-users-in-the-philippines/.

101. Stawarz K, Cox AL, Blandford A, editors. Don't forget your pill! Designing effective medication reminder apps that support users' daily routines. Proceedings of the SIGCHI Conference on Human Factors in Computing Systems; 2014.

102. Zhong B. How to calculate sample size in randomized controlled trial? Journal of thoracic disease. 2009;1(1):51.

103. Weichenthal S, Baumgartner J, Hanley JA. Sample Size Estimation for Random-effects Models. Epidemiology. 2017;28(6):817-26.

104. Green SB. How many subjects does it take to do a regression analysis. Multivariate behavioral research. 1991;26(3):499-510.

105. LEVENTHAL HOR, IAN B. The common-sense model of self-regulation of health and illness. The self-regulation of health and illness behaviour: Routledge; 2012. p. 56-79.

106. Prochaska JO, DiClemente CC. Transtheoretical therapy: toward a more integrative model of change. Psychotherapy: theory, research & practice. 1982;19(3):276.

107. Leventhal H, Phillips LA, Burns E. The Common-Sense Model of Self-Regulation (CSM): a dynamic framework for understanding illness self-management. Journal of behavioral medicine. 2016;39(6):935-46.

108. Philippine Statistics Authority. 2017 Philippine Standard Classification of Education (PSCED) 2017 [Available from: https://psa.gov.ph/classification/psced/.

109. Philippine Statistics Authority. Philippine Standard Occupational Classification (PSOC) 2017 [Available from: https://psa.gov.ph/content/philippine-standard-occupational-classification-psoc-1.

110. Fahey T, Peters T. What constitutes controlled hypertension? Patient based comparison of hypertension guidelines. BMJ. 1996;313(7049):93-6.

111. Committee SoWIMHL. Summary of 1993 World Health Organisation-International Society of Hypertension guidelines for the management of mild hypertension. BMJ: British Medical Journal. 1993:1541-6.

112. Sison J, Divinagracia R, Nailes J. Asian management of hypertension: Current status, home blood pressure, and specific concerns in Philippines (a country report). Journal of Clinical Hypertension. 2020.

113. Chong TTL, Li X, Yip C. The impact of COVID-19 on ASEAN. Economic and Political Studies. 2021;9(2):166-85.

114. Arroll B, Beaglehole R. Does physical activity lower blood pressure: a critical review of the clinical trials. Journal of clinical epidemiology. 1992;45(5):439-47.

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(2018). Factors associated with parental self-medication of antibiotics in Health Centers of Manila. KnE Social Sciences, 891-910.

Gutierrez, M. M. (2016). Effectiveness of Junior Faculty Mentoring Relationships in the Colleges of Pharmacy in Metro Manila, Philippines. Journal of Asian Association of Schools of Pharmacy, 5, 367-376.

Casimiro, M., Franchesca, M., Gutierrez, M., Leano, D. R., Judilynn, N., & Solidum, E. (2010). Evaluation of the hepatoprotective activity of Citrus microcarpa Bunge (Family Rutaceae) fruit peel against acetaminophen-induced liver damage in male BFAD-Sprague Dawley rats. Int J Chem Environ Eng, 1(2).

AWARD RECEIVED

FIP Ton Hoek Scholarship for Young Leaders, September 2019

One UP Faculty Grant Award in Pharmacy (Social and Administrative) for Outstanding Teaching and Public service in

UP Manila, 2019-2021Doctoral Fellowship Program UP OVPAA Scholarship Grant, September 2019

Gawad Dekana for outstanding faculty – Extension Services, 2017-2018

Gawad Dekana for outstanding faculty, 2014-2015

Gawad Dekana for outstanding faculty, 2013-2014

Gawad Dekana for outstanding faculty, 2012-2013

Gawad Dekana for outstanding faculty, 2011-2012

Luz Oliveros Faculty grant, 2013