Factors Affecting the Applicability of Telemedicine in Selected Areas of Luzon based on the Perceptions of Medical Professionals

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Abstract

The transition of healthcare delivery from face-to-face interactions to telemedicine is gradually recognized in developing countries. The applicability of telemedicine is influenced by different factors (e.g. technological difficulties). The study aims to determine the factors that affect the applicability of telemedicine in selected areas of Luzon based on the perceptions of medical professionals. It specifically focuses on the description of the sociodemographic characteristics of medical professionals participated in the study, identification of the advantages and disadvantages of telemedicine to both medical professionals and patients in selected areas of Luzon, description of the challenges encountered in telemedicine by Luzon-based medical professionals, and recognition of possible improvements that could be done in the Philippine healthcare system to aid the emergence of telemedicine practice especially in this time of the COVID-19 pandemic. The selected areas are Makati, Manila, Marikina, Las Piñas, Caloocan, Quezon City, Pasay City, Valenzuela, Cagayan, Dagupan, La Union, Bulacan, Pampanga, Tarlac, Laguna, Cavite, Batangas, and Oriental Mindoro. A survey questionnaire was disseminated through Google Forms. Statements reflect on the factors possibly encountered during clinical/ telemedicine practice. Descriptive and inferential statistics were performed to measure all responses. The perceived advantages of telemedicine are saves time, improves work efficiency, increases patient recall to follow-up consultations, reduces overall medical fees, and improves access to healthcare services. The perceived disadvantages are training requirements and understanding the system, and less connection between patients and physicians due to reduced physical interactions. The status of internet connectivity, and costly security and maintenance of telemedicine applications/ websites are perceived to be the main challenges. The healthcare system inefficiencies appear to be the main point of improvement. The prioritization of outpatient consultation in telemedicine practice obtained the most impact considering the COVID-19 pandemic. The applicability of telemedicine is influenced by its advantages and disadvantages, challenges, and points of improvement. The applicability of telemedicine is influenced by its advantages and disadvantages, challenges, and points of improvement.

Keywords: telemedicine; applicability; Luzon; perceptions; medical professionals

1. Introduction

The World Health Organization (WHO) defines telemedicine as "the delivery of health care services, where distance is a critical factor, by all healthcare professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and

injuries, research and evaluation, and for the continuing education of healthcare providers, all in the interests of advancing the health of individuals and their communities" (WHO Global Observatory for eHealth, 2010).

Telemedicine has shown the ability to enhance the delivery of health care by enhancing access, cost-effectiveness, quality, and reliability of health services (Macabasag et al., 2016). In the Philippines, this platform is already utilized but not as common as in developed nations. However, even when telemedicine has the promising potential to address health problems, its success rate has been unsatisfactory; numerous telemedicine programs discontinued shortly after initial funding or after the pilot phase (Macabasag et al., 2016). The applicability of telemedicine in the country is challenged by social, political, geographic, and economic factors that limit the availability of possible services.

Human and cultural factors may be potential barriers to the utilization of telemedicine. Some may refuse to conduct telemedicine due to the lack of ICT literacy that is needed to effectively perform telemedicine. Medical practitioners may prefer the traditional approach as it allows them to see the clinical evidence personally.

Economically, poor investments in infrastructure and underfunding of telemedicine programs may be due to the inadequate studies concerning the cost-effectiveness of telemedicine (WHO Global Observatory for eHealth, 2010). Telemedicine services have mostly been financed by combinations of various resources – government, private (local for profit or non-profit), and international organizations. A collaboration rather than a centralized approach to financing telemedicine has been proposed to allow effective use of government funding (Macabasag et al., 2016).

To sustain the implementation for low- and middle-income countries such as the Philippines, knowledge on capacity building for human resources, financing, creation of policies and governance in eHealth, fostering collaborations and partnerships, and technology should be deepened. Several studies suggest standardizing the practice of telemedicine for healthcare professionals by developing professional qualification or accreditation via structured academic courses.

There is a strong need for an eHealth technological framework to facilitate interoperability between various health systems. Asynchronous telemedicine is more practical and preferred for telemedicine in remote areas and developing countries as the solution is easier to adapt than conventional face-to-face medicine. Furthermore, it is easier than synchronous telemedicine. In the improvement of current asynchronous telemedicine, consideration should also be given to introducing other modes of telemedicine such as synchronous telemedicine. The use of mobile phones and other devices for video conferencing indicates that there are already low- and middle-income countries that have witnessed the use of synchronous telemedicine (Macabasag et al., 2016). While telemedicine shows great promise in advancing the delivery of medical services, there are existing barriers that may slow its utilization especially in far-flung and/or low-income communities. Still, the Philippines remains to be one of the top Asian countries where there is a high development possibility for telemedicine as a mode of healthcare delivery (Suzuki et al., 2020). With these, the researchers were motivated to conduct the study which described the sociodemographic characteristics of medical professionals, identified the advantages and disadvantages of telemedicine to both medical professionals and patients in selected areas of Luzon, described the challenges encountered by Luzon-based medical professionals, and recognized possible improvements that could be done in the Philippine healthcare system in the emergence of telemedicine practice in consideration of the COVID-19 pandemic.

2. Methods

2.1 Research Design

This quantitative study utilized a descriptive design with a survey questionnaire as the main methodology. The study aims to identify the factors that affect the applicability of telemedicine in selected areas of Luzon. It was assessed by medical professionals from different areas of Luzon such as nurses, medical technologists, primary care physicians, specialists, etc. who are and are not inclined with telemedicine. Perceptions varied depending on the experiences of the participant in the clinical setting both in face-to-face and in telemedicine practice. Data from the survey enabled the researchers to answer the research questions and provide a thorough discussion on the applicability of telemedicine.

2.2 Subjects and Study Site

The study was conducted through online platforms - primarily social networking sites and via Google forms. It employed a combination of snowball and purposive sampling techniques as the methods of choice in search of suitable subjects. In these sampling techniques, the participants were scouted and selected by the researchers. These participants subsequently recommended possible subjects to widen the study's reach. The initial subjects were identified and selected based on the study's inclusion criteria. All participants were contacted using social media or telecommunication services. The said sampling techniques were chosen given the limitations of the COVID-19 pandemic. Pilot testing was performed with 15 participants to test the reliability of the questionnaire. For the survey proper, 64 participants were involved. The target sample size was obtained based on the power analysis for an ANOVA with three groups as conducted in G* Power using an alpha of 0.05, power of 0.80, and large effect size ($f = 0.40$) (Faul et al., 2013). Participants for the reliability testing were different from the survey proper.

The inclusion criteria are the following: medical professionals working in healthcare facilities located in Luzon who have at least two years of experience in the clinical practice and who are and are not conducting telemedicine in the medical profession. The participants must know either English or the Filipino language. The exclusion criteria are the following: medical professionals who are not performing medical practice in Luzon and of aged 60 years old and above, regardless of if they are based in Luzon or not. The withdrawal criteria allowed the participant to withdraw from the study at his/her discretion and at any point during the data collection. Involvement in the study began upon signing the informed consent and ended after answering the survey questionnaire.

2.3 Data Instrumentation

The survey questionnaire was written in English with Filipino translation below each statement and was reviewed by the Ethics Review Board. It was adapted from Telehealth Usability Questionnaire (TUQ) and other relevant literature; modified in accordance with the objectives of the study. Pilot testing helped in establishing the validity of the survey. The reliability of the questionnaire was determined by using Cronbach's alpha wherein a score of 0.861 was obtained and is within the range of 0.70 – 0.99 indicating high reliability of the material. It consists of sociodemographic characteristics filled up by the participant and situational questions relating to possible aspects that may affect the applicability of telemedicine - advantages and disadvantages of telemedicine, challenges of telemedicine, and possible improvements for the applicability of telemedicine concerning the Philippine healthcare system and the COVID-19 pandemic. These were measured on a five-point Likert scale. The value of 1 represents strongly disagree and increases incrementally to 5 for strongly agree. The survey is a structured questionnaire containing close-ended

questions. It was administered online through Google forms.

2.4 Data Gathering and Ethical Considerations

The questionnaire and informed consent were validated by the Ethics Review Board before the selection of participants based on the inclusion and exclusion criteria were made. A pilot testing was conducted to test the reliability of the questionnaire. 15 medical professionals participated, and their responses got a Cronbach alpha score of 0.861 which is the acceptable range of 0.70-0.99. After the pilot testing, the survey proper was done wherein 64 medical professionals participated. Both the informed consent and the questionnaire were distributed in order via Google forms. The sociodemographic information of the respondents was required for the research alone. Only the respondents have access to it and were deleted once the study was completed.

In conducting the study, it is a priority to follow ethical principles. The informed consent and data privacy notice were presented to all respondents before the survey. All participation in the study was voluntary and no compensation of any form was provided to those who participated. The researchers guaranteed that all data and information was kept confidential. The study did not impose any risks to all the participants but would aid the medical and research field as it provided information concerning the different factors that affect the intention to practice telemedicine. Statements were assured to not violate any cultural or personal beliefs and do no harm to the dignity of the respondents. Respect, honesty, and transparency were prioritized in this study.

2.5 Data Analysis

The questionnaire utilized Likert scale with Likert items per domain. Each item will be divided into 5 points; 1 - strongly disagree, 2 - disagree, 3 - neutral, 4 - agree, 5 - strongly agree. Quantitative analysis, i.e., statistical analysis, was used for the survey questions.

The initial analyses that were conducted were the description and exploration of data. For the categorical variables, frequencies and percentages were computed to determine the distribution of the data. For the individual Likert-type statements, frequencies and percentages were also computed for the individual options (Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree). The composite scores for the six subscales were also computed after reverse-coding the negative statements. For the composite scores, means were computed to determine the central tendencies or where the data converged. Standard deviations were also derived to determine the variability of the data. These descriptive statistics facilitated the comparison among the statements and among the subscales.

To determine if there were significant differences in the perception of the respondents regarding the advantages and disadvantages, challenges, and improvement to telemedicine when the respondents are categorized according to their sociodemographic profile, Analysis of Variance (ANOVA) was used. It was utilized to compare if the means among categories of continuous variables are more than two groups. If there are only two groups, the independent samples t-test can be used. To facilitate the presentation of results, ANOVA was used for the set of variables with two categories and more than two categories. The statistical software utilized was SPSS. The level of significance for the inferential statistics was set at $\alpha = 0.05$.

3. Results and Discussion

This presents the sociodemographic characteristics of medical professionals, advantages and disadvantages of telemedicine to both medical professionals and patients, challenges encountered, and telemedicine practice in relation to the Philippine healthcare system and the COVID-19 pandemic.

3.1 Sociodemographic characteristics of medical professionals in selected areas of Luzon

Table 1 presents the sociodemographic profile of the 64 participants who are medical professionals in selected areas of Luzon regarding their sex, age, geographical location, educational qualification, employment qualification, years of clinical practice, medical qualification, and specialization if applicable.

Table 1. Sociodemographic characteristics of medical professionals in selected areas of Luzon

A Sociodemographic Characteristics of Medical Professionals in Selected Areas of Luzon	Frequency	Percentage
Sex		
Male	21	32.8
Female	43	67.2
Age		
21 – 30	26	40.6
31 – 40	15	23.4
41 – 50	14	21.9
51 – 60	9	14.1
Geographical Location		
National Capital Region (NCR)	37	57.8
Central Luzon	10	15.6
North Luzon	12	18.8
South Luzon	5	7.8
Educational Qualification		
Bachelor's degree	16	25
Master's degree	5	7.8
Doctorate degree	43	67.2
Employment Qualification		
Employee	38	59.4
Self-employed	26	40.6
Years of Clinical Practice		
1 – 5	31	48.4
6 – 15	19	29.7
16 – 25	11	17.2
> 25	3	4.7

The table displays the sociodemographic profile of the participants by frequency and percentage. Majority of the respondents are female; 40.6% of the respondents belong to the age group 21 - 30 years old. Most of the participants are from NCR. The selected areas of Luzon are not shown in the table; however, these were noted. The selected areas in NCR are the following: Makati, Manila, Marikina, Las Piñas, Caloocan, Quezon City, Pasay City, and Valenzuela. In North Luzon, the selected areas are the following: Cagayan, Dagupan, and La Union. In Central Luzon, the areas are Bulacan, Pampanga, and Tarlac. The selected areas in South Luzon are Laguna, Cavite, Batangas, and Oriental Mindoro. Approximately 67% of the respondents have doctorate degrees. 38 respondents are employed in hospitals and other healthcare facilities; others are self-employed. Almost half (48.4%) have less than 5 years of clinical practice. Majority are specialists and primary care physicians which are about 39% and 20%, respectively. Other medical qualifications are the following: physical therapist, nurse, medical technologist, radiologic technologist, medical officer IV, dentist, and general practitioner. There are 25 medical specialties recorded – Anesthesiology, Internal Medicine, OB-Gyne, Occupational Medicine, Urology, General Surgery, Ear-Nose-Throat (ENT) physician, Otolaryngology-Head and Neck Surgery (ORL-HNS), Neuro Rehab and Geriatic Care, Optometry, General Medicine, Emergency Nursing, Pain Medicine, Rehabilitation Medicine, Orthopedic Surgeon, Oral and Maxillafacial Surgery, Periodontics, Family and Community Medicine, Opthalmology, Occupational Health, Pediatrician, Dermatologist, Orthodontics and Oral Surgery, Public Health, and Echocardiograph Technicians. Anesthesiology, internal medicine, and dermatology have the most respondents with five participants from each field.

3.1.1 Participants' previous and current status regarding telemedicine practice

Table 2 summarizes the number of participants based on their previous and current status with regard to practicing telemedicine.

Table 2. Participants' previous and current status regarding telemedicine practice

Participants' previous and current status regarding telemedicine practice		Have practiced telemedicine before the COVID-19 pandemic		
		Yes	No	Total
Currently Practicing Telemedicine	Yes	30 (46.9%)	2 (3.1%)	32 (50%)
	No	7 (10.9%)	25 (39.1%)	32 (50%)
	Total	37 (57.8%)	27 (42.2%)	64 (100%)

More than half of the respondents, 37 (57.8%), have practiced telemedicine before the COVID-19 pandemic; 30 of the respondents are still currently practicing telemedicine while 7 do not practice it anymore. Additionally, out of the 27 respondents who did not practice telemedicine before the COVID-19 pandemic, 2 of them are now practicing it. Overall, exactly half of the respondents, 32 (50%), are currently practicing telemedicine while the other half do not currently practice it.

3.2 Summarized data of the six subcategories

Table 3 contains the summarized descriptive statistics for the six subcategories in the research instrument.

Table 3. Summarized data of the six subcategories

Subcategories	Mean	Standard Deviation
Advantages and Disadvantages of Telemedicine to both Medical Professionals and Patients in Selected Areas of Luzon		
Advantages and disadvantages of telemedicine to medical professionals in selected areas of Luzon	3.2188	0.55631
Advantages and disadvantages of telemedicine to patients in selected areas Luzon	3.2281	0.77898
Challenges Encountered in Telemedicine by Luzon-based Medical Professionals		
Challenges due to internet connectivity and hardware issues encountered in telemedicine by Luzon-based medical professionals	4.1531	0.77725
Challenges due to system design issues encountered in telemedicine by Luzon-based medical professionals	2.8344	0.52197
Telemedicine Practice in Relation to the Philippine Healthcare System and the COVID-19 Pandemic		
Possible points of improvement in relation to the Philippine healthcare system	3.8594	0.75566
Impact of telemedicine practice in relation to the COVID-19 pandemic	3.6281	0.62930

Note. Due to rounding errors, percentages may not be equal to 100%.

The mean scores obtained for each subcategory will be used as the limit to classify the individual statements in the subcategory. In the succeeding tables, the mean score of the individual item is compared to the corresponding mean score of the subcategory. Items with a mean score higher than the corresponding mean are perceived as advantages for medical professionals or patients, challenges concerning internet connectivity and hardware or system design, or points of improvement in relation to the Philippine healthcare system or impact of telemedicine on COVID-19 pandemic. Those having a mean score less than the desired ones are perceived as disadvantages, less of a challenge, or less of a concern for improvement. The subcategory having the lowest standard deviation indicates that the respondents have similar responses, thus, less varied. Otherwise, the subcategory having the highest standard deviation means that the responses vary across participants.

3.3 Advantages and disadvantages of telemedicine to both medical professionals and patients in selected areas of Luzon

The tables below show a list of advantages and disadvantages of telemedicine to medical professionals (Table 4) and patients (Table 5) in selected areas of Luzon. Shown in Table 3, the mean score of the subcategory, "Advantages and disadvantages of telemedicine to medical professionals in selected areas of Luzon" is M=3.2188 and for "Advantages and disadvantages of telemedicine to patients in selected areas of Luzon," is M= 3.2281. A corresponding positive statement is provided for item/s primarily presented in a negative connotation.

Table 4. Advantages and disadvantages of telemedicine to medical professionals in selected areas of Luzon

Advantages and disadvantages of telemedicine to medical professionals in selected areas of Luzon	Mean	Standard Deviation
Telemedicine saves time in terms of travelling to hospitals, patient admissions, referrals, etc.	4.05	0.98
Telemedicine requires training and understanding the system before practicing it.	4.17	0.97
Corresponding positive statement:		
Telemedicine does not require training and understanding the system before practicing it.	1.83	0.97
Telemedicine increases work efficiency and skills using computers or any gadget.	3.66	1.03
Telemedicine provides reliable results with respect to patient diagnosis and treatment.	3.02	0.93
Telemedicine helps increase patient recall to follow up consultations.	3.55	0.97

Note. Due to rounding errors, percentages may not be equal to 100%. A corresponding positive statement is provided for item/s presented in a negative connotation. The said statements are in bold font, while the original negative item is underlined.

The item "Telemedicine requires training and understanding the system before practicing it." has the highest mean response (M=4.17). Its corresponding positive statement obtained the lowest mean response (M=1.83); thus, it is considered as the least advantageous and perceived as the main disadvantage. This is in line with the study of Kruse et al. (2006) wherein the technology-challenged staff is one of the barriers in the application of telemedicine as seminars and workshops would require additional funding and time. "Telemedicine saves time in terms of travelling to hospitals, patient admissions, referrals, etc." has the highest mean response (M=4.05) with regards to the perceived level of advantageousness, making it the main advantage identified for this subcategory. A reduction in the costs and waiting period of patients for evaluation of pre-clinical and clinical conditions is attained. Patients residing far from the hospital or any medical center will not have to consider travel time (Guitton, 2013). The item "Telemedicine provides reliable results with respect to patient diagnosis and treatment." has the lowest standard deviation among the statements (SD=0.93) which means that the responses are relatively homogenous. With most of the participants being neutral regarding the reliability of results, this can be because telemedicine practice is not commonly used in the Philippines compared to developed countries. There is still limited experience to fully claim whether telemedicine provides reliable results. In the contrary, the item having the highest standard deviation is about telemedicine increasing the work efficiency (SD=1.03). Items that obtained a mean score greater than the overall mean for this subcategory (M=3.2188) are advantages and those with lower mean scores as disadvantages. Overall, telemedicine allows medical professionals to save time, improve their work efficiency, and have a good patient recall.

Table 5. Advantages and disadvantages of telemedicine to patients in selected areas of Luzon

Advantages and disadvantages of telemedicine to patients in selected areas of Luzon	Mean	Standard Deviation
Telemedicine reduces the overall medical fees of the patients.	3.39	1.08
Telemedicine connects patients to physicians	2.75	1.17

more compared to face-to-face interactions.

Telemedicine is a solution for patients that lack adequate access to healthcare.	3.33	1.04
Telemedicine allows patients to have no waiting period for their turn.	3.06	1.17
Telemedicine improves access to healthcare services.	3.61	0.97

Note. Due to rounding errors, percentages may not be equal to 100%.

The item "Telemedicine improves access to healthcare services." has the highest mean response (M=3.61) suggesting that it is the main advantage of telemedicine for patients. Hjelm (2005) identified telemedicine as a means of improving patient access to healthcare services. Patients can avail services in the comfort of their homes. "Telemedicine connects patients to physicians more compared to face-to-face interactions." has the lowest mean response (M=2.75) and is therefore considered to be the main disadvantage. Medical professionals still view face-to-face interaction as a better way to establish a connection between a patient and a physician. The item that has the lowest standard deviation (S=0.97) indicating that the respondents have the same perception is "Telemedicine improves access to healthcare services." The items having the highest standard deviation (S=1.17) are "Telemedicine connects patients to physicians more compared to face-to-face interactions." and "Telemedicine allows patients to have no waiting period for their turn." indicating mixed responses. Items that obtained a mean score greater than the overall mean for this subcategory (M=3.2281) are advantages and those with lower mean scores as disadvantages. In general, the overall medical fees are reduced in telemedicine to which about half of the respondents agreed as an advantage of telemedicine for patients. It supports the claim of several studies that telemedicine is cost-effective, and it allows more patients to receive treatment while also significantly lowering overall medical costs. Medical professionals also see telemedicine as a solution for patients that lack adequate access to healthcare.

3.4 Challenges encountered in telemedicine by Luzon-based medical professionals

The tables below show a list of challenges in telemedicine that can be encountered by Luzon-based medical professionals in terms of internet connectivity and hardware issues (Table 6) and system design issues (Table 7). Shown in Table 3, the mean score of the subcategory, "Challenges due to internet connectivity and hardware issues encountered in telemedicine by Luzon-based medical professionals" is M=4.1531 and for "Challenges due to system design issues encountered in telemedicine by Luzon-based medical professionals" is M= 2.8344.

Table 6. Challenges due to internet connectivity and hardware issues encountered in telemedicine by Luzon-based medical professionals

Challenges due to internet connectivity and hardware issues encountered in telemedicine by Luzon-based medical professionals	Mean	Standard Deviation
The status of internet connectivity affects the access to telemedicine platforms.	4.45	0.85
The availability of devices such as smartphones, tablets, and laptops are necessary for access to telemedicine platforms.	4.39	0.88
The conduct of telemedicine would be more difficult in far-flung communities due to	4.39	0.90

unestablished signal towers.

The internet connection required to conduct telemedicine is costly.	3.77	0.92
The devices required to conduct telemedicine are costly.	3.77	0.94

Note. Due to rounding errors, percentages may not be equal to 100%.

The item "The status of internet connectivity affects the access to telemedicine platforms." has the highest mean response (M=4.45) and is identified as the main challenge in telemedicine regarding internet connectivity and hardware issues. A well-established healthcare and technology infrastructure is essential for telemedicine practice to thrive (Macrohon & Fortunato, 2011). These include good cellular or WiFi signal, availability of computers or mobile phones, and whether or not the application or website to be used is user-friendly. Majority of the respondents agreed that the internet connectivity status and access to the necessary devices are crucial in making teleconsultation possible. It is difficult to conduct telemedicine especially in far-flung locations or areas with few to no cell towers that will facilitate signal transmission. Two items pertaining to the cost of the internet connection and devices required to conduct telemedicine obtained the same low mean response (M=3.77) and are less of a challenge when compared to the other items. In a program assessment conducted by the Ateneo de Zamboanga University in Mindanao, it was found that patients prefer using mobile phones for video calls with their physicians given the scarcity in more advanced and costly technology such as laptops or desktop computers (Macrohon & Fortunato, 2011). The item that has the lowest standard deviation (SD=0.85) indicating similar responses of the respondents is about the status of internet connectivity. The item that obtained the highest standard deviation (SD=0.94) refers to the devices required to conduct telemedicine. Other items that obtained a mean score of greater than the mean of this subscale (M=4.1531) are other challenges encountered by medical professionals. Most of the respondents agreed that the amount of money required to be able to put up a telemedicine system as a mode of healthcare delivery is expensive as it is inclusive of hardware, load allowance for texts and calls, and the funding for the initial design and launching, regular maintenance, and technical support necessary depending if the platform to be used is a website, application, or social media network. Internet connection status, availability of devices, and minimal number of established cell towers are mostly recognized as challenges by the medical professionals.

Table 7. Challenges due to system design issues encountered in telemedicine by Luzon-based medical professionals

Challenges due to system design issues encountered in telemedicine by Luzon-based medical professionals	Mean	Standard Deviation
Telemedicine applications or websites are easy to navigate.	3.36	0.90
Corresponding positive statement:		
Telemedicine applications or websites are challenging or difficult to navigate.	2.64	0.90
Telemedicine applications/ websites can easily be used by patients who have limited technological knowledge and skills.	2.97	1.01
Corresponding positive statement:		
Telemedicine applications/ websites can be challenging to patients with limited technological knowledge and skills.	3.03	1.01

Security and maintenance of telemedicine applications/ websites are costly.	3.66	0.82
The application or website interface is pleasant to use and appealing.	3.48	0.85
Corresponding positive statement:		
The application or website interface is not pleasant to use nor appealing.	2.52	0.85
The application or website allows a wide variety of functions.	3.67	0.84
Corresponding positive statement:		
The application or website does not offer a wide variety of functions.	2.33	0.84

Note. Due to rounding errors, percentages may not be equal to 100%. A corresponding positive statement is provided for item/s presented in a negative connotation. The said statements are in bold font, while the original negative item is underlined.

The item "Security and maintenance of telemedicine applications/ websites are costly." has the highest mean response (M=3.66) and is the main challenge for system design. With the continuous adoption of technological solutions especially in the field of healthcare, there is a need for people to keep up with the evolving technology. Therefore, eHealth literacy is highly recommended as it is essential for medical professionals to not only be excellent in their field, but to also have the technical skills to a certain extent (Anwar & Prasad, 2018). However, it is noted that there is a great cost on the security and maintenance of telemedicine platforms. The corresponding positive statement having the lowest mean response (M=2.33) is the item "The application or website does not offer a wide variety of functions." suggesting that it is least challenging compared to the other items. Majority of the respondents believed that current telemedicine platforms in place are already easy to navigate and offer a wide array of functions and services to users. The item having the lowest standard deviation (SD=0.82) indicating similar points of view of the respondents is about the security and maintenance of telemedicine. "Telemedicine applications/ websites can be challenging to patients with limited technological knowledge and skills." has the highest standard deviation (SD=1.01), suggesting mixed responses among the participants. Items which obtained a greater mean score compared to the mean of the subcategory (M=2.8344) are considered as challenges and those with lower mean scores as less challenging. The challenges identified when it comes to telemedicine systems are the need for digital literacy and technical skills to be able to use the platform and the possible high costs of the security and maintenance aspect of the application or website. Aspects such as functionality, complexity, and visual appeal of current telemedicine platforms are seen as less of a challenge than the issues on technological difficulties and financing.

3.5 Telemedicine practice in relation to the Philippine healthcare system and the COVID-19 pandemic

The tables below show telemedicine practice in relation to the Philippine healthcare system (Table 8) and the COVID-19 pandemic (Table 9). Shown in Table 3, the subcategory, "Possible points of improvement in telemedicine practice in relation to the Philippine healthcare system" has a mean score of M= 3.8594, while the subcategory "Impact of telemedicine practice on COVID-19 pandemic" has a mean score of M= 3.6281.

Table 8. Possible points of improvement in telemedicine practice in relation to the Philippine healthcare system

Possible points of improvement in telemedicine practice in relation to the Philippine healthcare	Mean	Standard Deviation

system		
Mismanagement of health finances including corruption can avert the system from improvements.	4.00	0.99
Healthcare system inefficiencies such as the lack of a defined and comprehensive telemedicine guidelines can impede the applicability of telemedicine.	4.09	0.94
Migration of medical professionals to other countries results in a slow referral network.	3.52	1.02
There is a likelihood of confidential data breach in the use of telemedicine.	3.67	1.01
The healthcare system facilities needed for practicing telemedicine are still underdeveloped.	4.02	0.88

Note. Due to rounding errors, percentages may not be equal to 100%.

The item "Healthcare system inefficiencies such as the lack of defined and comprehensive telemedicine guidelines can impede the applicability of telemedicine." obtained the highest mean response (M=4.09) and is seen as the main possible point of improvement that can be done in the Philippine healthcare system. To continuously develop telemedicine according to the COVID-19 situation, inadequacies such as the lack of structured guidelines should be addressed. The item having the lowest mean response (M=3.52) is "Migration of medical professionals to other countries results in a slow referral network." and is regarded to be the least point of improvement compared to the other statements. The item referring to healthcare system facilities has the lowest standard deviation (SD=0.88) indicative of a homogeneous response from the participants. Meanwhile, "Migration of medical professionals to other countries results in a slow referral network." garnered the highest standard variation (SD=1.02). Other items that obtained a mean score greater than the mean of this subcategory (M=3.8596) are regarded as other points of improvement and those with lower mean scores as less of a concern for improvement. There are multiple improvements concerning the Philippine healthcare system that must be considered to assist the emergence of telemedicine as a practice. These include, but are not limited to, the aspects of financial management, data security, and establishment of guidelines. By addressing these possible sources of improvement, the applicability of telemedicine to the COVID-19 healthcare situation would be received more positively by both medical professionals and patients.

Table 9. Impact of telemedicine practice on COVID-19 pandemic

Impact of telemedicine practice on COVID-19 pandemic	Mean	Standard Deviation
Telemedicine should be given more priority in the health system in terms of outpatient consultation considering the current situation.	4.06	0.91
The use of telemedicine services will decrease after the pandemic.	3.44	0.94
Corresponding positive statement:		
The use of telemedicine services will increase after the pandemic.	2.56	0.94
Telemedicine helps address the health	4.03	0.91

accessibility issues in the midst of pandemic.

Telemedicine allows fast acquisition of medical services in the midst of pandemic.	3.78	1.00
Telemedicine paved a way to an improved post-pandemic health system.	3.70	0.99

Note. Due to rounding errors, percentages may not be equal to 100%. A corresponding positive statement is provided for item/s presented in a negative connotation. The said statements are in bold font, while the original negative item is underlined.

The item "Telemedicine should be given more priority in the health system in terms of outpatient consultation considering the current situation." has the highest mean response (M=4.06) and is implied to have the most impact on the healthcare system amidst the COVID-19 pandemic. Telemedicine must be employed especially to outpatients. According to the medical professionals, it is the most impactful contribution of telemedicine to the healthcare system amidst the current situation. Knudsen et al. (2020) mentioned that during this time of pandemic, the use of telemedicine still provides rapid healthcare while preventing both the patient and the healthcare provider from contracting the virus. The corresponding positive statement "The use of telemedicine services will increase after the pandemic." has the lowest mean response (M=2.56) among other positive items and is regarded as less impactful and less of a point of concern. Most medical practitioners see that the use of telemedicine will decrease as soon as the COVID-19 pandemic is over. In the study of Mehrotra et al. (2020), it was mentioned that even with the forecast that the COVID-19 pandemic will still be with us for a longer time, physicians who switched telemedicine during the pandemic are now back to their face-to-face consultations because they doubt telemedicine's long-term sustainability. The items "Telemedicine should be given more priority in the health system in terms of outpatient consultation considering the current situation." and "Telemedicine helps address the health accessibility issues in the midst of pandemic." have the same lowest standard deviation (SD=0.91) indicating homogeneous responses. The item having the highest standard deviation (SD=1.00) is "Telemedicine allows fast acquisition of medical services in the midst of pandemic." implying varying perceptions among the respondents. Other items that obtained a mean score greater than the mean of this subcategory (M=3.6281) are considered to have a significant impact on the healthcare system during the COVID-19 pandemic. It can be inferred that medical professionals in selected areas of Luzon perceive telemedicine to have a positive overall impact on the healthcare system. The respondents believe that the practice of telemedicine should be given more priority as a means of providing healthcare. Moreover, the positive impact of telemedicine during the COVID-19 pandemic could serve as evidence of its potential benefits to the healthcare system.

3.6 Comparison of the mean scores of the sociodemographic profile per subcategory

The study reveals the comparison of the mean scores of the respondents in each subcategory. Analysis of Variance (ANOVA) was conducted to determine if the differences between the mean scores among the subcategories of a specific demographic profile are statistically significant. Statistically significant results are recognized when the p-value is less than or equal to 0.05. In this study, it was determined that the p-values of each subcategory exceeded 0.05, hence the results are not statistically significant. The responses showed no significant correlation with the sociodemographic characteristics of the respondents.

4. Conclusion

Medical professionals are at the forefront of telemedicine practice. Based on the perceptions of the respondents, telemedicine saves time in terms of travel is the main advantage while the training requirement and understanding of the system before performing it is the main disadvantage. On the other hand, improved access to healthcare services is the main advantage of telemedicine to patients while its main disadvantage is

the lack of connection between patient and physician. While it is already widely accepted as a mode of healthcare delivery, the challenges encountered in telemedicine affect the perceptions of medical professionals on its applicability to current circumstances. In the selected areas of Luzon, the two primary and main challenges are the status of internet connectivity affecting access to telemedicine platforms and the cost of security and maintenance of telemedicine applications or websites since high expenses are incurred to protect the data from possible breach and to maintain confidentiality and system organization. For the main possible point of improvement in the Philippine healthcare system that may aid in the emergence of telemedicine practice, systemic healthcare inefficiencies such as the lack of structured and comprehensive guidelines should be addressed by concerned authorities. The prioritization of telemedicine for outpatient services has the most impact on the healthcare system amidst the pandemic. The perceived response to telemedicine by medical professionals from various areas of Luzon is overall good, with the projection that its use is expected to decline but may still be prevalent even after the COVID-19 pandemic. The advantages and disadvantages of telemedicine to both medical professionals and patients, challenges encountered by medical professionals, and points of improvement involving the degree of impact are factors that affect the applicability of telemedicine in the selected areas of Luzon.

5. Recommendation

The scope of this study is limited to telemedicine in general, excluding its different forms such as synchronous and asynchronous, technicalities in terms of consultation, diagnosis, treatment, and medical prescriptions, and other roles involved such as data information controllers and privacy officers. It is advised to include these aspects as they are integral in understanding telemedicine. The study only tackles the applicability of telemedicine in selected areas of Luzon. If future researchers wish to conduct the study in the whole Luzon, it is recommended that all areas in Luzon must be well represented. Visayas and Mindanao can also be included to profoundly assess the status of telemedicine in the country.

Regarding the sampling technique of the study, the researchers recommend the use of random sampling to prevent selection bias instead of purposive and snowball sampling techniques as employed in this study. In random sampling, participants have an equal chance of being selected. The results of the analysis can be generalized to a larger population; unlike in purposive and snowball sampling techniques, it can only be descriptive of the sample and not of those outside of it.

The researchers recommend having a uniform way of constructing the survey questions. Statements could be constructed positively as this will make data interpretation easier. The conduct of mixed methods can also be considered to obtain more data and an in-depth understanding of the perceptions of medical professionals. This will confirm if the survey results validate the answers in the interview questions and vice versa. Asking open-ended questions in the interview would allow the participants to further explain and narrate their experiences which influence their perceptions. Future researchers could also conduct comparative research in which separate research on the perceptions of medical professionals who are inclined with telemedicine and those who are not are compared.

Acknowledgements

To Assoc. Prof. Jocelyn D. Domingo, RMT, MSMPR of the Faculty of Pharmacy, the proponents would like to express their sincere appreciation for being their thesis adviser. Your expertise, guidance, and consistent response to the questions and queries of the researchers are deeply acknowledged and recognized. Your feedback and invaluable suggestions have helped the researchers to improve and give their maximum efforts in finishing their work.

To Mr. Jerby V. Lopez, the researchers would like to extend their gratitude for being their statistician. Your input, recommendations, and suggestions regarding the statistical computations of the data are greatly valued. The authors are beyond thankful for all your efforts.

To the University of Santo Tomas, Faculty of Pharmacy, Department of Medical Technology, the researchers would like to show their sincerest gratitude for giving them the opportunity to conduct their study safely amidst the pandemic.

Above all, to the Lord God Almighty who is loving, omnipotent, and omniscient, thank you for the wisdom and strength you have bestowed upon the researchers. Thank you for constantly providing them everything they need to make this thesis possible.

References

WHO Global Observatory for eHealth. (2010). Telemedicine: opportunities and developments in Member States: report on the second global survey on eHealth. World Health Organization. https://apps.who.int/iris/handle/10665/44497

Macabasag, R. L., Magtubo, K. M., & Marcelo, P. G. (2016). Implementation of Telemedicine Services in Lower-Middle Income Countries: Lessons for the Philippines. Journal of the International Society for Telemedicine and EHealth, 4, e24 (1-11). Retrieved from https://journals.ukzn.ac.za/index.php/JISfTeH/article/view/168

Suzuki, T., Hotta, J., Kuwabara, T., Yamashina, H., Ishikawa, T., Tani, Y., & Ogasawara, K. (2020). Possibility of introducing telemedicine services in Asian and African countries. Health Policy and Technology, 9(1), 13-22. doi: https://doi.org/10.1016/j.hlpt.2020.01.006

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2013). G*Power Version 3.1.9.7 [computer software]. Uiversität Kiel, Germany. Retrieved from http://www.psychologie.hhu.de/arbeitsgruppen/allgemeine-psychologie-und-arbeitspsychologie/gpower.html

Kruse, C. S., Karem, P., Shifflett, K., Vegi, L., Ravi, K., & Brooks, M. (2016). Evaluating barriers to adopting telemedicine worldwide: A systematic review. Journal of Telemedicine and Telecare,24(1), 4-12. doi:10.1177/1357633x16674087

Guitton, M. (2013). Telemedicine in Tinnitus: Feasibility, Advantages, Limitations, and Perspectives. ISRN Otolaryngology, 2013, 1-7. doi: 10.1155/2013/218265

Hjelm, N. M. (2005). Benefits and drawbacks of telemedicine. Journal of Telemedicine and Telecare, 11(2), 60–70. https://doi.org/10.1258/1357633053499886

Macrohon, B. C., & Fortunato, C. L. (2011, May 5). Rural healthcare delivery using a phone patch service in the teleconsultation program of the Ateneo de Zamboanga University School of Medicine in Western Mindanao, Philippines [Letter written February 25, 2011 to The International Electronic Journal of Rural and Remote Health Research, Education, Practice, and Policy]. Retrieved from http://www.rrh.org.au

Anwar, S., & Prasad, R. (2018). Framework for Future Telemedicine Planning and Infrastructure using 5G Technology [Abstract]. Wireless Personal Communications, 193-208. Retrieved from https://link.springer.com/article/10.1007%2Fs11277-018-5622-8

Knudsen, K. E., Willman, C., & Winn, R. (2020). Optimizing the Use of Telemedicine in Oncology Care: Postpandemic Opportunities. Clinical Cancer Research, 27(4), 933–936. https://doi.org/10.1158/1078-0432.ccr-20-3758

Mehrotra, A., Wang, B., & Snyder, G. (2020). Telemedicine: What Should the Post-Pandemic Regulatory and Payment Landscape Look Like?. The Commonwealth Fund. Retrieved from https://www.commonwealthfund.org/publications/issue-briefs/2020/aug/telemedicine-post-pandemic-regulation