Telemedicine Readiness and Acceptability Among Resident Physicians of a Tertiary Government Hospital: A Cross-Sectional Analytic Study

Adrian Levi L. Magbojos, MD

Background: Multiple international studies found that Telemedicine is acceptable to physicians and healthcare teams. However, there are no available studies to determine if the residents of a tertiary hospital are ready and welcoming to this new approach.
Objective: To assess telemedicine readiness and acceptability among resident physicians of East Avenue Medical Center.
Methods: This cross-sectional study recruited 139 East Avenue Medical Center (EAMC) resident physicians using a web-based questionnaire. The majority of respondents were female (63.31%), with a mean age of 29.99 $\pm$ 2.45 years and a mean duration of training of 23 (11 to 34). Data were analyzed to determine readiness based on technological resource availability, hardware and software skills, and acceptability using a modified and validated questionnaire.
Results: The majority have Smartphones 125 (89.93%) and Personal Computers 122 (87.77%) and have access to mobile data 128 (92.09%) and Wi-Fi 119 (85.61%). Mean perceived device and software skills were 3.28 $\pm$ 0.58 and 3.38 $\pm$ 0.56, respectively. The overall acceptability was 2.88 $\pm$ 0.58. Males have higher perceived device skills, however, both sexes have similar perceived software skills (p-value $>$ 0.05) No correlation was seen between telemedicine acceptance with age and length of training.
Conclusion: This study demonstrated that EAMC resident physicians are equipped and ready for Telemedicine. Additionally, it demonstrated hesitancy but leaned towards telemedicine acceptance. Males have better perceived device skills, but readiness and acceptability are similar for both sexes in other domains. There is no correlation between age and length of training with readiness and acceptability.

Key words: Telemedicine, acceptability, readiness

Introduction

Telemedicine Services (TMS) is a new frontier in delivering healthcare services and poses a considerable challenge in shifting from office-based visits. Unlike office-based visits, a physician doing Telemedicine must learn new information and develop skills to adapt to this new medium. In addition to medical expertise, knowledge of essential computer software for Telemedicine, the internet, and basic computer troubleshooting is tantamount for a physician wanting to pursue Telemedicine as a healthcare delivery alternative.

Broens, et al. enumerated several determinants for telemedicine implementation success: Acceptance, Technology, Financing, Organization and Policy, and Legislation.[1]

Since the COVID 19 pandemic in March 2020, the Department of Health (DOH), Food and Drug Authority (FDA), National Privacy Commission (NPC), UP-PGH, and other agencies, issued memorandum circulars and guidelines on the use of Telemedicine as an alternative medium for healthcare delivery.[2,3] This also included the issuance of electronic prescriptions. These policies have shaped the "new normal" in ensuring quality and safe healthcare delivery.

Foreign studies have shown benefits from the utilization of Telemedicine. Sorwar et al. observed a 56% reduction in cost and a 94% reduction in travel time compared to the conventional approach, with most users highly satisfied.[4] Kiberu, et al. found a significant association between the state of readiness and the type of health facility.[5] Saleh, et al. noted that the majority of the study participants were ready for Telemedicine.[6] The physicians' behavioral intentions are influenced by perceived ease of use and perceived usefulness of telemedicine services, according to Kissi, et al.[7]

Assessment of technological resources is critical in performing Telemedicine. Mobile devices such as smartphones and laptops can be the key in performing Telemedicine.[8] Acceptance of Telemedicine

among physicians is a challenge that needs investigation. In 1989, Davis developed and validated the Technology Acceptance Model Questionnaire (TAM), a new measurement scale for perceived usefulness and perceived ease of use of technology.[9] Studies used TAM to assess the acceptance of new technology among healthcare workers worldwide.10 However, TAM is limited in explaining attitude and intention to use TMS.[10] TAM is generally adequate and applicable in a professional context.[11]

Local studies about telemedicine acceptability seem lacking and hence a relevant area for research. This pilot study identified the current status of the physician's readiness and acceptance in providing telemedicine services in East Avenue Medical Center, Out-Patient Department, by promulgating critical long-term policies. This study will benefit patients by decreasing their risk of COVID-19 exposure and encouraging continuity of care, especially for chronic diseases. On a larger scale, it is a crucial, timely, and relevant initial study towards assessing the readiness of primary care providers for the paradigm shift of Telemedicine health care delivery in our country by identifying baseline indicators and potential pitfalls in the implementation of Telemedicine in the out-patient setting for future research. Furthermore, findings will form the initial basis for future policies and healthcare programs, ultimately improving healthcare delivery for all Filipinos.

This study assessed telemedicine readiness and acceptability among East Avenue Medical Center resident physicians. Specifically, it aimed to determine the telemedicine readiness of East Avenue Medical Center resident physicians using the modified Technology Acceptance Model to determine the acceptability of Telemedicine among resident physicians and correlate telemedicine readiness and acceptability based on the sociodemographic and training profile of residents (gender, specialization, age, and length of training.)

Methods

This study utilized a Cross-Sectional Analytic Study design to determine the relationship between demographic and professional profiles with physician readiness and acceptability of Telemedicine among resident physicians of EAMC.

The researcher recruited residents who met the following criteria: PRC - Licensed physician with or without telemedicine experience, Male or Female, and at least three months of residency training at East Avenue Medical Center in the following subspecialties (Internal Medicine, Pediatrics, Obstetrics, and Gynecology, Family and Community Medicine, Surgery, Orthopedics, Urology, Otorhinolaryngology, Head and Neck Surgery, Ophthalmology, Dermatology, Neurosciences). On the other hand, residents were excluded from the study if they were resident physicians under training in specialties without the Out-patient Department (Emergency Medicine, Pathology, Radiology, Anesthesiology) or residents in training programs identified in the Inclusion Criteria but were rotating outside of East Avenue Medical Center or on leave at the time of conduct of the study. Withdrawal from the study can be made anytime by the participant without affecting his employment status.

All eligible resident physicians were encouraged to join the study and complete a validated online survey. The modified, pre-tested, and validated questionnaire is composed of 4 sections: Sociodemographic profile (7 questions), Technological resource availability (7 Questions), and Telemedicine skills self-assessment (13 questions) to assess readiness, while acceptance assessed through Technology Acceptance Questionnaire (18 questions.) All participants were encouraged to answer the online survey within the 2-week study period. Those who had already accomplished the Google Forms were not followed-up.

Demographic data such as Name, Age, Sex, Department/Training Program, Months in training, and Availability of Telemedicine in the department. The readiness aspect measured according to the Hardware, Software, and Connectivity readiness based on the minimum criteria set by UP-PGH Telemedicine: Guidance for Physicians in the Philippines, while acceptability with the modified Technology Acceptance Model questionnaire based on the instrument developed in the study on Predictive factors of physicians' satisfaction with telemedicine services acceptance by Kissi, et al.[7,9] Permission was sought and granted by original author.

Throughout the study, respondent confidentiality was achieved by replacing their names with unique identifier codes before statistical analysis. Participants were allowed two weeks to answer the questionnaire voluntarily.

Using G*Power 3.1.9.2, a minimum of 128 study participants were required for this study based on the assumed moderate effect size between two independent groups regarding their Telemedicine Acceptance and Readiness. This computation also accounted for a 5% level of significance and 80% power. Descriptive statistics were used to summarize the demographic and clinical characteristics of the participants. Frequency and proportion were used for categorical variables, and mean and SD for normally distributed continuous variables. An independent sample T-test was used to determine the difference between two individual groups, such as participant's Gender and Department of Specialization. Pearson product-moment correlation was used to determine the linear correlation between Telemedicine Readiness and Acceptance Questionnaire score to participant's Age and Length of months in training. Statistical tests done were two-tailed. No estimation or replacement was done for missing variables. Null hypotheses were rejected at a 0.05α-level of significance. STATA 13.1 was used for data analysis.

Results

A web-based survey was distributed to 246 eligible study participants; 139 (54.09%) resident physicians consented to the study within the alloted 2 weeks.

Table 1 describes the socio-demographic and training profile of EAMC resident physicians. Majority of the respondents were 88 females (63.31%) vs. 51 males (36.69%), with a mean age of 29.99 ± 2.45 years and a mean duration of training of 23 (11 to 34) months. The Department of Pediatrics had the most number of respondents (26 or 18.71%), whereas the lowest respondents came from the Department of Surgery (5 or 3.6%).

Table 2 depicts the Telemedicine Readiness of Resident Physicians of East Avenue Medical Center. Readiness was measured using the availability of technological resources, hardware, and software skills.

Table 1. Sociodemographic and training profile (n=139)

	Frequency (%); Mean ± SD; Median (IQR)
Age	29.99 ± 2.45
Sex	
Male	51 (36.69)
Female	88 (63.31)
Months in training	23 (11 to 34)
Department	
Pediatrics	26 (18.71)
Ophthalmology	20 (14.39)
Neurosciences	15 (10.79)
Obstetrics and Gynecology	14 (10.07)
Dermatology	13 (9.35)
Family and Community Medicine	12 (8.63)
Internal Medicine	12 (8.63)
Otorhinolaryngology, Head and Neck Surgery	9 (6.47)
Orthopedics	7 (5.04)
Urology	6 (4.32)
Surgery	5 (3.6)

Table 2. Telemedicine readiness of resident physicians of East Avenue Medical Center

Telemedicine Readiness: Technological Resources Availability (n=139).	Frequency (%); Median (IQR)
Personal Computer	122 (87.77)
With webcam	115 (94.26)
Mobile smartphone	125 (89.93)
With webcam	121 (96.8)
Landline	32 (23.02)
Office	23 (71.88)
Personal	9 (28.13)
Cellular phone (non-touchscreen)	14 (10.79)
Internet connection	
Wired	54 (38.85)
Speed (Mbps)	13 (5 to 60)
Wi-Fi	119 (85.61)
Speed (Mbps)	20 (6 to 43)
Mobile data	128 (92.09)
Speed (Mbps)	10.4 (4 to 25)

The majority of the respondents have Smartphones (125 or 89.93%) and Personal Computers (122 or 87.77%). Most have access to the internet via Mobile Data (128 or 92.09%) and Wi-Fi (119 or 85.61%) with average speeds of 10.4 Mbps and 20 Mbps, respectively. Among the available devices, more than half of the smartphone users (75 or 53.96%) and PC users 71 or 51.08%) rated themselves as "expert" and "advanced," respectively. The majority of respondents have advanced skills in both productivity and telecommunication applications. Overall readiness on device and software skills were 3.28 ± 0.58 and 3.38 ± 0.56, respectively.

Table 3 presents the acceptability of telemedicine among resident physicians using the Modified Technology Acceptance Model. Telemedicine Acceptance was also measured using the validated modified technology acceptance questionnaire. All domains had mean scores greater than 2.5 and may signify the perception of residents leaning towards acceptance of Telemedicine. Among the dimensions, the highest acceptance rating from respondents was the Actual telemedicine service used (3.11 ± 0.58) and the lowest was perceived ease of use (2.67 ± 0.69). In addition, a bulk of the respondents (126 or 90.65%) have already performed Telemedicine for an average of 10 months. A majority (90 or 64.75%) preferred synchronous Telemedicine with video calls as the most accepted mode. Among those who have not yet performed Telemedicine, most (12 or 92.31%) respondents indicated an interest in using Telemedicine even after the pandemic.

Statistical tools to correlate telemedicine readiness and acceptability based on residents' socio-demographic and training profile (gender, specialization, age, and length of training) were student's t-test and Pearson's product-moment correlation. Student's t-test was used for the mean scores of categorical variables (gender and specialization) whereas, Pearson's product-moment correlation was used for quantitative variables (age and length of training). In terms of telemedicine readiness, males have higher mean scores than females for perceived device skills (3.42 ± 0.5 vs. 3.19 ± 0.60), which is statistically significant (p-value < 0.05); however, both sexes have similar perceived

Telemedicine Readiness: Hardware and Software Skills Self-assessment (n=139)

	Frequency (%)			
How would you rate your skills in using the following devices?	None to basic	Average	Advanced	Expert
Personal Computer	1 (0.72)	9 (6.47)	71 (51.08)	58 (41.73)
Smartphone or Tablet	1 (0.72)	7 (5.04)	56 (40.29)	75 (53.96)
Cellular phone (non-touchscreen)	4 (2.88)	18 (12.95)	61 (43.88)	56 (40.29)
Landline	7 (5.04)	23 (16.55)	62 (44.6)	47 (33.81)
Perceived Device skills				
Mean ± SD		3.28 ± 0.58		
How would you rate your software skills?	None to basic	Average	Advanced	Expert
Word processing (MS Word, Google Docs, Pages, etc.)*	0	11 (7.91)	73 (52.52)	55 (39.57)
Spreadsheets (MS Excel, Google Sheets, etc.)*	2 (1.44)	19 (13.67)	69 (49.64)	49 (35.25)
Web Browsing and Internet Search (Google Chrome, Safari, etc.)*	0	12 (8.63)	64 (46.04)	63 (45.32)
Teleconferencing Apps (Google Meet, Zoom, Webex meetings, etc.)**	1 (0.72)	18 (12.95)	78 (56.12)	42 (30.22)
Communication apps like (Viber, WhatsApp, and Telegram)**	1 (0.72)	11 (7.91)	70 (50.36)	57 (41.01)
Social Media Apps (Facebook Messenger, Facebook Business Suite)**	2 (1.44)	10 (7.19)	70 (50.36)	57 (41.01)
Perceived Software skills				
Mean ± SD		3.38 ± 0.56		

*Productivity applications

**Telecommunication applications

software skills (p-value > 0.05) In terms of specialization, no significant difference was found in perceived device and software skills (p-value > 0.05). As to age and training length, no correlation was found in perceived device and software skills mean scores (p-value > 0.05). Mean scores for Telemedicine acceptability was similar for both sexes and specialty groups (p-value > 0.05). Telemedicine acceptability was not correlated with age and length of training (p-value > 0.05).

Discussion

This study assessed the telemedicine readiness and acceptability among East Avenue Medical Center resident physicians. They have access to hardware and connectivity and essential hardware and software skills necessary to perform Telemedicine (Table 2). The majority of responders use smartphones and personal computers. Over half of smartphone and PC users assessed themselves as "expert to advanced." Participants gave the highest acceptance rating to the actual telemedicine service used, while perceived ease of use received the lowest rating. For telemedicine readiness, males have statistically significant higher perceived device skills, but both sexes have similar software skills. Regarding specialization, both have similar perceived device and software skills. No correlation was found for perceived device and software skills and age and length of training. For telemedicine acceptability, both sexes and specialty groups are similar; no correlation was found with age and length of training.

The onset of the COVID-19 pandemic in the Philippines prompted UP-PGH to develop guidelines for Telemedicine practice (Telemedicine: Guidance for Physicians in The Philippines), which cited minimum standards in setting it up - a communication device, whether a landline phone, a cellphone with or without a camera, and/or a computer can be used and a minimum of 2 Mbps per user is recommended (for a video call resolution of HD720p and a frame rate of 30fps).[3] All study participants had the recommended device and connectivity requirements. Most of the respondents in this study rated themselves as advanced to expert in using smartphones and personal computers, respectively, which gives an idea of their computer literacy. This finding is similar to that from a multicenter cross-sectional study by Shaker, et al., where a majority of doctors possessed more than a satisfactory degree of computer literacy.[12] Saleh, et al. also found that majority of physicians among Primary Healthcare Centers in Lebanon were comfortable using computers, concluding that local healthcare workers, including physicians, were equipped to deliver e-health.[6] A cross-sectional study on telemedicine awareness by Elhadi, et al. noted high computer competence in 36.8% of respondents.[13]

The acceptability of Telemedicine among resident physicians was measured using the modified Technology Acceptance Model (Table 3). Interpretation of mean scores is as follows: a mean score of 3 and above favors acceptance of Telemedicine; a mean score between 2 and 3 shows a level of uncertainty in acceptance, and a mean score of 2 and below shows the degree of disagreement with the use of Telemedicine. Generally, the three domains have mean scores between 2 and 3 (Perceived usefulness, Perceived ease of use, and intention to use telemedicine services); however, they were above 2.5 and may signify the residents' perception leaning towards acceptance of Telemedicine. This finding can be explained by the fact that most of the training they received from medical school before the pandemic was delivered via traditional means involving all senses (e.g., sight, touch, hearing). They may have felt ill-equipped to carry out consultations relying on limited sight and hearing afforded by Telemedicine. A similar observation by Nies, et al. noted respondents' concerns about the inability to perform physical examinations and internet connectivity issues.[14] An important observation by Kissi, et al. noted that perceived ease of use and usefulness of Telemedicine influenced the intention to use Telemedicine.[7] Among the domains, the Actual telemedicine service used by physicians had a mean score > 3. This score meant that they agreed on the value of Telemedicine in their practice. A similar finding was found in the cross-sectional study by Segrelles-Calvo, et al., wherein Telemedicine received 77% overall satisfaction using a similar Technology Acceptance Model questionnaire.[15] Likewise, Altulaihi, et al. found that half of their participants described their telemedicine experience as convenient and

Table 3. Acceptability of telemedicine among resident physicians using the Modified Technology Acceptance Model.

	Score Mean ± SD*
Perceived usefulness	2.85 ± 0.73
Perceived ease of use	2.67 ± 0.69
Intention to use telemedicine services	2.91 ± 0.66
Actual telemedicine service used by physicians	3.11 ± 0.58
Overall Acceptability Score	2.88 ± 0.58
Other Acceptability Questions	**Frequency (%); Median (IQR)**
Have you performed Telemedicine?	
Yes	126 (90.65)
No	13 (9.35)
If yes, how long have you been performing Telemedicine? (months)	10 (5 to 12)
If not, are you interested in using Telemedicine in the future, even without a pandemic? (n=13)	
Yes	12 (92.31)
No	1 (7.69)
Preferred mode of Telemedicine	
Asynchronous Telemedicine	49 (35.25)
Synchronous Telemedicine	90 (64.75)
Preferred mode of Asynchronous Telemedicine (n=49)	
Text messaging	23 (46.94)
Chat (Viber, Messenger, Telegram, etc.)	45 (91.84)
Email correspondence	21 (42.86)
Preferred mode of Synchronous Telemedicine (n=73)	
Video Calls	57 (78.08)
Voice Calls	16 (21.92)

*Likert scale – where 1 means strongly disagree, and 4 means strongly agree)

satisfactory.[16] For those already doing Telemedicine in this study, more than half of the study participants prefer synchronous Telemedicine, with video call as the most preferred mode. This observation may again point to their desire to involve more senses in Telemedicine's already limited patient interaction, which would be further limited with the use of asynchronous mode.

Gender may have a role in telemedicine readiness and acceptability. This study showed that males' perceived device skills were statistically significant. This finding is similar to the that of a meta-analysis by Cai, et al., where males continue to have a more favorable attitude about technology usage than females.[17] Regarding telemedicine acceptability between genders, this study found similar acceptability scores. This observation agreed with Alharbi, et al., where there was no statistically significant correlation between gender and telemedicine preference.[16] This study found similar acceptability mean scores in both specialty groups. This observation meant that whether the specialty is clinical or surgical, Telemedicine is found acceptable. In the study by Nies, et al., the majority of health providers (clinical and surgical) believe that telemedicine would be useful in providing care after the pandemic is over.[14] In this study, age, and length of training have no significant correlation with readiness and acceptability, which is in contrast with the findings of Nies, et al., where the younger group were more likely to use Telemedicine in the future (mean age 44, range 42-46 years vs. mean age 50, range 46-55 years; p=.048 (odds ratio 1.05, 95% CI 1.01-1.08)).[14]

This study used cost-effective, nature-friendly, web-based surveys. However, this study has been limited by several factors. First, there was a low turnout of study participants from surgical departments, which may explain the low significance of some results. Second, the age range is limited to those still in residency training; thus, this study could not investigate any generational differences in technological skills and telemedicine acceptability. Lastly, technological device and software skills assessments were subjective and relative to the definition given on the questionnaire.

Conclusion

This study has shown that resident physicians of East Avenue Medical Center are appropriately equipped and, therefore, ready for Telemedicine. Based on the modified Technology Acceptance Model, there is hesitancy but generally leaning towards acceptance of Telemedicine. Males have better perceived device skills, but telemedicine readiness and acceptability are similar for both sexes in other domains. Age and length of training are not correlated with telemedicine readiness and acceptability.

Strategies to increase participant turnout include using traditional paper-based and web-based surveys. Web-based surveys have advantages and disadvantages; it is convenient for both the researcher and the respondents. However, it is also easy for the study participants to overlook or ignore these messages, which may explain the low turnout of study participants, mainly from surgical departments. Using both approaches will also reduce a possible selection bias for participants who are hesitant or inexperienced with online surveys. Future studies may cover a wider age group to investigate generational differences in technological skills and telemedicine acceptability. Finally, a potential area for research is to identify technological barriers to telemedicine implementation; hence a standardized computer literacy questionnaire is recommended to investigate the technological skills of physicians and patients objectively.

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