Perception of the Use of Mobile Applications for Health Monitoring Among Filipinos in Manila City

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Abstract: - The development of the technological domain in the Philippines, paired with the surge of mobile applications that aid in health monitoring, has catalyzed the popularization of mHealth applications. The successful implementation in the country, however, can be impeded by attitudinal barriers and the lack of input from the appropriate target population during the phase of the application's development. This study seeks to determine the perception of Filipinos residing in Manila City towards mHealth applications. This was conducted to tackle the lack of studies regarding the perceptions of mHealth applications in the Philippine setting. The target population of the study includes Filipinos living in Manila City within the age group of 18-50 years old. The Technology Acceptance Model (TAM) was utilized, and an adaptive survey questionnaire was formulated to gather data. The data were analyzed using the SPSS software. A total of 569 respondents participated in the survey, but only 405 were deemed acceptable in lieu of the established inclusion criteria. Various parametric statistical methods were used, such as the Student's t-test and one-way ANOVA. The results from the tests and statistical analysis showed that the majority of the respondents answered positively towards the use of mHealth applications. There is no significant difference in the perception according to gender (p=0.448), occupation (p=0.680), and age group (p = 0.978) of the respondents. Moreover, it was found out that there is a significant difference in the perception according to the type of lifestyle (p=0.047). Furthermore, users were found to have a more positive perception of mobile health applications than non-users. An understanding of the factors involved in the acceptance of mHealth in the Philippines can lead to its successful implementation and can eventually aid in the improvement of the existing shortcomings in the healthcare system of the Philippines.

Key Words: - ***mHealth, Perception, Application, Technology Acceptance Model (TAM), Perceived Usefulness, Perceived Ease of Use.***

I. INTRODUCTION

The scope of mobile applications surged to all spheres of life in the emergence of technological creativity and is now revolutionizing healthcare. With over 74 million Filipino smartphone users, ICT companies are gradually gearing towards mobile health applications (Sanchez, 2020). There exist more than 43,000 health-related applications on accessible digital distribution platforms that span multiple functionalities such as diagnostic and monitoring apps, clinical reference apps, productivity apps, and health metric tracking apps (Gagnon et al., 2015). These applications are now more commonly known as "mHealth apps." According to the Global Observatory for eHealth (GOe), mHealth has been defined as the "medical and public health practices supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDA), and other wireless devices" (Speidel & Sridharan, 2014). The World Health Organization has deemed the use of mHealth as an integral part of eHealth and has recognized its potential in advancing patient care as they provide ease of access to healthcare and health information, especially to those living in remote areas, consequently aiding the health professionals in the diagnosis and formulation of treatment (Ventola, 2014). However, it is important to note that mHealth apps are not limited to provider directories, treatment

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compliance, and diagnosis education. Other lifestyle-tracking services are also available and are more appealing to the public's eyes. These include lifestyle and diet-focused apps that track the users' calorie intake, menstrual cycle, weight, BMI, and exercise log (Ventola, 2014).

The provision of basic healthcare services remains a serious predicament globally, especially in third-world countries like the Philippines (Orach, 2009). In 2012, WHO described the country's health financing system as "fragmented." This is reflected in the various limitations Filipinos face today, such as the shortage of medical staff, inaccessible healthcare facilities, and the rising cost of healthcare (Pru Life UK, 2019). Being forced to live in these conditions, Filipinos tend to rely on other sources of health information such as mobile health applications, which offer a free and convenient way to monitor their wellness.

With the steady influx of new health-related applications to digital platforms daily, regulation in product development poses an impediment to the reliability of these applications and the general public's acceptance of its usage (Callier & Fullerton, 2020). Considering its direct influence on health-promoting behavior, the development of mobile health applications should be rigorously approached coupled with medical professional involvement. In a study conducted by Akbar, Coiera, and Magrabi (2019), various concerns regarding mobile health applications include the areas of disease management, quality of information, and functionality. They have concluded that mHealth Applications pose great risks on consumer health; nevertheless, it can be improved with the involvement of healthcare workers in developing the application and adopting a user-centered approach. In 2015, Sinha & Varghese conducted a prospective cross-sectional study among 310 healthcare workers to assess their perceptions towards mHealth applications. More than 70% of the respondents agreed that mHealth apps could aid in data collection and surveillance, but the rest had issues with patient privacy and confidentiality. Multiple studies, such as those mentioned, have only considered a narrow perspective regarding the acceptability of mHealth applications to either patients or healthcare workers in a specific field. This scarcity is even more notable in the quantity of studies that address the perspective of Filipinos regarding mHealth applications, which is a necessary prerequisite in the development and provision of these electronic services.

Both usability and usefulness are key players in the success and acceptance of mobile health applications. ISO-9241-11 defines an application's usability as "the effectiveness, efficiency, and satisfaction with which specified users achieve specified goals in particular environments.'' It may also pertain to the comfort with which users have experienced while operating the application, along with the completeness and accuracy of the achieved specified goal. On the other hand, usefulness pertains to the capability of the application to produce the intended beneficial effect completely and accurately in a specific context. In the case of mHealth applications, it can pertain to the achievement of the improvement of the user's health or in the management of the user's health. In the study of Liew et al. (2019), it has stated that indifference towards the challenges of users in the usability of mobile applications had negatively affected the retention of users in the long run. Moreover, the study has also stated that usability has been frequently utilized to inspect software applications. This idea is backed by a study done by Broderick et al. (2014), which stated that usability is a key component used as a guide in the development of mobile health applications. Many studies have also determined the effectiveness of specific mHealth applications to execute its stated intended effect or benefit. In the technology acceptance model developed by Davis (1989), both perceived usefulness and ease of use were constructs that can influence an individual's behavioral intention to use a particular system that could subsequently affect system utilization. Perceived usefulness, according to Davis, pertained to the "degree to which a person believes that using a particular system would enhance his or her performance," while perceived ease of use pertained to "the degree to which a person believes that using a particular system would be free of effort." Lastly, actual system use pertains to the utilization of the system by the individual.

In this quantitative descriptive study, the difference in perception of Filipinos, both in the medical and non-medical fields, between males and females across age groups and among different lifestyles regarding mHealth applications will be determined through an adaptive survey. Since perception is a broad term that may pertain to several concepts such as associated risks, usefulness, or critique, perception in this study is defined and specified to be perceived usefulness and ease of use. This study will address the lack of studies regarding the perception of mHealth applications in the Philippine setting. Through this, a comprehensive viewpoint can be established, which can aid in the improvement of the research and production of mHealth applications in adopting a user-centric

and context-appropriate approach through the inputs from the target populations.

A. Objectives of the Study

The main objective of this study is to determine the perception of Filipinos residing in Manila City on the use of mobile health applications.

Specifically, the study aims:

- To determine the sociodemographic profile of Filipinos residing in Manila City who will participate in the study.
- To determine the overall perception of Filipinos residing in Manila City towards mobile health applications.
- To determine if there is a significant difference in the perception of Filipinos residing in Manila City grouped according to age, gender, occupation, and type of lifestyle.
- To determine if there is a significant difference between users and non-users in terms of their perception of mobile health applications.
- To determine the perception of Filipino users and non-users residing in Manila City on mobile health applications.

B. Statement of the Problem

When a basic human right, such as access to proper healthcare and information, costs more than a worker's minimum wage, people find other ways to fill what is lacking, and here come mobile health applications. With the surge of mHealth applications that are being developed covering various fields of healthcare information, it is with no doubt that a number of people rely on these said applications, which in turn may pose as a problem rather than a solution towards the health of the user. Since mHealth apps are still in its nascent stage, the operating system of these applications, including patient information input, knowledge of user profiles, and real-time feedback, remains unpolished and flawed. The lack of extensive research in developing such applications, coupled with the lack of strict monitoring and surveillance, also paves the way for opportunists to mask their applications under the mHealth category. Moreover, the lack of support and feedback from healthcare providers themselves regarding these mobile health applications also makes its reliability questionable (Vo et al., 2019). Ramos et al. (2015) further said that with the emerging popularity of the usage of mobile devices, their access to mHealth is still under criticism because of the lack of access or usability issues. Challenges in usability persist despite existing available guidelines on designing applications for a better user experience. Indifference to usability issues may lead to difficulty in the operation of the application, errors in the collection of data, and inconsistency in the long- term usage of the application (Kamana, 2016).

The aim of this research is to gain an extensive view regarding the perception of Filipinos residing in Manila on mobile health applications based on both perceived usefulness and ease of use. To aid in the determination of the differences in perception, the following questions were devised:

- What is the sociodemographic profile of the Filipinos residing in Manila City involved in the study?
- What is the overall perception of Filipinos who reside in Manila City towards mobile health applications?
- Is there a significant difference in the perception of the Filipinos residing in Manila City grouped according to age, gender, occupation, and type of lifestyle?
- Is there a significant difference between users and non-users of Filipinos who reside in Manila City in terms of their perception of mobile health applications?
- What is the perception of Filipino users and non-users residing in Manila City on mobile health applications?

C. Review of Related Literature

Multiple published studies have taken on and addressed queries regarding the perspective or acceptance of various target groups towards the implementation of mHealth applications. Although there exist extensive studies with varied populations, limited studies have broached multi-perspective approaches towards the perception of mHealth of a population with varying demographics and characteristics. According to Hussein, Harun, and Oon (2016), characteristic factors can influence a user's perception or approval of the usage of these applications. Such factors include demographic factors, the user's health status, lifestyle, and educational level. Demographic factors such as age and sex were found to modify an individual's tendency for technology acceptance to utilize mobile devices and applications.

The role of gender in the adoption of information technology-related advances has been investigated extensively. In the study of Wang et al. (2014), gender differences were highlighted by the difference in computer utilization wherein males were found to spend more time using computers as they appear to exhibit greater interest in general information technology systems than women. However, the study reported that women were found to utilize more healthcare applications than men despite the latter's inclination towards the usage of technological systems due to women exhibiting greater interest in good health practices. Similarly, another study done by Xie et al. (2018) reported that women were more likely to use health applications than men due to their tendency to be more conscious about their health behaviors. Moreover, the study has highlighted conditions such as menstruation, pregnancy, and postpartum recovery, contributing to the gender difference between health app usages. In the study of Hoque (2016), it was found that there is a significant difference in the perceived ease of use and perceived usefulness of mHealth applications between males and females. However, the study of Hussein, Harun, & Oon (2016) and Becker et al. (2010) revealed no significant difference in the adoption of mHealth applications between males and females. According to Hargittai and Shafer (2006), the gender gap regarding their attitude towards technological innovations has been narrowing due to increased ease of use and widened accessibility of internet or mobile services.

Similarly, another factor that may impact the perception of mobile health applications is age. According to a study conducted by Bigné et al. (2007), age affects one's attitude towards technology acceptance due to the difference in the capacity to comprehend the complexities of new technologies. Moreover, a study by Sedlar, Volk, and Bešter (2015) stated that mHealth applications developed for the general population are not necessarily suitable for elderly users. These studies revealed that the youth population has a tendency to spend more time on mobile devices and are more willing to embrace and discern technological advances.

In another study conducted by Acarturk and Guner (2020), usefulness, perceived ease of use, and anxiety over usage of ICT services significantly affect the attitude of the elderly population towards ICT. This implies that facilitating conditions such as user-friendly interface designs may positively impact the behavior and usage of mobile applications. Generational differences may also be a factor that affects perception. In a survey conducted by Pew Research Center in 2019, it has been found that 93% of individuals aged 23-38 own smartphones while only 68% of individuals aged 55-73 and 40% of individuals aged 74-91 own smartphones. In another survey conducted by the Pew Research Center in 2018, among every country surveyed, the results shared a common theme wherein those aged 35 and below were more likely to own smartphones and use the internet and various applications than those aged 50 and above. In the study of Hussein, Harun, & Oon (2016), however, it was revealed that there was no significant difference in the perception and usage of mHealth applications between the age groups of 18-20, 21-30, 31-40, 41-50 and 51-60.

Lifestyle factors have a significant impact on an individual's quality of life. The adoption of a sedentary lifestyle, in addition to unhealthy practices, is associated with increased risk for conditions such as non-insulin-dependent diabetes, cardiovascular diseases, and certain cancers (Leitzmann and Schmid, 2014). Increasing mobile health interventions have been launched with inactive individuals as its target group to promote physical activity and reduce sedentary time.

mHealth applications have been frequently used to modify and improve lifestyle behaviors, especially through applications that target diet and weight management. The scoping review of Lee et al. (2019) revealed that only 5 out of the 13 studies that included a control group showed a significant positive impact on the physical activity outcome of adolescents while the majority did not. The study has concluded that despite the majority of studies presenting no significant improvement with the use of mHealth interventions, it does not reflect the downright unsuitability of mHealth apps in the betterment of physical activity of individuals but reflects the importance of the development and regulation of the application and its appropriateness towards its target population. In the study of Loo (2009), health-conscious individuals tend to use mobile health technologies which allow the users to gain personal control over health.

Health information- seeking individuals also rely on mobile health technologies to provide health information due to its accessibility and potential for a personalized approach. Moreover, the health status of individuals influences an individual's acceptance of health-related technologies. It was reported that patients suffering from health conditions rely on mobile health technologies more than those without. This is of significance, especially for patients suffering from chronic conditions which require long-term monitoring and

management. Applications were deemed to be more of an inconvenience rather than assistive by healthy individuals.

The comprehension of new technologies significantly affects one's perception of its acceptance, especially in the elderly population. Subsequently, the individual's educational level may be a factor that can alter one's acceptance of health applications. In the study of Wang et al. (2014), it was reported that individuals with a bachelor's degree had a greater inclination to the usage of healthcare applications. Similarly, an individual's occupation may also alter behavior and attitude towards new applications. In this context, the perception of healthcare workers on mHealth applications bears weight since its development should be coupled with contributions from members of the healthcare system (Barton, 2012).

In the study conducted by Kong et .al. (2020), a qualitative study was done on the perception of physicians towards the adoption of mobile health applications and devices. The majority agreed on the collective benefits of the health applications in promoting health-seeking behaviors among patients. However, more than half of the respondents were reluctant to recommend the use of mobile health applications to their patients.

Based on a study by Simpson et al. (2017), the perspective of healthcare workers on asthma self-management was also assessed through an online survey. Based on the findings of this study, a significant number of healthcare workers expressed their positive perception in incorporating mHealth for asthma management and action plan. In another study conducted by Mutebi & Devroey (2018) in Belgium, a total of 23 family physicians ranging from 26-35 years old [13 (57%) men and 10 (43%) women] were surveyed online. Two-thirds of the family physicians indicated that they were not interested in offering any mobile health service which is mainly due to problems encountered in terms of the exchangeability of data, difficulty in putting relevant data in patient files, and safety of patient information. Attitudinal barriers from healthcare providers would be a big impediment to the success of the implementation of mHealth in the country.

Considering these various factors in different segments of the population, a comprehensive picture would lead to a better understanding of the issues and possible impediments in the development, implementation, and regulation of mHealth applications. Through the comparison of different perceptions, provision of tailored needs of users and context-appropriate approaches are possible, which can result in the favorable perception of mHealth applications. However, limited studies exist that take on a multiperspective approach considering various demographics and contexts, which is especially true for studies that have tackled the perception of Filipinos on health applications. The implementation of mHealth in the Philippines needs to be based and adjusted on the current conditions present in the country to effectively provide the ideal and appropriate services.

II. CONCEPTUAL FRAMEWORK

The study will utilize the Technology Acceptance Model (TAM). This theoretical model is the most prominent among the different existing models for technology acceptance and adoption and has been used in varied fields (Hoque, 2016). In this model, Davis (1989) states that system utilization is determined by two theoretical constructs, namely "Perceived usefulness" and "Perceived ease of use." The integration of these two determinants influences an individual's behavioral intention towards a particular system that directly impacts actual system usage. Davis (1989) has defined "Perceived usefulness" as the "degree to which a person believes that using a particular system would enhance his or her performance" and "Perceived ease of use" as "the degree to which a person believes that using a particular system would be free of effort."

Perceived usefulness is considered as one of TAM's theoretical factors that pose an essential influence in the adoption of technology. It allows the person to focus on the task accomplishment as well as emphasizing effectiveness and efficacy and indicates the person's desire to use technology as a result of the award that was given. Perceived ease of use must be considered an important factor in the use of technology since there are new users who find it difficult to operate (Septiani et al., 2017).

When a user's perceived usefulness is positive, people find it easier to use mobile applications. However, if their perceived usefulness is deemed negative, their attitude will change, and it will result in application users not being satisfied. Perceived ease of use influences the attitude of users directly or indirectly regarding the usage of technology.

Davis' original model was expanded with the addition of necessary variables suitable for attaining the study's objectives which are the following: 1) Age, 2) Gender, 3) Occupation, and 4) Type of Lifestyle.

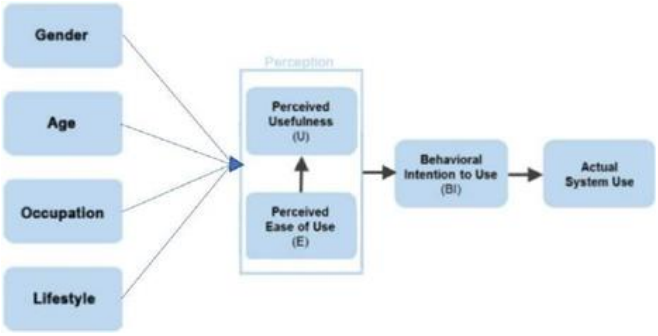

Fig.1. Proposed conceptual framework based on TAM

III. METHODOLOGY

A. Research Design

A quantitative descriptive research design was utilized in the study wherein possible differences in the perceptions of mHealth applications in terms of actual system use among Filipinos residing in Manila City are determined. The said research design was used since the study intends to investigate different variables and provide systematic information about a certain phenomenon using questionnaires to gather the data needed.

B. Subjects and Study Site

With its current population size of 1,600,000 in the year 2020 (Worldometers.info, 2021), a sample population of 385 residents of Manila City, Philippines, will be selected. The sample size was computed using the Raosoft Calculator with the following parameters: 5% margin of error, 95% confidence level, 50% response distribution, and 1,600,000 as the population size representing the population in Manila City, Philippines in the year 2020 (retrieved from worldometers.info). The sample respondents were grouped with corresponding categories and stratum. The groups are namely: (1) gender, (2) age groups, (3) occupation, and (4) type of lifestyle, with no particular order which is based on the determinants on the survey itself. Afterward, these groups were further subdivided based on the following characteristics: gender (male and female), age groups (18-28 years old, 29-39 years old, and 40-50 years old), occupation (healthcare worker or non-healthcare worker), and lifestyle (active and sedentary). Data collection was done using purposive sampling wherein the researchers intentionally and soundly select respondents who are eligible and meet the inclusion criteria mentioned above to satisfy the research objectives. Purposive sampling was utilized because of its cost-effectiveness and time effectiveness. In the case that one of the items in the inclusion criteria was not met, such as the age requirement and nationality, the individual was rejected and excluded from the study. Specifically, individuals that do not reside in the study's targeted geographic location (Manila City), participants whose ages are under 18 and above 50 years old, and participants whose nationality is not Filipino are excluded from the study. The survey was conducted online or electronically via Google Forms from April 2021 to May 2021.

C. Data Measure/Instrumentation

The formulated questionnaire (see appendix E) was adapted from studies of Krebs & Duncan (2015) entitled Health App Use among US Mobile Phone Owners: A National Survey and Hoque (2016) entitled An empirical study of mHealth adoption in a developing country: the moderating effect of gender concern. The survey was adjusted for a Filipino-focused study. The survey was deployed through Google Forms which required an internet connection and an electronic device such as laptop, mobile phone, tablet, etc., in answering the questionnaire. A consent form was placed at the very beginning of the survey to be filled out by a participant, consenting to participate in the study. The form is available in both English and Filipino. The softcopy of the consent form was also linked for the perusal of the respondent before the start of the survey. The survey consisted of several questions that encompassed the following domains: Sociodemographic, Use/nonuse of mHealth, and Perception of effectiveness and ease of use of mHealth. The sociodemographic domain contains questions about the participant's age, gender, type of lifestyle, and if they do or do not belong in the medical stream. For the "Use/nonuse of mHealth" domain, the participant was asked about their history of downloading health apps and the time spent on the application. Lastly, in the "perception of effectiveness and ease of use of the mHealth" domain, the participant was asked about the extent of how health apps have contributed to their improvement in terms of health. This particular domain analyzes the previous domains, which address different variables such as gender, age, occupation, and lifestyle, and see whether these have significant effects on a person's perception of the effectiveness of mHealth. The Likert scale was employed and a score of 1 indicates that the respondent strongly disagrees with the statement presented. On the other hand, the score of 5 indicates that the respondent strongly agrees with the statement

that was asked in the questionnaire. The questions in the survey were presented to the participants in a logical and cohesive order and will be available in English and Filipino.

A pilot testing with 30 respondents was conducted to assess the reliability and consistency of the instrument to be used prior to the data gathering proper. With a score of 0.835 in Cronbach's alpha statistics, the survey questionnaire was deemed to have good internal consistency and was acceptable to be used in the study.

D. Ethical Considerations

The ethical clearance of this study was granted by the Faculty of Pharmacy Research Ethics Committee (FOPREC) of the University of Santo Tomas, Manila, Philippines. The right of participants to informed consent, autonomy, integrity, and confidentiality was respected, and this was ensured through the provision of an informed consent form prior to the dissemination of the questionnaire. Participants have the freedom of choice to participate or decline in the process of the study and perceived risks, as well as the nature and purpose of the study, which was thoroughly explained beforehand. The participant may also withdraw from participating in the study at any time. The participant's privacy and confidentiality were preserved by conducting the electronic survey through secure tools such as Google Forms.

E. Data Analysis

In this study, both descriptive and inferential statistics were done to analyze and interpret the gathered data with the use of SPSS software. Descriptive statistics were utilized to describe, show or summarize raw data gathered from the study's sample population. At the same time, inferential statistics were also utilized to prove the study's hypotheses that there are no significant differences in the perception among different genders, ages, lifestyles, and between healthcare and non-healthcare workers regarding mHealth applications.

After data collection, the answers from the respondents were tallied. The software, Microsoft Excel, was used to organize the data that would be collated from the electronic survey. The tallying of data was done accurately and with minimal error. A tabular representation was created to aid in the simplification of the organization of the collected data from the four domains of the questionnaire and to facilitate the detailed analysis of the patterns present in the population with respect to a given variable.

The p-value was determined to assess if the hypothesis should be accepted or rejected using SPSS Software. The researchers specified the null hypotheses, which state that there is no significant difference between the perceptions of using mHealth applications among the different target groups. The statistical tools that were employed in the study were parametric tests such as Student's t-test and one-way ANOVA. Parametric tests were utilized since the type of data collected is continuous. To ensure the accuracy and reliability of the resulting data from the analysis, a consultation with a professional statistician was done beforehand to further discuss the specific and appropriate statistical tools to be used in the study.

IV. RESULTS AND DISCUSSION

This chapter contains a detailed presentation and discussion of data analysis and the results of the study. The findings are presented under the following sections: Socio-demographic Profile of Respondents, Overall Perception of Filipinos who Reside in Manila City towards the Use of Mobile Health Applications, Differences in Perception According to Different External Variables, and the Perception of Users and Non-Users on Mobile Health Applications.

A. Sociodemographic Profile of Respondents

The researchers have collected the data, answered through Google Forms, needed from the respondents. 569 respondents completed the survey, but only 405 respondents were accepted after filtering the responses using the established exclusion criteria. There are 215 respondents (53.09%) who were male, and 190 respondents (46.91%) were female (Table 1). It was found that 345 respondents (85.19%) are within the age range of 18-28 years old, while there are 30 respondents (7.41%) each for both 20-39 and 40-50 age groups (Table 1). Among the respondents, 374 (92.35%) are not healthcare workers, and only 31 respondents (7.65%) are healthcare workers (Table 1). There are 213 respondents (52.59%) who are categorized as living a sedentary lifestyle, and 192 respondents (47.41%) shown to live an active lifestyle (Table 1). The data were sent to a statistician to be analyzed in order to come up with a conclusion.

Table.1. Sociodemographic Profile of Respondents

Variables		n	Percentage (%)
Sex	Male	215	53.09
	Female	190	46.91
Age Group	18-28 years old	345	85.19
	29-39 years old	30	7.41
	40-50 years old	30	7.41
Occupation	Healthcare Workers	31	7.65
	Non-Healthcare Workers	374	92.35
Lifestyle	Active	213	52.59
	Sedentary	192	47.41

B. Overall Perception of Filipinos who reside in Manila City towards the Use of Mobile Health Applications

The Likert scale was used to determine the overall perception of Filipinos living in Manila City towards mobile health applications. Respondents are asked to answer questions based on their agreement level using a metric scale (Joshi et al., 2015). The score of 1 indicates that the respondent strongly disagrees with the statement presented, which reflects the perception of the respondent in that specific question. On the other hand, the score of 5 indicates that the respondent strongly agrees with the statement that was asked in the questionnaire. Perception, in this study, is defined by usefulness and ease of use. The perception was computed by getting the overall mean of the items under domain 3: Perceptions on Effectiveness and Ease of Use of mHealth. Results showed an overall mean of 3.40, which is above the midpoint of 3 (Table 2).

Table.2. Summary of the Overall Perception of the Respondents towards the Use of Mobile Health Applications

Questions	Mean score	Interpretation
PU1: Health applications have greatly improved your health.	3.19	Neutral
PU2: Using mHealth will improve my life quality.	3.41	Agree
PU3: Using mHealth will make my life more convenient.	3.32	Neutral
PU4: Using mHealth will make me more effective in my life	3.42	Agree
PU5: Overall, I find mHealth services to be useful in my life.	3.42	Agree
PEoU1: Learning to operate the mHealth services will be easy for me.	3.67	Agree
PEoU2: I can easily become skillful at using the mHealth services.	3.63	Agree

PEoU3: I can get the mHealth services to do what I want it to do.	3.48	Agree
PEoU4: Overall, the mHealth services are easy to use.	3.61	Agree
PEoU5: Health apps automatically record your data accurately.	3.18	Neutral
PEoU6: Health apps keep your data safe and secure.	3.12	Neutral
Overall Mean Score	**3.40**	**Agree**

Legend: PU = Perceived Usefulness; PEoU = Perceived Ease of Use
Mean Score Interpretation: 1.00 to 1.79 = Strongly Disagree; 1.80 to 2.59 = Disagree; 2.60 to 3.39 = Neutral; 3.40 to 4.19 = Agree; 4.20 to 5.00 = Strongly Agree

C. Differences in Perception According to Gender

A two-independent sample t-test revealed that there was no significant difference in the perception between males (n=215) and females (n=190) in using mobile health applications (t(403)= 0.759; p=0.448; 95% CI -0.096-0.217) (Table 3.4). The p-value is greater than 0.05, indicating an insignificant result; hence, there is insufficient evidence to reject the null hypothesis. Similar results were discussed in a study conducted by Bol, Helenberg & Weert (2018), which showed that gender was not associated with aggregated mobile health app use but was significantly related if it is in the context of specific types of mobile health apps. Men were more likely to use fitness apps than women, whereas women were more likely to use nutrition apps, self-care apps, and productive health apps (Bol et al., 2018). The study of Hussein, Harun, & Oon (2016) and Becker et al. (2010) likewise concluded that there was no significant difference in the adoption of mHealth applications between males and females. Hargittai and Shafer (2006) acknowledged that the gender gap regarding the acceptance and use of technological innovations has narrowed due to increased ease of use and widened accessibility.

Table.3. Summary Table of the Perception of Respondents on Mobile Health Applications According to Gender

	Male		**Female**	
Questions	**Mean score**	**Interpretation**	**Mean score**	**Interpretation**
PU1	3.25	Neutral	3.12	Neutral
PU2	3.46	Agree	3.35	Neutral
PU3	3.43	Agree	3.21	Neutral
PU4	3.47	Agree	3.35	Neutral
PU5	3.49	Agree	3.35	Neutral
PEoU1	3.60	Agree	3.74	Agree
PEoU2	3.57	Agree	3.69	Agree
PEoU3	3.47	Agree	3.48	Agree
PEoU4	3.56	Agree	3.66	Agree
PEoU5	3.23	Neutral	3.12	Neutral
PEoU6	3.21	Neutral	3.02	Neutral
Overall Mean Score	**3.43**	**Agree**	**3.37**	**Neutral**

Legend: PU = Perceived Usefulness; PEoU = Perceived Ease of Use
Mean Score Interpretation: 1.00 to 1.79 = Strongly Disagree; 1.80 to 2.59 = Disagree; 2.60 to 3.39 = Neutral; 3.40 to 4.19 = Agree; 4.20 to 5.00 = Strongly Agree

D. Differences in Perception According to Occupation

A two-independent sample t-test revealed that there was no significant difference in the perception between Filipino healthcare workers (n=31) and non-healthcare workers (n=374) on the usage of mHealth applications since the p-value (t(403)=0.363; p=0.713; 95% CI -0.23867-0.34854) is greater than 0.05 (Table 3.4) and thus, it fails to reject the null hypothesis. The result of the study agrees with the findings of White et al. (2016) that it is both considerably beneficial for users such as healthcare workers and non- healthcare workers similarly patients and helps provide adaptability on users'

occupations. As stated by Latif (2017), mHealth helps health care professionals by expanding their medical education. The mHealth system can be used by healthcare workers for organizing patient's data. In the study of Simpson et al. (2017), healthcare workers had expressed a positive opinion on the use of mobile health systems to aid asthma self-management. The perception of individuals in the medical stream on mobile health applications bears weight as development and regulation should be coupled with contributions from members of the healthcare system (Barton, 2012). Moreover, attitudinal barriers from healthcare workers would greatly hinder the acceptance and implementation of mHealth in the country (Ventola, 2014).

Table.4. Summary Table of the Perception of Respondents on Mobile Health Applications According to Occupation

	Healthcare Worker		**Non-Healthcare Worker**	
Questions	**Mean score**	**Interpretation**	**Mean score**	**Interpretation**
PU1	3.29	Neutral	3.18	Neutral
PU2	3.29	Neutral	3.42	Agree
PU3	3.39	Neutral	3.32	Neutral
PU4	3.52	Agree	3.41	Agree
PU5	3.45	Agree	3.42	Agree
PEoU1	3.87	Agree	3.65	Agree
PEoU2	3.81	Agree	3.61	Agree
PEoU3	3.58	Agree	3.47	Agree
PEoU4	3.81	Agree	3.59	Agree
PEoU5	3.10	Neutral	3.19	Neutral
PEoU6	2.90	Neutral	3.14	Neutral
Overall Mean Score	**3.45**	**Agree**	**3.40**	**Neutral**

Legend: PU = Perceived Usefulness; PEoU = Perceived Ease of Use
Mean Score Interpretation: 1.00 to 1.79 = Strongly Disagree; 1.80 to 2.59 = Disagree; 2.60 to 3.39 = Neutral; 3.40 to 4.19 = Agree; 4.20 to 5.00 = Strongly Agree

E. Differences in Perception According to Type of Lifestyle

An independent two-sample t-test revealed that individuals with a sedentary lifestyle (n=213) and those who are engaged in an active lifestyle (n=192) had a significant difference in their perception of using mobile health applications (t(403)=-1.992; p=0.047; 95% CI -0.31327-0.00209). The comparison of the overall perception mean score of the respondents with an active lifestyle group and sedentary lifestyle showed that the mean score of those with an active lifestyle (M=3.49) is higher than the scores of those with a sedentary lifestyle (M=3.33), as seen in Table 3.3. Based on the results, it was revealed that the mean score of the respondents who have an active lifestyle (M=3.49) is higher than those with a sedentary lifestyle (M=3.33). This indicates that active individuals will more likely use mHealth applications. A study by Leung et al. (2019) stated that innovativeness is one of the strongest predictors for lifestyle improvement, thus supporting the idea that people who are more inclined to a healthy lifestyle are more likely to use mHealth applications. This further supports our results and reinforces the idea of why there is a significant difference with regards to the perception of people towards mHealth applications between people who have high or moderate physical activity and those who have low physical activity.

Conversely, a study conducted by Silva et al. (2020) states that there is a low quality of evidence that suggests that mHealth applications may be of help in increasing or decreasing sedentarism. In the scoping review of Lee et al. (2019), it was revealed that only a small number of studies demonstrated the positive impact of mHealth applications on the physical activity outcome of adolescents. The study concluded that mHealth applications are not unsuitable for the improvement of the physical activity outcome of individuals but rather highlight the importance of the development of the applications which is tailored and appropriate to the user.

Table.5. Summary Table of the Perception of Respondents on Mobile Health Applications According to the Type of Lifestyle

	Active Lifestyle		**Sedentary Lifestyle**	
Questions	**Mean score**	**Interpretation**	**Mean score**	**Interpretation**

PU1	3.33	Neutral	3.06	Neutral
PU2	3.49	Agree	3.34	Neutral
PU3	3.41	Agree	3.24	Neutral
PU4	3.52	Agree	3.32	Neutral
PU5	3.51	Agree	3.34	Neutral
PEoU1	3.74	Agree	3.60	Agree
PEoU2	3.67	Agree	3.59	Agree
PEoU3	3.53	Agree	3.44	Agree
PEoU4	3.64	Agree	3.58	Agree
PEoU5	3.30	Neutral	3.08	Neutral
PEoU6	3.21	Neutral	3.04	Neutral
Overall Mean Score	**3.49**	**Agree**	**3.33**	**Neutral**

Legend: PU = Perceived Usefulness; PEoU = Perceived Ease of Use
Mean Score Interpretation: 1.00 to 1.79 = Strongly Disagree; 1.80 to 2.59 = Disagree; 2.60 to 3.39 = Neutral; 3.40 to 4.19 = Agree; 4.20 to 5.00 = Strongly Agree

Table.6. Differences in Perception of Mobile Health Applications According to Gender, Occupation, and Type of Lifestyle

Parameter	t	df	p-value	Decision	Interpretation
Gender	0.759	403	0.448	Failed to reject Ho	Not Significant
Occupation	0.363	403	0.680	Failed to reject Ho	Not Significant
Type of Lifestyle	-1.992	403	0.047	Reject Ho	Significant

Level of Significance = 0.05

F. *Differences in Perception* According to Age Group

A One-way ANOVA Test revealed no significant difference in the perception of mobile health applications among the age groups. Results showed that the significance value (p=0.978) was greater than 0.05, indicating an insignificant result; hence, the researchers failed to reject the null hypothesis (Table 3.6). The results can be supported by the study of Harun & Oon (2016), wherein it was imparted that there was no significant difference in the perception and usage of mHealth applications between the age groups of 18-20, 21-30, 31-40, 41-50 and 51-60. In contrast, the study of Bigné et al. (2007) revealed that the youth population is more likely to embrace technological advances due to their advantageous capacity to comprehend complex technological advancements.

Table.7. Summary Table of the Perception of Respondents on Mobile Health Applications According to Age Group

	18-28 y/o		**29-39 y/o**		**40-50 y/o**	
Questions	**Mean score**	**Interpretation**	**Mean score**	**Interpretation**	**Mean score**	**Interpretation**
PU1	3.19	Neutral	3.23	Neutral	3.10	Neutral
PU2	3.42	Agree	3.50	Agree	3.20	Neutral
PU3	3.32	Neutral	3.33	Neutral	3.40	Neutral
PU4	3.43	Agree	3.43	Agree	3.23	Neutral
PU5	3.44	Agree	3.47	Agree	3.20	Neutral
PEoU1	3.64	Agree	3.77	Agree	3.90	Agree
PEoU2	3.61	Agree	3.67	Agree	3.80	Agree
PEoU3	3.46	Agree	3.47	Agree	3.73	Agree
PEoU4	3.59	Agree	3.70	Agree	3.70	Agree
PEoU5	3.19	Neutral	3.10	Neutral	3.13	Neutral

PEoU6	3.15	Neutral	3.07	Neutral	2.87	Neutral
Overall Mean Score	**3.40**	**Agree**	**3.43**	**Neutral**	**3.39**	**Neutral**

Legend: PU = Perceived Usefulness; PEoU = Perceived Ease of Use
Mean Score Interpretation: 1.00 to 1.79 = Strongly Disagree; 1.80 to 2.59 = Disagree; 2.60 to 3.39 = Neutral; 3.40 to 4.19 = Agree; 4.20 to 5.00 = Strongly Agree

Table.8. Difference of the Age Groups in Terms of Perception of mHealth Applications

Age group (years)	Mean	p-value	Decision	Interpretation
18-28	3.40	0.978	Failed to reject Ho	Not significant
29-39	3.43			
40-50	3.39			

Level of Significance = 0.05

G. Perception of Users and Non-Users on Mobile Health Applications

The Likert scale was employed to reveal the perception of Filipino users and non-users residing in Manila City on mHealth applications. A score of 1 indicates that the respondent strongly disagrees with the statement presented, and a score of 5 indicates that the respondent strongly agrees with the statement that was asked in the questionnaire. The overall mean score of users (M=3.72) is higher than the overall mean score of non-users (M=3.14) (Table 4). Moreover, results revealed that the majority of the users answered "Agree" on the Likert scale, and the majority of the non-users answered "Neutral" on the said scale. This implies that users have a better perception of mHealth apps as compared to non-users. A study by Septiani et al. (2017) stated that perceived ease of use is regarded as an important factor in the use of technology since new users may find it difficult to operate complex applications. Moreover, when a user's perceived usefulness is positive, individuals are more likely to use mobile applications when they view them to be beneficial. However, if their perceived usefulness is regarded poorly, users' attitudes will shift, and they will stop using the program.

Based on the data gathered from the questionnaire, the top three reasons why users have downloaded mHealth applications are because they want to track their activity and the amount of exercise they get (n=117, 15.27%), to help them in weight loss (n=86, 11.23%), and to help them watch and improve what they eat (n=78, 10.18%). This showed that most users had downloaded mHealth apps that may help an individual become physically fit. For the non-users, the top three reasons why they have not yet downloaded mHealth applications are because they are not interested in the said applications (n=86, 23.56%), their health is fine, and they don't need mHealth apps (n=37, 10.14%), and they don't trust the apps in collecting their data (n=27, 7.40%). It was also revealed that most respondents spend more than 30 minutes (n=198, 48.89%) using mHealth applications a few times a month (n=60, 14.81%) on average.

Table.9. Summary Table of the Perception of Users and Non-Users on Mobile Health Applications

	Users		Non-Users	
Questions	**Mean score**	**Interpretation**	**Mean score**	**Interpretation**
PU1	3.66	Agree	2.79	Neutral
PU2	3.74	Agree	3.14	Neutral
PU3	3.65	Agree	3.05	Neutral
PU4	3.70	Agree	3.18	Neutral
PU5	3.75	Agree	3.15	Neutral
PEoU1	3.97	Agree	3.41	Agree
PEoU2	3.89	Agree	3.40	Agree
PEoU3	3.74	Agree	3.26	Neutral
PEoU4	3.88	Agree	3.38	Neutral
PEoU5	3.54	Agree	2.88	Neutral
PEoU6	3.40	Neutral	2.89	Neutral

Overall Mean Score	**3.72**	**Agree**	**3.14**	**Neutral**

Legend: PU = Perceived Usefulness; PEoU = Perceived Ease of Use
Mean Score Interpretation: 1.00 to 1.79 = Strongly Disagree; 1.80 to 2.59 = Disagree; 2.60 to 3.39 = Neutral; 3.40 to 4.19 = Agree; 4.20 to 5.00 = Strongly Agree

V. CONCLUSION

The extensive increase in the use of mobile phones and the influx in the release of health applications in digital distribution platforms have popularized the use of mobile applications for health monitoring and management. However, limited studies have tackled users' perceptions with varying characteristic factors, especially in the Philippine setting. The purpose of this study is to determine the different perceptions of Filipinos regarding mHealth applications and to determine the perceptions of Filipinos regarding mHealth applications. This study addresses the lack of research papers regarding the perception of mHealth applications with varying demographics and user characteristics; thus, this study is a significant aid to the improvement of research and production of mHealth applications in the Philippines. This was achieved by dividing the respondents between different external variables such as gender, age, occupation, and lifestyle, which were then analyzed using the respondents' data from the conducted survey. Upon analysis of the data, it was discovered that the majority of the respondents showed a positive perception towards the use of mHealth applications.

Furthermore, the results showed no significant difference with regard to the respondents' gender, age, and occupation. There is, however, a significant difference in the perception of the respondents according to lifestyle. Lastly, users were revealed to have a more positive perception of mobile health applications than non-users. The current conditions in the Philippines can serve as an idealized springboard for the successful utilization of mHealth applications to bridge the shortcomings in the prevailing healthcare system of the country. Through the inclusion of external variables, this research may provide significant insights that can contribute to the further development of mobile health applications which are appropriate and tailored to its target population. Through the continuation of research on this subject in the Philippine setting, an understanding of the myriad of factors that affect the acceptance of Filipinos towards mHealth applications will be established, which would lead to the successful implementation of mHealth applications.

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