



MEDICAL-SURGICAL NURSES' KNOWLEDGE, PERCEPTION, AND ATTITUDE TOWARDS TELEMEDICINE

Rachelle Gil B. Pangilinan, RN
Joseph Michael D. Manlutac, PD-SMI, PhD, MPH, RN, FRIN, FRSPH

¹ *Graduate School, Angeles University Foundation, Angeles City, Philippines*

² *Faculty, Graduate School, Angeles University Foundation, Angeles City, Philippines*

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ABSTRACT

Telemedicine has been around for decades but has not been appreciated until recently. To disrupt the spread of the 2019 coronavirus disease (COVID-19) infection, health authorities are strategizing to shift face-to-face patient interaction to a virtual mode of care. Advances have been developed and protocols have been revised to accommodate different clients across the country. Studies were conducted and several issues were noticed. Among these, clinicians' knowledge, perceptions, and attitudes were factors affecting clinicians' willingness to use telemedicine. On the other hand, few studies only focus on nurses; therefore, the researchers would like to investigate the nurses' knowledge, perception, and attitude towards telemedicine from December 2023 to April 2024. An electronic questionnaire was developed that was adapted from the studies of Ayatollahi, et.al (2015) and Chang, et.al (2021). The researchers include 355 participants classified as nurses, classified by the Saudi Commission for Health Specialties (SCFHS), aged 18-59 years to exclude vulnerable populations, working in the hospital with at least a year of medical-surgical clinical experience during the study regardless of work experience in a selected tertiary hospital in Riyadh, Saudi Arabia. The analysis of the data revealed that on average, medical-surgical nurses' knowledge of telemedicine is very high with an average of 4.62, have a very high perception of its advantages (mean=4.82), low extent of its disadvantages, a high view for its necessity(mean=4.82), ease of use (mean=4.81), security (mean=4.85) and strong positive attitude toward it (mean= 4.84-4.87).

Keywords: *telemedicine, telehealth nursing, knowledge, perceptions, attitude, virtual care*

INTRODUCTION

It is recorded that in 1993 the Saudi government launched a National E-health program under the supervision of the Ministry of Health (MOH, 2021) to deliver telemedicine services such as consultation and medical education through videoconferencing and networks. It provides medical care, and it accommodates patients' access to care inside and outside the country using advances in modern medical systems, and diagnostic and therapeutic applications. However, telemedicine implementation has not reached its full capacity due to several identified barriers (El Mahalli et al., 2012). Following the reports of COVID-19 infection in the country, an increase in the demand for healthcare providers (HCP) and the transmission of the said infection have affected the way of care delivery drastically (Alghamdi et al., 2020; Kaliyadan et al., 2020, Jalabneh et al., 2021; Ahmed et al., 2021). The healthcare authorities continue to discuss the preventive measures to stop the spread of COVID-19. National E-Health was one of the strategies that was implemented in the Kingdom of Saudi Arabia (KSA) to slow down the transmission of the virus including the use of telemedicine to improve the accessibility and quality of care among patients and HCP (MOH Saudi Arabia, 2021). The dramatic change in the modality of care from in-person into virtual practice has caused a shift in the paradigm of practice in healthcare and nurses were expected to adapt to an unfamiliar method of healthcare delivery (Rutledge & Gustin, 2021; Rouleau et al., 2017; Sensmeier, 2012). By contrast with telemedicine, telehealth (TH) includes a broader range of remote medical services than telemedicine. In addition to remote clinical services, TH can refer to non-clinical services such as training, education, organizational meetings, and information sharing to facilitate and support patient care management. (American Academy of Family Physicians, 2021). In this study, the terms TH and telemedicine are used interchangeably.

As a result of the COVID-19 outbreak, TH has been essential for the delivery of primary health services. MOH has encouraged people to use mobile apps rather than visit primary care clinics during this time (Kaliyadan et al., 2020). Besides from teleconsultations, TH applications have an important role in tracing, tracking, and disseminating information about COVID-19 (Alghamdi et al., 2020). As the largest professional group of HCPs, nurses have a vital role to play in ensuring the success of TH utilizations (Barret & Wallis, 2013). It is now appropriate to embrace this new paradigm and train nurses to not only support telemedicine but to take the initiative in ensuring that it is fully integrated into healthcare and becomes a crucial means of providing treatment (Kaliyadan et al., 2020). It is helpful both in reducing the administrative and technical problems in hospitals and saving a lot of HCPs time, which can be better allocated for the care of admitted patients (Kaliyadan et al., 2020). In KSA, telemedicine's goal is to improve the standards of medical care and the well-being of certain groups of patients. Many studies have proved that healthcare quality has tremendously improved by utilizing telemedicine services in consultations (Jalabneh et al., 2021; Assiri et al., 2021).

With the development and expansion of telemedicine services, this is expected to continue after the COVID-19 era (Bhaskar et al., 2020). TH seems to be a long-term care solution. Better patient outcomes, reduced workforce inequities, access to specialists or clinicians, a more effective healthcare system, and lower hospital transfer or travel expenses for families are just a few of the potential effects. Telenursing has been used to provide multimodal treatment, including remote interventions, follow-up, family education, and support, outside of acute settings, with a focus on chronic wellness and self-management. This allows for prompt nurse interventions while being under the supervision of a doctor, giving the patient convenience and a sense of security (Bashir & Bastola, 2018). The MOH is providing proactive measures for the country's vulnerable population through telemedicine, virtual, and phone and text message clinics, as well as online medication delivery. The implementation of electronic medical records in all hospitals across KSA is one of the core components of the healthcare strategy, in line with Vision 2030 (Global Health Exhibition, 2020). According to a recent report by KPMG Al Fozan & Partners (2021), KSA's health system will continue to benefit tremendously from better out-of-hospital and community-based services, as the Kingdom adopts Integrated Care Systems (ICS) and the MOH continues to implement its e-health strategy that seeks to connect all levels of care digitally. In addition to the rapid onset of digital healthcare transformation, the Kingdom is also experiencing a monumental shift in the way that the healthcare industry is working with partner industries, from both the public and private sectors, to provide innovative technologies and solutions to protect the healthcare infrastructure of the country. The hope is that all government entities and private organizations across the globe will continue to work together to design a better, more digitally connected way to cope with the pandemics of the future.

There are several digital tools used to enhance ICS delivery in KSA. There are platforms to provide care guidance that arm patients with relevant information and reminders of key points in their interaction with the healthcare system. Some employ wearable technologies that help patients track and manage existing conditions and enable preventive approaches. Most use remote telemedicine to diagnose and treat patients using video conferencing over mobile devices or a web portal, allowing them to access physicians, specialists, or care professionals from their homes. ICS also offers health networks that help people find new treatments, connect with others, and take action to improve their health outcomes. Additionally, it also provides continuous, automatic, and remote monitoring of users via sensors, to enable people to continue living in their own homes.

Quite a few studies have been carried out in KSA to assess clinicians' knowledge, perception, and attitude regarding this modality of healthcare to remotely manage acute or chronic patients. The researchers decided to take a different view and carried out a study to determine nurses' knowledge, perceptions, and attitudes towards telemedicine.

Research Questions

The study aims to determine nurses' knowledge, perception, and attitude towards telemedicine.

Guided by the overall objective, the study aims to answer the following questions:

1. To describe the medical-surgical nurses' demographic profile as to:
 - a. Age;
 - b. Sex;
 - c. Civil Status;
 - d. Nationality;
 - e. Education attainment;
 - f. Type of employment and;
 - g. Length of KSA work experience.
 2. To describe the medical-surgical nurses' knowledge of telemedicine.
 3. To describe the medical-surgical nurses' perception of telemedicine as to:
 - a. Advantages of telemedicine technology;
 - b. Disadvantages of telemedicine technology;
 - c. Necessity of telemedicine technology;
 - d. Telemedicine technology ease of use, and;
 - e. Security of telemedicine technology.
 4. To describe the medical-surgical nurses' attitude toward telemedicine.
 5. To determine the difference in knowledge, perception, and attitude in telemedicine across demographic variables.
 6. To determine the relationship among knowledge, perception, and attitude of the respondents regarding telemedicine
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METHODOLOGY

1. Study Design and Locale

This study is descriptive research where the researcher described the medical-surgical nurses' socio-demographic characteristics, knowledge, perceptions, and attitudes. This study was conducted in King Fahad Medical City (KFMC), one of the tertiary hospitals in Riyadh with a 1200-bed capacity. Being one of the largest and fastest-growing medical complexes in the Middle East and the capital of KSA, Riyadh, this hospital continues to strive to become a regional and international benchmark for specialist medical services.

2. Study Participants

2.1. Sample Size and Sampling

The sample size is measured because the sample group will be representative of the total population of the study. The target number of participants for the study was calculated using Raosoft® tool. Considering that the population size is more than 2800 (Al-Yamany, 2018) with a 5% margin of error, 95% confidence level, and a 50% response distribution; the calculated minimum recommended size is 338 participants.

The research made us of purposive sampling.

2.2. Inclusion and Exclusion Criteria

The researcher included a total of 355 eligible participants classified as nurses by the SCFHS taking care of medical-surgical patients, aged 18-59 years to exclude vulnerable populations, working in the hospital with at least a year of medical-surgical clinical experience during the study regardless of work experience from December 2023 to April 2024. The researcher involved participants through purposive sampling because the researchers could not access the complete list of hospital nurses' names. Participants who are more than 60 years of age, who are currently working in another setting with medical-surgical experience before the study, who do not wish to partake in the study, and those who are currently on vacation during the study period are excluded.

3. Research Instruments

The study utilized two questionnaires that were adapted from the previous study of Ayatollahi, et.al (2015) and Chang, et.al (2021). The researcher chose these two instruments because of their applicability to the study of interest and revealed a wide perspective to cover the objectives of the study. Ayatollahi's study aimed to compare knowledge and perceptions of telemedicine technology among different groups of clinicians. The content validity of the questionnaire was checked, and the reliability was calculated using Cronbach's α coefficient ($\alpha = 0.73$). Meanwhile, Chang's study aimed to identify factors that significantly affect nurses' behavioral intention to practice telenursing, applying the decomposed theory of planned behavior model as the research framework. The study adopted the content validity index of expert validity, and the total content validity index of the questionnaire was 0.93. The Cronbach's α value was used to evaluate the self-developed tool after collecting the data. The Cronbach's α value of attitude, subjective norms, perceived behavior control, and behavioral intention was 0.948, 0.862, 0.790, and 0.889, respectively, indicating good reliability of our self-developed questionnaire content. Therefore, these questionnaires are apt for the current research.

Since the researchers combined the two questionnaires, the newly developed questionnaire underwent a pretest, and reliability validation, and conducted a pilot study before floating it to the targeted participants. The researcher hired a psychometrician, language expert, subject matter expert, and statistician to test the validity and reliability of the tool. The self-made questionnaire was tested for reliability/ internal consistency using Cronbach's α with the following results: alpha of 0.9243, 0.9127, 0.9494, 0.9254, 0.9397, 0.9662 and 0.9676 (excellent internal consistency) for the constructs of knowledge, perception of the advantages, perception of the disadvantages, perception of the necessity, perception of the ease of use, perception of the security, and attitude of telemedicine technology.

The researcher will use this as a scoring guide. The overall perception was categorized, using Bloom's cut-off point, as good if the score was between 80 and 100%, moderate if the score was between 60 and 79%, and poor if the score was less than 60%. The overall attitude was categorized, using Bloom's cut-off point, as good if the score was between 80 and 100%, moderate if the score was between 60 and 79%, and poor if the score was less than 60% (Feleke, 2021).

4. Specific Procedures Based on Study Objectives

4.1. Procedure 1: Communication Letters

An electronic mail was sent to the nursing director and nurse managers. Individual consent is part of the electronic questionnaire to get the permission of the participants before proceeding with the electronic survey. The researcher hired a coordinator or data collector to follow up with participants' responses.

4.2. Procedure 2: Floating of Questionnaire

The study questionnaire was designed based on previously published research articles. The researchers developed an electronic questionnaire distributed to participants with instructions for filling out and obtaining the respondents' consent.

5. Statistical Analysis of Data

Guided by the statistician, researchers analyzed the data with Statistical Package for Social Sciences (SPSS) software, and results were shown using descriptive data (frequency percentage distribution, mean score, and standard deviation). ANOVA T-test was used to test the significant difference across nurses' demographic characteristics, knowledge, perception, and attitude. Non-parametric tests such as the Wilcoxon Rank Sum Test and the Kruskal-Wallis Test were used to test differences with data that do not show the normality of data. Dunn's test was used to test multiple comparisons of variables. Spearman correlation was used to determine the relationship between variables (knowledge, perception, and attitude).

RESULTS

A total of 355 nurses participated in this study. Table 1 presents the demographic profile of the medical-surgical nurses. Among these, 251 (70.70%) were female, and 104 (29.30%) were males. The majority were 25 to 35 years old (38.03%), followed by those 18 to 24 years old (27.89%), and 36 to 44 years old (20.56%). In terms of civil status, most of the respondents were single (65.07%), while others were married (33.80%). More than half of the nurses in the study were Filipinos (53.24%), followed by those from Saudi (19.72%), Indian (11.27%), and Jordanian (4.51%). Almost all (98.59%) were graduates of a Bachelor's degree, while 5 (1.41%) were other degree graduates, and 1 (0.28%) was a graduate of a post-doctoral degree. Almost all respondents were working full-time (99.44%), and only 2 were working part-time (0.56%). In terms of their length of KSA work experience in handling patients, most of them were working for 1 to 3 years (29.30%), followed by those working for 10 or more years (26.27%).

Table 1. Demographic characteristics of participants

Demographic Profile	Frequency	Percentage
Age (in years)		
18-24	99	27.89
25-35	135	38.03
36-44	73	20.56
45-54	33	9.30
55 and above	15	4.23
Sex		
Female	251	70.70
Male	104	29.30
Civil Status		
Single	231	65.07
Married	120	33.80
Others	4	1.13
Nationality		
Saudi	70	19.72
Filipino	189	53.24
Indian	40	11.27
Jordanian	16	4.51
Others	40	11.27
Educational Attainment		
Bachelor's degree	350	98.59
Others	5	1.41
Type of employment		
Full-time	353	99.44
Part-time	2	0.56

Length of KSA work experience in handling medical-surgical patients

Less than 1 year	53	14.93
1-3 years	104	29.30
4-6 years	60	16.90
7-9 years	43	12.11
10 or more years	95	26.76

The knowledge of the medical-surgical nurses on telemedicine is presented in Table 2. The context in their assessment of their knowledge applied to the medical-surgical clients and/or units. Most of the nurses have a very high familiarity with telemedicine technology (79.44%), the medical applications of telemedicine (79.72%), tools (73.34%), and the use of telemedicine in other countries (62.54%). There are also conferences, speeches, and meetings regarding telemedicine technology being held in the majority of the workplaces of the nurses (78.59%). Moreover, 69.86% have a very high extent of applying the telemedicine guidelines in their unit. The majority also believe that there is a very high necessity for continuous training in the use of telemedicine (85.92%).

On average, nurses have very high knowledge of telemedicine except for the familiarity with the use of telemedicine in other countries, which they only have high knowledge of. Overall, the knowledge of telemedicine is very high with an average of 4.62.

Table 2. Knowledge of telemedicine technology

Statement	Very Low (1)	Low (2)	Average (3)	High (4)	Very High (5)	Mean	*VI
1. To what extent are you familiar with telemedicine technology?	6 (1.69%)	4 (1.13%)	13 (3.66%)	50 (14.08%)	282 (79.44%)	4.68	*VH
2. To what extent are you familiar with the medical applications of telemedicine technology?	4 (1.13%)	7 (1.97%)	14 (3.94%)	47 (13.24%)	283 (79.72%)	4.68	VH
3. Are there conferences, speeches, or	7 (1.97%)	5 (1.41%)	9 (2.54%)	55 (15.49%)	279 (78.59%)	4.67	VH

meetings held in your workplace regarding telemedicine technology?							
4. To what extent are you familiar with telemedicine tools?	6 (1.69%)	5 (1.41%)	16 (4.51%)	57 (16.06%)	271 (73.34%)	4.64	VH
5. To what extent are you applying telemedicine guidelines in your unit?	7 (1.97%)	5 (1.41%)	16 (4.51%)	79 (22.25%)	248 (69.86%)	4.57	VH
6. To what extent are you familiar with the use of telemedicine in other countries?	5 (1.41%)	11 (3.10%)	75 (21.13%)	42 (11.83%)	222 (62.54%)	4.31	*H
7. To what extent is continuous training in the use of telemedicine necessary for nurses?	6 (1.69%)	2 (0.56%)	14 (3.94%)	28 (7.89%)	305 (85.92%)	4.76	VH
Overall knowledge mean						4.62	VH

*VI = verbal interpretation; *VH= very high; *H= high

The nurses' perception of the advantages of telemedicine technology is shown in Table 3.1. The majority are very familiar with the benefits of telemedicine (88.45%). Moreover, around 90% of the respondents believe that telemedicine is very effective in reducing transportation costs (91.27%), the cost of patient care in hospitals (91.55%), and in improving patient care (89.01%). Most of the nurses also believe that telemedicine influences satisfaction of patients in the care being provided (88.45%), that it saves nurses' time (90.42%), and provides faster and better medical care (90.42%).

The nurses have very high perception on the advantages of telemedicine technology with mean ranging from 4.79 to 4.85. Overall, the respondents have very high extent of agreement on the advantages of telemedicine technology (mean=4.82).

Table 3.1. Nurses' perception of the advantages of telemedicine technology

Statement	Very Low (1)	Low (2)	Average (3)	High (4)	Very High (5)	Mean	*VI
1. To what extent are you familiar with the benefits of telemedicine?	6 (1.69%)	1 (0.28%)	12 (3.38%)	22 (6.20%)	314 (88.45%)	4.79	*VH
2. In your opinion, to what extent is telemedicine effective in reducing the unnecessary transportation costs?	5 (1.41%)	2 (0.56%)	9 (2.54%)	15 (4.23%)	324 (91.27%)	4.83	VH
3. In your opinion, to what extent is telemedicine effective in reducing the costs of patient care in hospitals?	5 (1.41%)	3 (0.85%)	9 (2.54%)	13 (3.66%)	325 (91.55%)	4.83	VH
4. In your opinion, to what extent does telemedicine influence users' satisfaction in terms of care provided?	4 (1.13%)	2 (0.56%)	14 (3.94%)	21 (5.92%)	314 (88.45%)	4.80	VH
5. In your opinion, to what extent does telemedicine technology save nurses' time?	4 (1.13%)	1 (0.28%)	12 (3.38%)	12 (3.38%)	326 (91.83%)	4.85	VH
6. In your opinion, to what extent does telemedicine technology provide faster and better medical care?	3 (0.85%)	2 (0.56%)	15 (4.23%)	14 (3.94%)	321 (90.42%)	4.83	VH
7. In your opinion, how effective is telemedicine technology in	3 (0.85%)	4 (1.13%)	13 (3.66%)	19 (5.35%)	316 (89.01%)	4.81	VH

improving patient care?

Overall mean for the perception of the advantages of telemedicine technology	4.82	VH
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*VI = verbal interpretation; *VH= very high

Table 3.2 presents the perception of the medical-surgical nurses on the disadvantages of telemedicine. In their opinion, there is a very low extent to which telemedicine disrupts a nurse-patient relationship (71.55%), to which it reduces the effectiveness of patient care (67.89%), it causes ethical issues in terms of privacy, confidentiality, and security (63.94%), and endanger their privacy (63.94%). They also believe that it has a very low extent in reducing the efficiency of patient care (64.51%), results in unauthorized access to patient medical information (64.51%), increase expenses of a hospital (76.90%), and increase malpractice in healthcare (65.91%).

On average, they believe that there is a very low extent to telemedicine disrupting nurse-patient relationships, reducing the efficiency of patient care, and increasing the expenses of a hospital. Overall, the nurses believe to a low extent the disadvantages of telemedicine technology.

Table 3.2. Nurses' perception of the disadvantages of telemedicine technology

Statement	Very Low (1)	Low (2)	Average (3)	High (4)	Very High (5)	Mean	*VI
1. In your opinion, to what extent may telemedicine technology disrupt a nurse-patient relationship?	254 (71.55%)	58 (16.34%)	26 (7.32%)	8 (2.25%)	9 (2.54%)	1.48	*VL
2. In your opinion, to what extent has telemedicine technology reduced the effectiveness of patient care?	241 (67.89%)	71 (20.00%)	27 (7.61%)	6 (1.89%)	10 (2.82%)	1.52	*L
3. In your opinion, can telemedicine technology cause	227 (63.94%)	79 (22.25%)	32 (9.01%)	6 (1.69%)	11 (3.10%)	1.58	L

ethical issue to the patient in terms of privacy, confidentiality and security issues?								
4. In your opinion, to what extent does telemedicine technology endanger patient privacy?	227 (63.94%)	83 (23.38%)	31 (8.73%)	4 (1.13%)	10 (2.82%)	1.55	L	
5. In your opinion, to what extent does telemedicine technology reduce the efficiency of patient care?	255 (71.83%)	56 (15.775)	28 (7.89%)	5 (1.41%)	11 (3.10%)	1.48	VL	
6. In your opinion, to what extent may telemedicine technology result in unauthorized access to patient medical information?	229 (64.51%)	81 (22.82%)	32 (9.01%)	3 (0.85%)	10 (2.82%)	1.55	L	
7. In your opinion, to what extent may telemedicine technology increase the expenses of a hospital?	273 (76.90%)	48 (13.52%)	20 (5.63%)	5 (1.41%)	9 (2.54%)	1.39	VL	
8. In your opinion, to what extent may telemedicine technology increase malpractice in healthcare?	234 (65.91%)	77 (21.69%)	30 (8.45%)	4 (1.13%)	10 (2.82%)	1.53	L	
Overall mean for the perception of the disadvantages of						1.51	L	

telemedicine
technology

*VI = verbal interpretation; *VL= very low; *L= low

The medical-surgical nurses also rated their perception on the necessity of telemedicine technology, and results are shown in Table 3.3. More than 90% of the nurses said that the extent that it provides healthcare on a timely manner (90.70%), that new techniques should be used with the current technology (90.42%), that it is essential in providing healthcare to remote areas (91.55%), and that it provides access to patient's information (91.83%) is very high. Moreover, 90.99% of the nurses said that there is a very high extent of implementation of telemedicine in their hospitals. In terms of its necessity for patient care, 89.58% believes it to be very high.

Overall and on the average, the nurses view the necessity of telemedicine technology as high with means ranging from 4.79 to 4.89 and an overall mean of 4.82.

Table 3.3. Nurses' perception of the necessity of telemedicine technology

Statement	Very Low (1)	Low (2)	Average (3)	High (4)	Very High (5)	Mean	*VI
1. In your opinion, to what extent is telemedicine technology necessary for patient care?	5 (1.41%)	2 (0.56%)	18 (5.07%)	12 (3.38%)	318 (89.58%)	4.79	*VH
2. In your opinion, to what extent can telemedicine provide healthcare to patients in a timely manner?	4 (1.13%)	2 (0.56%)	17 (4.79%)	10 (2.82%)	322 (90.70%)	4.81	VH
3. In your opinion, to what extent should new techniques be used along with the current technology?	4 (1.13%)	4 (1.13%)	13 (3.66%)	13 (3.66%)	321 (90.42%)	4.81	VH
4. In your opinion, to what extent is telemedicine essential to provide	4 (1.13%)	2 (0.56%)	15 (4.23%)	9 (2.54%)	325 (91.55%)	4.83	VH

healthcare to underprivileged and remote areas?

5. In your opinion, to what extent can telemedicine technology provide nurses with instant access to patient information?	4 (1.13%)	2 (0.56%)	16 (4.51%)	7 (1.97%)	326 (91.83%)	4.83	VH
6. In your opinion, to what extent are national standards essential for telemedicine technology implementation?	4 (1.13%)	3 (0.85%)	15 (4.23%)	10 (2.82%)	323 (90.99%)	4.82	VH
Overall mean for the perception of the necessity of telemedicine technology						4.82	VH

*VI = verbal interpretation; *VH= very high

Table 3.4 shows the perception of nurses on the ease of use of telemedicine. The majority said that the extent of practicality for nursing staff is very high (90.70%). Similarly, there is also a very high extent of understanding software programs for telemedicine (91.27%), increasing efficiency (90.42%), reducing errors (90.42%), facilitating learning (90.14%), and increasing nursing skills (90.70%).

On average and overall, there is a very high extent perception of the ease of use of telemedicine technology among the medical-surgical nurses in the study. The overall mean is equal to 4.81.

Table 3.4. Nurses' perception of telemedicine technology ease of use

Statement	Very Low (1)	Low (2)	Average (3)	High (4)	Very High (5)	Mean	*VI
1. In your opinion, to what extent does the ease of use of telemedicine	4 (1.13%)	4 (1.13%)	14 (3.94%)	11 (3.10%)	322 (90.70%)	4.81	*VH

technology make it practical for the nursing staff?								
2. To what extent do easy-to-understand software programs make it easy for nurses to apply telemedicine technology?	3 (0.85%)	2 (0.56%)	16 (4.51%)	10 (2.82%)	324 (91.27%)	4.83	VH	
3. To what extent does easy-to-use telemedicine technology increase the efficiency of nurse users?	3 (0.85%)	2 (0.56%)	17 (4.79%)	12 (3.38%)	321 (90.42%)	4.82	VH	
4. To what extent does ease of use of telemedicine technology reduce nurses' errors?	3 (0.85%)	3 (0.85%)	18 (5.07%)	10 (2.82%)	321 (90.42%)	4.81	VH	
5. To what extent does ease of use of telemedicine technology facilitate its learning?	3 (0.85%)	3 (0.85%)	18 (5.07%)	11 (3.10%)	320 (90.14%)	4.81	VH	
6. To what extent does ease of use of telemedicine increase nurses' skills?	4 (1.13%)	5 (1.41%)	18 (1.69%)	6 (1.69%)	322 (90.70%)	4.79	VH	
Overall mean for the perception of the ease of use of telemedicine technology						4.81	VH	

*VI = verbal interpretation; *VH= very high

The security of telemedicine technology was also rated based on the nurses' perception with the results presented in Table 3.5. Like other constructs of perception on telemedicine, the majority, or more than 90% believe that there is a very high extent in

the following areas: the necessity of authorized access (92.11%), the necessity of policies and guidelines (91.83%), creation of framework for preventing data breach (92.39%), and for accessing medical information (92.11%). Moreover, they believe to a very high extent that telemedicine requires legal clarification for patients (92.39%), and that it needs to be supported by the nursing community (92.11%).

Overall, the perception of nurses on the security of telemedicine is to a very high extent with a mean equal to 4.85.

Table 3.5. Nurses' perception of the security of telemedicine technology

Statement	Very Low (1)	Low (2)	Average (3)	High (4)	Very High (5)	Mean	*VI
1. In your opinion, to what extent is authorized access necessary for the implementation of telemedicine?	2 (0.56%)	3 (0.85%)	16 (4.51%)	7 (1.97%)	327 (92.11%)	4.84	*VH
2. To what extent are security policies and guidelines necessary for the use of telemedicine technology?	2 (0.56%)	2 (0.56%)	14 (3.94%)	11 (3.10%)	326 (91.83%)	4.85	VH
3. To what extent does telemedicine need to be supported by the nursing community?	2 (0.56%)	3 (0.85%)	15 (4.23%)	8 (2.25%)	327 (92.11%)	4.85	VH
4. To what extent should a framework be created to prevent breaching data confidentiality when using telemedicine?	3 (0.85%)	3 (0.85%)	13 (3.66%)	7 (1.97%)	329 (92.68%)	4.85	VH
5. To what extent does telemedicine technology require legal clarification for patients?	2 (0.56%)	3 (0.85%)	13 (3.66%)	9 (2.54%)	328 (92.39%)	4.85	VH

6. To what extent does telemedicine technology require a formulated and clear framework for access to medical information?	3 (0.85%)	3 (0.85%)	13 (3.66%)	9 (2.54%)	327 (92.11%)	4.84	VH
Overall mean for the perception of the security of telemedicine technology						4.85	VH

*VI = verbal interpretation; *VH= very high

Table 3.6 shows the summary of the nurses' perception.

Table 3.6. Summary table for nurses' perception

	Mean	VI
1. Overall mean for the perception of the advantages of telemedicine technology	4.82	VH
2. Overall mean for the perception of the disadvantages of telemedicine technology	1.51	L
3. Overall mean for the perception of the necessity of telemedicine technology	4.82	VH
4. Overall mean for the perception of the ease of use of telemedicine technology	4.81	VH
5. Overall mean for the perception of the security of telemedicine technology	4.95	VH

*VI = verbal interpretation; *VH= very high; *L= low

Table 4 shows the attitude of nurses towards telehealth nursing. More than 90% of the respondents strongly agree that the communication systems of telehealth can provide information interpretation function (91.83%) and can increase efficiency (91.83%). They also strongly agree that the following features are very important in telenursing: provide accurate information (92.11%), send instant messages (92.11%), fire instant alerts as soon as possible for abnormal physiological measurements (92.11%).

The majority also strongly agree that nurses should be familiar with using the telehealth communication system (92.39%) and that the system should be easy to use and easy to learn (91.83%).

In terms of telehealth being of service to patients, most of the nurses strongly agree that it would assist people with disabilities, older adults, and patients with chronic diseases (91.83%), that it helps patients carry out self-care (91.83%), self-manage and control health issues (92.11%), and develop good personal health management habits (91.27%). They also believe that it helps the patients reduce the frequency of hospital visits (92.11%) and save time in hospital consultations (92.11%). Most of the nurses also believe that it can help caregivers improve their care skills (91.27%) and can help reduce expenditure on national health insurance (91.55%).

The nurses strongly agree on the important roles they play in telenursing (90.99%); that professional competence is important (92.39%), must have excellent communication skills (92.96%), and that they should have the ability to provide care and consultations for chronic diseases (92.68%).

The average rating for each statement on the attitude of medical-surgical nurses on telehealth nursing ranges from 4.84 to 4.87, which corresponds to strongly agree.

Table 4. Attitude towards telehealth nursing

Statements	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)	Mean	*VI
1. I think that telehealth communication system can provide medical personnel with information interpretation function.	2 (0.56%)	3 (0.85%)	14 (3.94%)	10 (2.82%)	326 (91.83%)	4.85	*SA
2. I think the ability of telehealth communication system to provide accurate information is very important in telenursing	2 (0.56%)	3 (0.85%)	13 (3.66%)	10 (2.82%)	327 (92.11%)	4.85	SA

3. I think the ability of telehealth communication system to instant messages is very important in telenursing.	2 (0.56%)	2 (0.56%)	14 (3.94%)	10 (2.82%)	327 (92.11%)	4.85	SA
4. I think the ability of telehealth communication system to fire instant alert as soon as it receives abnormal physiological measurements, including blood pressure, heart rate, blood glucose and blood oxygen values is very important in telenursing.	2 (0.56%)	2 (0.56%)	17 (4.79%)	7 (1.97%)	327 (92.11%)	4.85	SA
5. I think that telehealth communication system can increase work efficiency.	2 (0.56%)	2 (0.56%)	17 (4.79%)	8 (2.25%)	326 (91.83%)	4.84	SA
6. I think that nurses involving in telenursing must be familiar with the use of telehealth communication system	2 (0.56%)	3 (0.85%)	11 (3.10%)	11 (3.10%)	328 (92.39%)	4.86	SA
7. I think that an easy-to-learn and	1 (0.28%)	2 (0.56%)	14 (3.94%)	12 (3.38%)	326 (91.83%)	4.86	SA

easy-to-use telehealth communication system is very important for telenursing.

8. I think that telenursing would assist people with disabilities, older adults, and patient with chronic diseases.

2	1	15	11	326	4.85	SA
(0.56%)	(0.28%)	(4.23%)	(3.10%)	(91.83%)		

9. I think that telenursing can help the person being served to carry out self-care in their home or the living environment they are familiar with.

2	1	19	7	326	4.84	SA
(0.56%)	(0.28%)	(5.35%)	(1.97%)	(91.83%)		

10. I think that telenursing can help the person being served with the ability to self-manage and consequently in controlling health issues (e.g. blood pressure, blood glucose, etc).

2	4	14	8	327	4.84	SA
(0.56%)	(1.13%)	(3.94%)	(2.25%)	(92.11%)		

11. I think that telenursing can help the person being served to develop good personal health

2	1	17	11	324	4.84	SA
(0.56%)	(0.28%)	(4.79%)	(3.10%)	(91.27%)		

management habits.								
12. I think that telenursing can help caregivers to improve care skills	2 (0.56%)	2 (0.56%)	16 (4.51%)	11 (3.10%)	324 (91.27%)	4.84	SA	
13. I think that telenursing can help the person being served to reduce the frequency of hospital visits.	2 (0.56%)	3 (0.85%)	13 (3.66%)	10 (2.82%)	327 (92.11%)	4.85	SA	
14. I think that telenursing can help the person being served to save time in hospital-consultation	2 (0.56%)	3 (0.85%)	10 (2.82%)	13 (3.66%)	327 (92.11%)	4.86	SA	
15. I think telenursing can help reduce national health insurance expenditure.	2 (0.56%)	2 (0.56%)	15 (4.23%)	11 (3.10%)	325 (91.55%)	4.85	SA	
16. I think that nurses play very important roles in telenursing.	3 (0.85%)	2 (0.56%)	13 (3.66%)	14 (3.94%)	323 (90.99%)	4.84	SA	
17. I think that professional competence is very important for telehealth nurses.	1 (0.28%)	3 (0.85%)	11 (3.10%)	12 (3.38%)	328 (92.39%)	4.87	SA	

18. I think that nurses participating in telehealth must have excellent communication skill.	2 (0.56%)	2 (0.56%)	11 (3.10%)	10 (2.82%)	330 (92.96%)	4.87	SA
19. I think that nurses participating in telehealth must have ability to provide care and consultation for chronic diseases	2 (0.56%)	1 (0.28%)	14 (3.94%)	9 (2.54%)	329 (92.68%)	4.86	SA
Overall mean for attitude on telehealth nursing						4.85	SA

*VI = verbal interpretation; *SA= strongly agree

Table 4.1 shows the summary of the knowledge, perception, and attitude on telemedicine of medical-surgical nurses based on Bloom's cut-off point. Bloom's cut-off point categorized knowledge as high if the score was between 28 to 35 (80% to 100%), moderate if the score was between 21 to 27 (60% to 79%), and low if the score was below 21 (<60%). In terms of perception, it was considered high if the score was between 132 to 165, moderate if between 99 to 131, and low if the score was less than 99. Lastly, attitude was categorized as high for scores 76 to 95, moderate for scores 57 to 75, and low for scores less than 57.

There were 314 (88.45%) nurses with high knowledge, 28 (7.89%) with moderate knowledge, and 13 (3.66%) with low knowledge. For the perception, 328 or 92.39% have good perception, 16 or 4.51% have moderate, and 11 or 3.10% have low or poor perception. Lastly, 332 (93.52%) have a high or positive attitude, 16 or 4.51% have moderate or neutral attitude, and 7 or 1.97% have a negative or low attitude.

Table 4.1. Knowledge, perception, and attitude on telemedicine

Construct	Category	Scores	n	%
Knowledge	High	28-35 (80%-100%)	314	88.45
	Moderate	21-27 (60%-79%)	28	7.89
	Low	<21 (<60%)	13	3.66

	Good	132-165 (80%-100%)	328	92.39
Perception	Moderate	99-131 (60%-79%)	16	4.51
	Poor	<99 (<60%)	11	3.10
Attitude	Positive	76-95 (80%-100%)	332	93.52
	Neutral	57-75 (60%-79%)	16	4.51
	Negative	<57 (<60%)	7	1.97

To determine if the demographic characteristics affect the knowledge, perception, and attitude on telemedicine, a test of difference across demographic profiles was utilized. Knowledge, perception, and attitude scores were computed by summing the ratings of the nurses on the statements under these constructs. Higher scores mean higher knowledge, positive perception, and positive attitudes toward telemedicine and telehealth. For the perception, negatively stated statements such as those under disadvantages were reverse coded to reflect positive perception. The scores were then subjected to a normality test and results showed that the data were not normally distributed. Hence, non-parametric tests such as the Wilcoxon Rank Sum Test and the Kruskal-Wallis Test were used to test differences. Table 5.1 presents the results of the tests.

There is a difference in the knowledge of telemedicine across nationality ($p=0.0479$), and length of work experience in KSA handling medical-surgical patients ($p=0.0022$).

For the overall perception of telemedicine, a significant difference was found across sex ($p=0.0494$), and employment status ($p=0.0279$). Males have a higher (more positive) perception of telemedicine compared with females, and those who work full-time also have higher (more positive) perception on telemedicine compared to those who work part-time.

Furthermore, there is a significant difference in the attitude toward telehealth nursing across sex ($p=0.0353$), and civil status ($p=0.0005$). Males have a higher (more positive) attitude on telehealth nursing compared with females.

Table 5.1. Test of difference on the knowledge, perception, and attitude in telemedicine across demographic characteristics of nurses

Demographic Variable	Knowledge	Perception	Attitude
Age	0.1104	0.4959	0.2767
Sex	0.3317	0.0494*	0.0353*

Civil Status	0.1228*	0.0792	0.0005*
Nationality	0.0479*	0.9387	0.7791
Educational attainment	0.0846	0.2355	0.3755
Employment status	0.9686	0.0279*	0.5768
Length of KSA work experience in handling medical-surgical patients	0.0022*	0.1132	0.2171

*significant at 0.05 level

Table 5.2 shows the multiple comparisons of knowledge across different civil statuses. From the Dunn's Test, significant differences were found between those single and widow/widower ($p=0.0031$), married and widow/widower ($p=0.0026$), and separated and widow/widower ($p=0.0206$). In all multiple comparisons, the widow/widower has lower knowledge compared with the other three categories.

Table 5.2. Multiple comparison test on knowledge across civil status

	Single	Married	Widow/Widower
Married	Diff= -0.35 $p=0.3622$		
Widow/Widower	Diff= 2.74 $p=0.0031^*$	Diff= 2.79 $p=0.0026^*$	
Separated	Diff= -0.77 $p=0.2218$	Diff= -0.73 $p=0.2342$	Diff= -2.04 $p=0.0206^*$

*significant at 0.05 level

The multiple comparison of knowledge across nationalities is presented in Table 5.3. There is a significant difference between Jordanians and those from Saudi ($p=0.0119$), Filipinos ($p=0.0045$), Indians ($p=0.0032$), and other nationalities ($p=0.0017$). In all comparisons, Jordanians have higher knowledge.

Table 5.3. Multiple comparison test on knowledge across nationality

	Saudi	Filipino	Indian	Jordanian
Filipino	Diff= 0.38 $p=0.3525$			
Indian	Diff= 0.90 $p=0.1832$	Diff= 0.72 $p=0.2344$		

Jordanian	Diff= -2.26 p=0.0119*	Diff= -2.61 p=0.0045*	Diff= -2.72 p=0.0032*	
Others	Diff= 1.21 p=0.1137	Diff= 1.07 p=0.1422	Diff= 0.27 p=0.3939	Diff= 2.93 p=0.0017*

*significant at 0.05 level

The multiple comparison test for the difference in knowledge across the length of experience in KSA is shown in Table 5.4. There is a significant difference in knowledge among those less than one year when compared to those with experience for 4 to 6 years ($p=0.0166$), 7 to 9 years ($p=0.0009$), and above 10 years ($p=0.0002$). Those with longer experience have higher knowledge scores compared to those with less than 1 year. It can also be observed that the difference increases as the years of experience increase. There is also a significant difference between those with 1 to 3 years of experience compared with those with 7 to 9 years of experience ($p=0.0196$) and above 10 years of experience ($p=0.0087$). Those with higher years of experience also have higher knowledge compared with those 1-3 years.

Table 5.4. Multiple comparison test on knowledge across length of KSA work experience in handling medical-surgical patients

	Less than 1 year	1-3 years	4-6 years	7-9 years
1-3 years	Diff= -1.59 p=0.0563			
4-6 years	Diff= -2.13 p=0.0166*	Diff= -0.82 p=0.2050		
7-9 years	Diff= -3.13 p=0.0009*	Diff= -2.06 p=0.0196*	Diff= -1.20 p=0.1145	
Above 10 years	Diff= -3.53 p=0.0002*	Diff= -2.38 p=0.0087*	Diff= 0-1.24 p=0.1081	Diff= 0.20 p=0.4216

*significant at 0.05 level

Table 5.5 shows the multiple comparison test on attitude toward telehealth nursing across civil status. Only one pair showed a significant difference— single vs married ($p=0.0001$). Those with single status have a higher (more positive) attitude compared to married nurses.

Table 5.5. Multiple comparison test on attitude across civil status

	Single	Married	Widow/Widower
Married	Diff= 3.85 p=0.0001*		
Widow/Widower	Diff= 1.25 p=0.1059	Diff= 0.50 p=0.3081	
Separated	Diff= -0.24 p=0.4047	Diff= -0.67 p=0.2509	Diff= -0.84 p=0.2011

*significant at 0.05 level

The relationship of knowledge, perception, and attitude on telemedicine is presented in Table 6. Spearman correlation was used to determine the relationship between the variables. There is a significant relationship between knowledge and perception ($p < 0.0001$), knowledge and attitude ($p < 0.0001$), and perception and attitude ($p < 0.0001$). Furthermore, a strong relationship on all pairs of variables was observed (spearman correlation equal to 0.5805, 0.4047, and 0.4542, respectively).

Table 6. Relationship of knowledge, perception, and attitude on telemedicine

	Knowledge	Perception
Perception	0.5802 $p < 0.0001$	
Attitude	0.4047 $p < 0.0001$	0.4542 $p < 0.0001$

Figure 1 shows the scatter plot of the knowledge, perception, and attitude on telemedicine. As shown in the graph, as the knowledge increases, the perception also increases or is more positive; as the knowledge increases, attitude also increases or is more positive, and lastly as the perception increases, attitude also increases or is more positive.

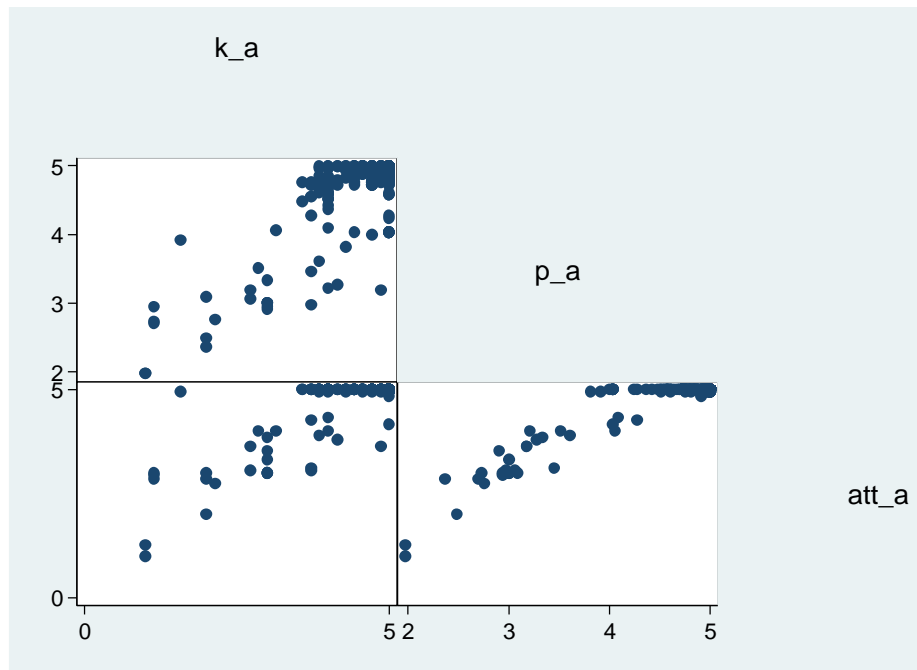


Figure 1. Scatter plot matrix of knowledge, perception, and attitude towards telemedicine.

DISCUSSION

Literature offers a generous number of studies that implies on the importance of telemedicine in the improvement of patient care in the medical industry and HCP play a vital role for its usage and sustainability. Still, there has not been any particular research regarding nurses' knowledge, perception, and attitude toward telemedicine and that is the focus this research and to fill in the gap in that area. Notably, our study showed that participants expressed an overall high knowledge, positive perception, and attitude. Although this study was randomized and anonymous, the study limits generalizability of some of its findings because of small-scale of sample. Also, since this study is self-reported, the results could be liable to underestimation or overestimation by the participants.

This study was able to describe the nursing population of KFMC. Zippia in 2023 gave an in-depth look into sociodemographic profile of employees of KFMC in total, self-reported details from employees. Their data is supportive to this study where they accounted 68% of KFMC employees are female, 50% are between the ages of 20-30 years, and 44% work and stay at the company for 1-2 years. In a discussion paper in 2019 talking about the nursing workforce in KSA revealed that the number of nurses produced in Saudi Arabia is extremely low therefore, the heavy reliance upon expatriates or foreign nurses for the health workforce from India and Philippines which also supports why majority of the nurses' respondents in this study are Filipinos.

One of the findings in our study showed widow/widower respondents have lower knowledge compared to married and single nurses. However, the researchers could not generalize this finding because those who belong to this group only account for 0.85% of the total sample size (3 out of 355 respondents). There is no other research to back this up, but a study done in China in 2020 (Yu-tong, 2021) explained that married nurses are less receptive to telemedicine because married women must work while taking care of their families to lessen the financial strain on their families and TH scope takes more time and adds further labor. However, Davis et al. (2017) proved that the TH approach also boosts nurses' take-home pay and elevates their level of expertise. Consistent with the findings of Tian et al. (2023), this also indirectly enhances married nurses' willingness to engage in telehealth services and their access to pertinent knowledge, boosting their initiative to successfully deploy telehealth.

Although this study revealed that Jordanian nurses have higher knowledge, the study limits the generalizability of the findings because those who belong to this group only account for 4.51% of the total sample size (16 out of 355 respondents). There has been no reported study that would have supported why Jordanians have higher knowledge when it comes to telemedicine but a study in 2022 by Murshidi et al. disclosed that most of the Jordanian participants portrayed favorable views toward telemedicine. Higher educational degrees, living in urban districts, and having a higher perception of electronic usage ability were linked to Jordanian's higher knowledge and better attitudes toward telemedicine.

Contrary to a finding in this study in which nurses with higher years of experience also have increased knowledge, there is a cross-sectional study that was carried out in the same research local which is King Fahad Medical City, KSA from June 2019 until February 2020, during which 370 healthcare professionals, including physicians, nurses, and other healthcare professionals participated that reported no statistically significant association observed between knowledge score of telemedicine and length of work experience (Bashir, et.al, 2023). Similar results were generated by a survey in Peru in 2021 to a group of physicians and medical students where there was no association of knowledge to experience and previous training in telemedicine (Garcia-Guiterrez, et.al, 2023).

This study has suggested that males have a more positive perception of telemedicine compared to females and to support this finding, a study regarding pandemic-triggered adoption of telehealth in Alabama that gathered data from March 2019-June 2021 revealed that both the female and male groups saw a considerable increase in the rate of telemedicine visits during the pandemic, with the male group experiencing a somewhat higher rate than the female group. This is probably because telemedicine services were not available for many female visits, including labor and delivery (Xu, et.al, 2022). Additionally, men were more likely than women to convert to telemedicine services during the epidemic because they tend to have higher levels of self-efficacy and trust in telemedicine technologies compared to women who are more likely to trust telemedicine services because of the influence of the people around them (Wu, et.al, 2021).

Another finding in this study suggests that nurses who work full time have more positive perception in telemedicine compared to who works part-time. Contradictory to this, a study done considering the clinical workload of physicians, in a large academic health

care system in New York City have suggested that doctors who utilized telemedicine more frequently during the pandemic's different phases completed more electronic health record-based after-hours work than doctors who utilized it less frequently. This shows that telemedicine as it is now provided might be less effective than in-person care and might put more pressure on doctors to work after hours (Lawrence, et.al, 2022).

Additionally, this study indicated that males have a more positive attitude compared to their counterpart which is congruent to the findings of a study on healthcare providers at Zagazig University and Hospitals in Egypt where men had the highest level of interest in telemedicine. This may be because many occupations have been forced to work remotely due to the coronavirus pandemic, and the increase in the use of internet services to maintain the work-life balance. One of the apps that people were more interested in at that time was TH. Factors such as the attitude towards TH, the relationship between the patient and the doctor, and the usage of technology may all play a role in the willingness to use TH (Fouad, et.al, 2023). On the contrary, Elhadi et al. 2021, who investigated telemedicine awareness, knowledge, attitudes, and skills of health workers in a low-resource country during the COVID-19 pandemic in Libya, found that there were no differences in attitudes between men and women.

In our study, single nurses have a more positive attitude compared to married nurses as reinforced by a study in Bangladesh in 2021 showed that compared to the married, the unmarried participants were significantly more likely to 'may utilize' and 'will utilize' telehealth (Kabir, et.al, 2022). Additionally, Chinese clinical nurses in the 2020 study also presented significantly higher domain scores recorded for nurses in the unmarried, head of responsible nursing group. There were positive correlations between telehealth readiness level and service experience, service willingness, mode cognition, manpower allocation, and policy guidance. Thus, having more opportunities to participate in telehealth services and training than ordinary nurses can improve personal readiness because of their clinical practice and learning.

Our study revealed that when the nurses' knowledge is high, their perceptions and attitudes toward telemedicine also increase. The same finding was disclosed by a global survey done by Navqi et.al in 2022. Another study shows that healthcare workers have a favorable attitude and perception towards telemedicine despite having limited knowledge of it (Bashir, 2023). This only shows that there is a promising opportunity to introduce remote working systems nationwide and to ensure the proper implementation and continuation of telemedicine across the country, it is necessary to establish specialized training programs for healthcare professionals, especially nurses.

Nurses are vital conductors of telemedicine in the country; unfortunately, the literature is very anemic in regards to data regarding nurses' knowledge, perception, and attitude toward telemedicine. Without health authorities' cognizance of this issue, enforcement of such technology will bring up a lot of issues. However, this research is very substantial because it generated insight into how nurses use technology and its future implications in local or global settings.

This study is not without any inefficiencies. The results may be dependent on over or under-estimation by the surveyed group. Additionally, several factors such as access to

the questionnaire and connectivity may have indirectly affected the outcome of the study since the distribution of the survey is online.

Conclusions

The hospital-wide investigation suggests multi-level grasp and understanding with telemedicine by exploring the nurses' knowledge, perception, and attitude in King Fahad Medical City among 355 respondents. We can shed light on nurses, in general, have very high knowledge of telemedicine, have very high perception on its advantages, low extent of its disadvantages, high view for its necessity, ease of use, security and strong positive attitude toward it.

The researchers were pleased to see that nurses in this study were very accepting of telemedicine implementation. With the nationwide use of mobile apps and remote telemedicine use that started during the COVID-19 pandemic and was carried out years after, structures and standards have been developed by Saudi's health system, and platforms were introduced to make the HCP work easier, faster, and more effective to reach out to patients who have less access to the facilities. It is at this time that we see technologies revolutionizing and TH has shown promise in clinical and non-clinical areas. The introduction of a new system will have its challenges, but telemedicine is now becoming widely accepted and may be successful in its application nationally.

Recommendations

This study has made notice of nurses' role in the effective operation of such technology in the workplace and as KSA approach Saudi Vision (2030) wherein health authorities has increased investment in digital healthcare, MOH should focus on strengthening the nurses' engagement and develop strategies for its long-term and wider scale use of telemedicine services in KSA by continuing to update legislation, regulations, security, and HCPs education and training.

Compliance with Ethical Standards

The researchers got an ethical clearance from the Ethics Review Committee and Institutional Review Board. Additionally, the researchers got approval from the Chairperson of the Nursing Research Committee in Riyadh, Second Health Cluster (King Fahad Medical City) to allow nursing staff to be included in the study. The researchers got an informed consent from participants by disclosing information regarding the study before they make an informed decision, facilitating understanding and promoting their voluntariness. The participants proceed to answer the survey once they agree and sign the informed consent. Participants can freely withdraw from the study without any questions and potential loss of any benefits. The researchers are responsible for safeguarding the participant's privacy and confidentiality following KSA's new Personal Data Protection Law Royal Decree M/19 of 9/2/1443H (16 September 2021); Cabinet Resolution No. 98 of 7/2/1443H (14 September 2021). The data is electronically stored and protected and does not include the name of the participants which means there is no way that data analysis can be traced back to the participants. The data was accessed by the research team for data analysis and stored as a computer file a year after publication

for reference and will then be deleted. Data and statistics will be published for public access.

The researchers do not see any conflicts of interest in this work. Plagiarism was strictly avoided, there was no bias in the interpretation of the findings and that the results were used purely for research. The authors would also like to declare that this research was not funded and conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest and was purely research in nature.

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Corresponding author: pangilinan.rachellegil1994@auf.edu.ph