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KNOWLEDGE, ATTITUDES, AND PRACTICES OF NURSES REGARDING DIGITAL HEALTH IN TERTIARY CARE HOSPITALS OF PESHAWAR, PAKISTAN

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Abstract

Objective: *To assess the knowledge, attitudes, and practices of nurses regarding digital health and to explore the associations among these variables and demographic factors.*

Methodology: *A cross-sectional descriptive design was used to evaluate knowledge, attitudes, and practices of nurses regarding digital health at tertiary care hospitals of Peshawar. A total of 265 nurses voluntarily participated using a convenient sampling method. The data was collected using an adopted structured questionnaire that asked 30 questions. For data entry and analysis, SPSS version 25.0 was used.*

Results: *Among the 265 participants, 48.7% of nurses had good knowledge, 61.1% showed strong practical skills, and 76.2% had a positive attitude toward digital health. The mean and standard deviation for knowledge, attitudes, and practices were 2.30 ± 0.78, 1.76 ± 0.42, and 2.56 ± 0.57, respectively.*

Conclusion: *The majority of nurses exhibited good knowledge, positive attitudes, and strong practices related to digital health. A highly significant association was found between each variable.*

INTRODUCTION

It is an indisputable fact that our healthcare system has been revolutionized due to the adoption of digital technologies. The World Health Organization (WHO) defines digital health as the field of knowledge and practice associated with any aspect of adopting digital technologies to improve health" (WHO, 2021). However, as the world continues advancing, new versions of healthcare technologies are expected to come, with the need for professionals to be proficient enough to work with new technologies. The nursing profession needs to build desperately needed informatics knowledge and competences for the better delivery of care in a new and changing digital health reality (1).

Becoming a digitally connected healthcare provider does not imply replacing analog or paper processes with digital ones. When technological interventions fail, they are merely arranged on top of existing structures and work patterns, increasing the strain for healthcare workers. The technologies that have provided the most immediate benefits have been carefully designed to make people's jobs or patient interactions easier, with significant expenditure in the design phase (2).

Staffing shortfalls concerning nursing care exist in many countries and will likely increase in intensity owing to the changing population dynamics. There are many technologies available, and even more that can be developed, but none have yet become popular

Frontier in Medical & Health Research

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in nursing practice. In order to ensure that this does not happen, the Federal Government of Germany's Federal Ministry of Education and Research (BMBF) established the initiative, "Nursing Care Innovation Centre" towards the cluster "Future of Nursing Care". The objective is to invent new nursing technologies, test them and instigate the reforms needed to adopt them (3)

Because nursing is a responsive profession, both current and future nurses need to be ready to use digital tools for knowledge building, nursing information management, and decision-making. They also need to be able to think of innovative methods to do their jobs in digital environments. Therefore, nursing educators, healthcare administrators, politicians, and academics are currently very concerned about the unresolved gaps in nursing students' and nurses' digital health capacity (1).

The use of technology for communication and information advancement in the health industry is impacted by the current revolution in global technology. Quick access to knowledge worldwide is a result of rapidly evolving technologies. This obviously has an impact on the development of health technology as well, particularly in the nursing sector. One effect is the computerization of the nursing documentation system, which was previously handwritten (4).

Robot-assisted treatments, and electronic records—these are forms of digital applications with the help of which the quality and safety of care improves along with being cost-effective and resource efficient. (5).

Digital health literacy (DHL) builds on HL as its enabling tools and resources are geared to efficiently solving health problems with technology or through electronic information resources. The improvement achieved through digital health translation enables patients to receive care on time to an extent that the quality of life is also enhanced together with easier access to opportunities for better living and easing chronic disease management programs. Health seeks to use strategies such as seeking, obtaining, and using health-related information from the digital domain. Understanding of digital health and guidance on its adoption are skills to be possessed by healthcare providers. Nurses have to evaluate the credibility of online knowledge and jump into digital skills. People with high DHL in the least time are able to get access to credible health information, making the decision-making process and the process of working together easier. In relation to the care given to the patients, the nurses ought to be able to scrutinize the credibility of the sites they consult. Given the novelty of HL and DHL as science-driven matters, evaluation of DHL sophistication in nurses is important for improving technology usage in the management of patients' data. Some studies have noted deficits in electronic health literacy, indicating a need to assist people in adopting health measures and greater health self-reliance. (6).

The global study demonstrates how digital technology provides innovative approaches to learning that enhance nursing practice and education. Younger cancer patients can now receive virtual pain management counselling from nurses via mobile technology, especially cellphones and modern health software (apps). Patients with cardiovascular disease and terminal cancer have had their vital signs continually and in real-time monitored by wearable sensors, whatever the age or severity of the condition (7).

The term 'eHealth' (WHO) refers to the use of information and communication technology to improve health. Digital health builds on eHealth by incorporating a broader range of smart devices and technology such as the Internet of Things, artificial intelligence (AI), massive data sets, and robotics. Current developments in AI have demonstrated tremendous growth, especially AI-powered chatbots. Advanced artificial intelligence, such as ChatGPT, shows potential as a virtual assistant for patients and healthcare workers. Hopkins AM (2023) discovered that ChatGPT could efficiently determine and give cancer-related information, such as tumor types, diagnoses, and therapies, with results similar to Google's displayed highlights. This technology provides precise information while presenting it in a manner that minimizes stress, offering practical advice. In healthcare, the adoption of new technologies and digital services has become vital to nursing practices, making informatics knowledge essential for nurses to successfully perform their duties. There is a growing need for training in areas such as patient registration systems, organized

Frontier in Medical & Health Research

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documentation, basic IT skills, and the implementation of new digital services in patient care (7).

In Egypt, the implementation of Electronic health record (EHR) has become obsolete as only a small proportion, around 7% of clinicians have started using it. Sadly, a good number of nurses in health care do not know the system let alone the benefits of the system. All hope is not lost as given time there can be a possibility of a complete use of an e-health system with a proper change management strategy influencing its growth. (8)

Artificial intelligence (AI) is a key technology that is expected to be central to the fourth industrial revolution. Numerous experts have explored AI's potential to significantly enhance diagnostic accuracy, support decision-making, and help mitigate healthcare staffing shortages. In nursing, AI has already been implemented in areas such as the analysis of electronic nursing records, clinical decision support for assessing bed ulcers and safety risks and scheduling tasks (9).

During COVID-19 pandemic Taiwan utilized big data in the fight against COVID-19 by integrating health insurance with immigration and customs databases, using real-time notifications, travel... and symptoms reporting through QR codes to assess and manage exposure risks. A consolidated electronic health records system also facilitated this process. In the same way, South Korea's database of medical exposure, credit card purchases and static CCTV images assisted contacts tracing and tracking. In Germany, telemedicine and secure doctor-patient communications websites have proved to be valuable resources in the era of pandemic when health care services were delivered virtually, enabled many thousands of doctors in the US and across the globe to transition virtually overnight without any hurdles (10)

The means to address the identified issues within professional nursing practice can be provided by digital technologies. This is why, for example, a significant number of healthcare organizations and nurses themselves hope that digital medium will help improve the care of patients and, simultaneously, alleviate the occupational stress experienced by nurses. Nowadays, some nurses work with computerized charts and use telehealth technologies.(11).

Knowledge is defined as the comprehension of information, which involves the conscious and non-symbolic recognition of its meaning. According to Ajzen and Fishbein, attitude pertains to the positive or negative judgment of an object. Practice refers to habitual actions shaped by commonly accepted social norms and beliefs. (7)

Objectives:

- To evaluate the level of knowledge, Attitude & Practices among nurses regarding digital health in a tertiary care hospital in Peshawar.

Significance:

As healthcare systems globally move toward digital technology, there's an immense need to understand how nurses in tertiary care hospitals in Peshawar perceive and interact with digital tools. This research also highlighted gaps in knowledge and areas where additional training was needed, ultimately leading to improvements in patient care quality. Nurses are the front-line care workers for patient care, and their attitudes and practices regarding digital tools can greatly influence directly or indirectly the success of digitalization initiatives.

This study also gave insight to understanding the current state of digital readiness among nurses which can help in designing policies that support a smoother transition to digital healthcare systems.

Aim:

The aim of this study was to identify the level of awareness and understanding of digital healthcare tools among nurses and explore their attitudes toward the adoption of such technologies. The goal was to provide insights that can guide the development of strategies to enhance digital competency among nurses, improve the implementation of digital systems, and optimize patient care outcomes in the region.

METHODOLOGY:

Design:

A cross-sectional, descriptive study design was used in this study.

Frontier in Medical & Health Research

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Study Setting:
Three tertiary care hospitals in Peshawar were included in this study.

Sample size:
- For this study, the sample size was determined using Rao soft software, considering a known population of 756 nurses, a 5% margin of error, and a 95% confidence interval, resulting in a calculated sample size of 265 participants.

Target Population:
Registered Nurses who were directly involved in patient care.

Inclusion Criteria:
- Registered nurses who were working in tertiary care hospitals of Peshawar.

Exclusion Criteria:
- Nurses with any psychomotor illness that may impact their ability to participate.
- Nurses who were working in managerial posts.

Sampling Technique:
- The convenient sampling method was used to collect data from three hospitals as defined under the study setting.

Data Collecting Procedure:
The data was collected by using an adopted structured questionnaire. The participants were guided properly for appropriate responses to the questions asked. The questionnaire was developed from the article "Assessing digital health knowledge, attitudes, and practices among nurses in Naples: a survey study protocol" (7).

Operational Definition:
This study was conducted using a cross-sectional design to assess the status of knowledge, attitude, and practice among nurses at the tertiary care hospital of Peshawar. **Knowledge** was assessed by asking 10 questions about digital health. Each response was scored as 'yes' or 'no'. Knowledge scores ranged from 10 (maximum) to 0 (minimum). A score of ≤ 4 was considered poor knowledge, a score of >4 and ≤ 7 was considered average knowledge, and a score of >7 was considered good knowledge about digital health. Knowledge scores for individuals were calculated and summed up to give the total knowledge score.

The **attitude** of the study respondents towards digital health was assessed by asking ten questions. Each question was labeled with a positive or negative attitude; the respondents were allowed to choose only one response. A score of 1 was given to positive while 0 was given to negative attitudes with a score range of a maximum of 10 to a minimum of 0. A level of ≤ 5 was considered negative whereas > 5 was considered a positive attitude toward digital health.

Practices towards digital health were assessed by asking ten questions. Each question was labeled with never, sometimes and always. A score of (0-4) was given to never (Bad) while (5-7) was given to some time (Moderate) and a score of (8-10) was considered as always (Good) showing maximum practice by the participant towards digital health. With a score range of a maximum of 10 to a minimum of 0.

Data Analysis Procedure:
For data entry and analysis, SPSS version 25.0 (IBM Corporation Armonk, New York, USA) was used. Computing frequency distribution for categorical variables, mean values, and standard deviation. The association between knowledge, attitude, and practice was measured by using a chi-square test, a P-value of 0.05 was considered significant.

Ethical Considerations:
This study received ethical approval from the Rehman College of Nursing, the Ethical Review Committee, and the respective hospitals' Ethical Review Boards. Nurses who met the study's requirements were provided with the questionnaire, and they were informed about the research's practical significance. Consent forms were signed by the participants. Confidentiality of provided data was strictly maintained, and participants' anonymity was guaranteed throughout and after the study.

RESULTS:
Table 1 shows that the total number of participants was 265. The largest age group was 26-30 years (46.4%), followed by 20-25 years (41.1%) and 31 and

Frontier in Medical & Health Research

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above (12.5%). Regarding gender, 59.2% were female and 40.8% were male. Additionally, 33.6% attended digital technology training, while 66.4% did not.

Table:1

Variable	Categories	Frequency	Percentage
Age	20-25 years 26-30 years > 31 years	109 123 33	41.1 % 46.4 % 12.5 %
Gender	Male Female	108 157	40.8 % 59.2 %
IT training	Yes No	89 176	33.6 % 66.4 %

Figure 1 shows that the majority of nurses (48.7%, n = 129) had good knowledge of digital health, followed by 32.8% (87) with average knowledge, and 18.5% (49) with poor knowledge.

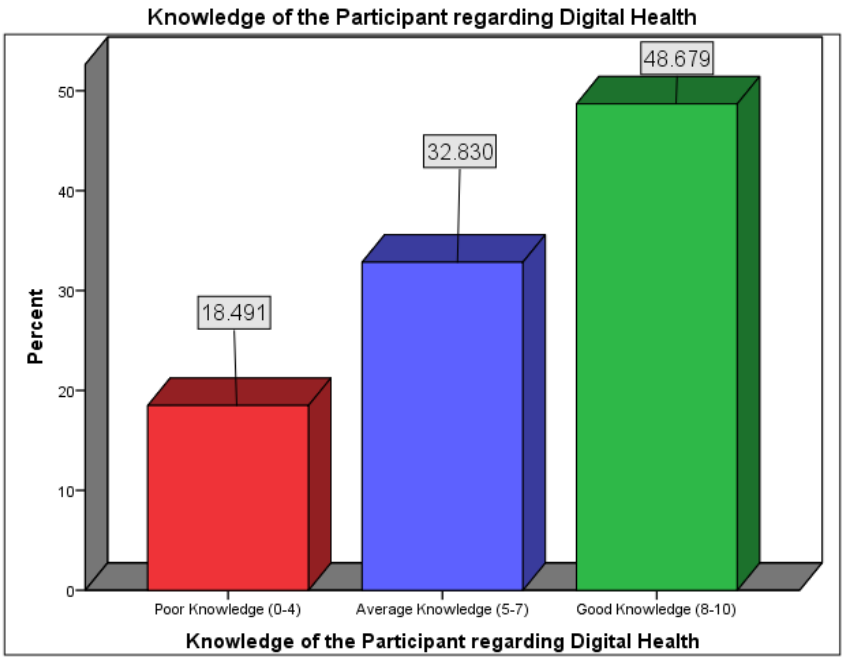

Figure 1: Frequency of Distribution according to the Knowledge of participants regarding Digital Health

Figure-2 shows that the majority of participants (76.2%, n = 202) held a positive attitude toward digital health, while 23.8% (n = 63) had a negative attitude.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

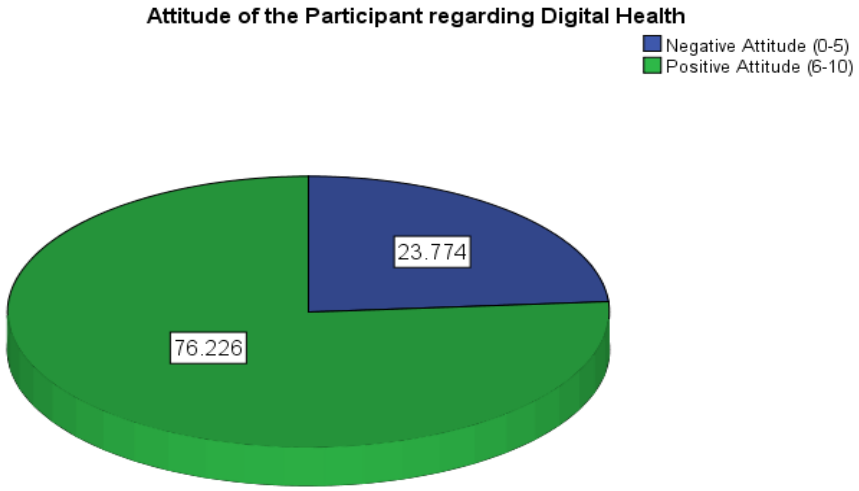

Figure 2: Frequency of Distribution according to the Attitude of participants' regarding Digital Health

Figure-3 shows that only 11 (4.2%) participants were within the bad practice range, whereas 92 (34.7%) showed moderate practice scores. The majority of the participants (n = 162) had good practices toward digital health with a percentage of 61.1%.

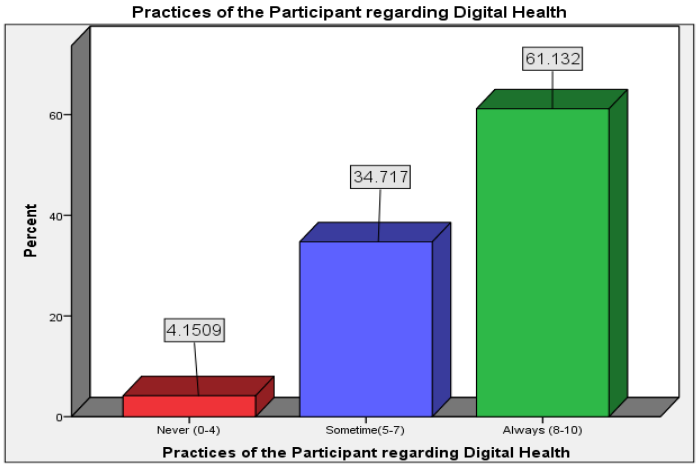

Figure:3 Frequency of Distribution according to the Practices of participants regarding Digital Health

Associations among demographic factor with Knowledge, attitude and practices

Association between Age and Knowledge

A significant association was found between age and knowledge (p = 0.004). The majority of participants with good knowledge were in the 26-30 years age group (n = 73), followed by 48 in the 20-25 years group.

Association between Qualifications and Knowledge

A significant association was observed between qualifications and knowledge (p = 0.004). All master's degree holders (n = 5) demonstrated good knowledge. Among bachelor's degree holders (n = 185), 98 had good knowledge, 60 had moderate, and 27 had poor knowledge. For diploma holders (n = 75), 26 had good knowledge, 27 had average, and 22 had poor knowledge.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Association between Experience and Knowledge
A significant association was found between experience and knowledge (p = 0.002). For participants with 1-5 years of experience, 93 had good knowledge, 59 had average, and 23 had poor knowledge. For those with 6-10 years of experience, 31 had good knowledge, 22 had average, and 16 had poor knowledge. In contrast, participants with 11+ years of experience showed fewer with good knowledge (5), with 6 having average and 10 having poor knowledge.

Association between Experience and Attitude
only significant association was found between experience and attitude (p = 0.002). For participants with 1-5 years of experience, 33 had a negative attitude, while 142 had a positive attitude. In the 6-10 years group, 19 had a negative attitude, and 50 had a positive attitude. For those with 11+ years of experience, the attitude distribution was more balanced (11 negative vs. 10 positive).

Association between Qualifications and Practices
only significant association was found between qualifications and practice (p = 0.042). Among master's degree holders (n = 5), 4 reported good practice. Among bachelor's degree holders (n = 185), 123 had good Practice, 56 moderate, and 6 poor practices. For diploma holders (n = 75), 35 had good Practice, 35 moderate, and 5 poor practices.

Association between Knowledge, Attitude, Practices
Table 2 shows a significant association between knowledge and attitude (p = 0.000). Among 49 nurses with poor knowledge, 31 had a negative attitude, while 18 had a positive attitude. Of 87 nurses with average knowledge, 66 had a positive attitude. Among 129 nurses with good knowledge, 118 had a positive attitude.

Table 1: Association between knowledge and Attitudes of the participants

		Attitude		P-Value
		Negative Attitude	Positive Attitude	
Knowledge	Poor Knowledge	31	18	0.000
	Average Knowledge	21	66	
	Good Knowledge	11	118	

Table-3 The relationship between knowledge and practice was also significant (p = 0.000). Nurses with poor knowledge mostly practiced "sometimes" (29), while those with average and good knowledge practiced "always" more frequently (50 and 101, respectively), indicating a strong relation between higher knowledge and more consistent positive practices.

Table 3: Association between knowledge and Practices of the participants

		Practices			P - Value
		Never	Sometime	Always	
Knowledge	Poor Knowledge	9	29	11	0.000
	Average Knowledge	1	36	50	
	Good Knowledge	1	27	101	

Table 4 shows that the nurses with a negative attitude had a relatively even distribution: 9 reported "never," 27 practiced "sometimes," and 27 practiced "always." In contrast, those with a positive attitude were more likely to practice "always" (135), with 65 practicing "sometimes" and only 2 reporting "never" practicing good practice with the p-value of 0.000.

Frontier in Medical & Health Research

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Table 4: Association between the Attitudes of the participants with Practice

		Practices			p-value
		Never (Bad)	Sometime	Always (Good)	
Attitude	Negative Attitude	9	27	27	0.000
	Positive Attitude	2	65	135	

Discussion:

Knowledge:

In this study it is elaborated that the majority of participants, 129 (48.7%), were having good knowledge, while 87 (32.8%) participants having average knowledge, subsequently, 49 (18.5%) participants were having poor knowledge regarding digital health, with a mean of 2.30 and a standard deviation of 0.78. Similarly, the study was conducted in India, revealed that 59 (49%) nurses had good knowledge, 55 (46%) had average knowledge, and 6 (5%) had poor knowledge of digitalization in healthcare (12). Another similar study was conducted in indonesia which revealed that the majority of respondents 63% have high knowledge about digital nursing documentation, and 37% having low knowledge about digital nursing documentation. (4). In contrast to our findings, a study conducted in Egypt reported that the majority of participants, 83.60% had poor level of knowledge regarding nursing informatics (13), similarly another study in Egypt revealed that most of the nurses had low knowledge levels regarding nursing informatics. This result may be due to nearly two-third of the participants don't use computers at work and more than half of nurses didn't have courses about basic components of computers (8).

Attitude:

Current study findings revealed that 76.2% of the participants held a positive attitude while only 23.8% of the participants were having a negative attitude toward digital health, with a mean of 1.76 and a standard deviation of 0.78. similarly, the findings from (13) revealed that more than half of nurses (54.6%) were having a positive attitude towards nursing informatics. Another study in Kenya reveled the same result, it was found that nurses had a positive attitude towards the computerization of nurses in KNH, had a significantly higher attitude (mean = 74.56) compared to those in AKUH (mean = 69.86, p = 0.0274). (14). Similarly, another study respond that the majority of respondents have a positive attitude of 68.14%, and 31.85% have a negative attitude (4). In contrast, a study was conducted in Egypt which stated that 75% of the participants held negative attitudes toward nursing informatics (15).

Practice:

Our study findings showed only 4.2% of participants were within the bad practice range, whereas 34.7% exhibited moderate and majority 61.1%, having good practices toward digital health. The mean and standard deviation were 2.56 and 0.57 respectively. This study is in line with a study conducted in Europe, revealed that the use of digital technology at work was widespread, 94.4% (16) this may be potentially due to high contextual differences in terms of development and proper availability of digital tools at the workplace. According to (17) 50.4% of the participants had a high level of health information technology practice. Contrary a study was conducted in Egypt, where 63.3% of nurses reported unsatisfactory overall nursing informatics competencies (15). Similarly, another study in Egypt, only 40.40% of nurses had a good level of practice about nursing informatics, the majority 83.6%, couldn't solve common errors on the computer, but more than two-thirds of nurses 70% can have basic computer skills like turning on and off (13)

Associations:

In our study results, there was a significant association between ages and qualifications with knowledge, with the P-value of 0.004, while experience and IT training attended with knowledge were also highly significant at the P-values of 0.002 and 0.000, respectively similarly this is supported by an Iranian study which stated The overall level of digital health literacy was significantly influenced by education, with individuals holding a diploma

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demonstrating lower digital health literacy compared to healthcare professionals with a bachelor's degree or higher levels of education (18). This is contradicted by study conducted in Jordan that showed No significant correlation was found between the total Digital Health Literacy scores and factors such as age, gender, hospital type, educational level, or years of experience (6).

Attitude with experience was also significantly associated at the p-value of 0.002. Qualifications and training attended with practice were found strongly associated with the p-values of 0.042 and 0.007, respectively. Statistically significant associations were found between knowledge and attitude, knowledge and practice, and attitude and practice, all with a p-value of 0.000. These findings align with study conducted in Ethiopia which showed the impact of knowledge on attitude and practice revealed a strong positive and significant association between attitude and practice, with a p-value of 0.001. However, when controlling for the effect of attitude on knowledge and practice, it was found that there was no significant association between practice and knowledge (17).

Conclusion:

Knowledge, attitudes, and practice of digital health are key components that can lead the way towards digitalization in the health care sector that will ultimately lead to the provision of safe, effective, and quality patient care. The current research was conducted to assess the knowledge, attitudes, practices, and associations with each variable of registered nurses at the tertiary care hospitals of Peshawar, Pakistan. Overall study findings revealed that the majority of the nurses exhibited high levels of knowledge, attitudes, and practice regarding digital health.

Ages, education, experience, and IT training were all found to be highly significant associated with knowledge. Only experience is highly associated with attitude and any IT training with practices. Knowledge with attitude and practice and attitude with practice were found to be statistically significantly correlated.

Recommendation:

- Hospitals should implement continuous, structured digital health training programs for nurses to improve their knowledge and practical skills.
- Hospitals should ensure that the necessary infrastructure, such as reliable internet connectivity, user-friendly digital tools, and technical support, is available to nurses.
- Educational institutions offering nursing programs should integrate digital health concepts and technologies into their curricula.
- Regular assessments of nurses' knowledge, attitude, and practices regarding digital health should be conducted. Additionally, feedback mechanisms should be in place to address challenges nurses face in using digital health technologies.
- Collaboration between healthcare institutions, digital health professionals, and policymakers is essential for creating policies and practices that support the effective implementation and use of digital health in nursing practice.

Strengths and Limitations:

Strengths:

- The research addresses an important and timely issue, as digital health is becoming an integral part of healthcare systems worldwide.
- This study provides an in-depth insight to assess the level of nurses' knowledge, attitudes, and practice regarding digital health at the tertiary care hospitals of Peshawar, Pakistan.
- Digital health is an umbrella term; through this study, many aspects of digital health were assessed through a comprehensive, adopted, self-administered questionnaire.
- As per the best of the researcher's knowledge and literature search, for the first time this KAP study was conducted in Peshawar; even in the whole country, no significant studies have been conducted in nurses on digital health.

Limitation:

- Since the study was conducted only in three hospitals in Peshawar, the findings may not be representative of the entire country or other regions with different healthcare systems. More widespread research is needed for a broader understanding of nurses' knowledge, attitudes and practices toward digital health.
- Factors such as nurses' age, years of

Frontier in Medical & Health Research

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experience, educational background, and previous exposure to digital tools may influence their knowledge and attitudes. These factors should be considered when interpreting the results.

The variation in hospital infrastructure and access to digital health tools could be a limitation, as some hospitals may have better resources than others, potentially affecting nurses' attitudes and practices differently.

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