Nurses Attitude Regarding the Effects of Utilizing Technology in Patient Care Practices in Critical Care Units

Background: *Nurses work in more technologically advanced environment, with a variety of medical technologies supporting healthcare delivery. It is important to know nurses' attitude towards using technology in critical care units to improve their practice. There have been no published studies in Saudi Arabia that have investigated the nurses' attitude toward the effects of utilizing technology in critical care units on nursing practice.* ***Purpose:*** *This study aimed is to assess the nurse's attitude regarding the effects of utilizing technology in nursing care practice among critical care nurses.* ***Method:*** *Quantitative descriptive research design was utilized in this study and recruited a total number of 120 nurses working in the Critical Care Units using convenience sampling technique. The Influences of Technology Questionnaire (ITQ) tool was used in the study.* ***Result:*** *The result of the study showed there is no significant differences in the demographic date (age, gender, length of experiences, educational level, and working area) except the nationality the researcher found there is significant differences with score .001. There is significant different between the nationality of the respondents and their Attitude regarding the effect of utilizing technology in patient care practice in critical care nurses.* ***Conclusion:*** *Further studies need to be done to understand both nurses' attitudes and the factors that contribute to these attitudes. To guide effective implementation and safe device usage in an increasingly technologically rich care environment, while still acknowledging nurses' professional identity and the need of compassionate patient care.*

Keywords: *Nurses' attitude, nursing practice, modern technology, critical care nurses*

List of Abbreviations

FCMS	Fakeeh College for Medical Sciences
ICIS	Intensive Care Information Systems
NIS	Nursing Information Systems
ICU	Intensive Care Unit
HIT	Health information technology
AI	Artificial Intelligence
EMR	Electronic Medical Report
EHR	Electronic Health Record
ITQ	Influences of Technology Questionnaire

Introduction, Background and Research Context

This chapter describes the identified research problem and statement of the problem and justifies the significance of the delineated problem.

Introduction

The healthcare technology has become a global modernization of society that headed to technology and information systems being increasingly developed. In daily practice, nurses experience the application of communication and IT technologies. Implementing new nursing technologies improves the productivity of nurses but the way of taking care of patients is also evolving. It is leading to develop the connection between technological skills, culture and social acceptance in the working environment by the nurses using technology (Friganović A., 2016).

Nurses in clinical practice must be able to operate quickly and manipulate a multitude various instruments and equipment. Medical devices are an important aspect of clinical practice in healthcare settings, and nurses are facing with an increase in the number, complexity, and functionality of these devices. These devices were used to monitor patients' vital signs, support vital functions, administer medications, facilitate patient self-care, and perform a variety of other tasks. Managing the relationship between nurses and their technical instruments has become a critical issue in caregiving as the use of medical devices grows (Zhang, W., et al 2014).

Research on digital technologies for nursing care is carried out in many countries in the hope that these technologies may facilitate or even substitute some aspects of human nursing work and thus contribute to mitigate the rapidly rising costs of care and shortages of skilled workers (Khosravi, et al 2016). Nevertheless, due to the limited evidences on effectiveness of digital technologies in nursing care, it is not surprising that care institutions are reluctant to put innovative technologies into practice (Huter et al., 2020).

The implementation of the intensive care information systems (ICIS) has resulted in major improvements in the quality and effectiveness of nursing documentation, transcription of medication orders and administration. In order to increase the quality of care, nurses should spend more time with patients. These also led to improvements in overall performance in nursing (Qin, et al, 2017).

It is shows to promote patient safety minimize medical errors and help increase the time spent on patient care by medical/nursing staff. Information on the actual effect of ICIS on patient outcomes is scarce; the implementation of ICIS enabled ICU length of stay to be reduced without affecting other patient outcomes (Levesque, et al, 2015). In hospitals or long- term care institutions, nursing staff may be supported in working more effectively, providing better quality care, or improving patient safety (Meißner, et al, 2014,)

Background of the Problem

As a clinical nurse specialist working on critical care units, the researcher found the nature of nursing has been transformed by technical changes. Technological developments are taking place at an even more pace in changing human health and wellbeing services. Technological innovations have transformed the nursing structure and organization dramatically. That allows the development of ever more sophisticated healthcare technology, robotics technology. Hospitals now using modal in developing healthcare and its delivery

systems, along with artificial intelligence, have changed the future of nursing.

The establishment of a health information system in the hospitals of many countries like US, Canada, United Kingdom and Korea cost them a lot of money for the main purpose

is to increase the patient safety and quality of care. HIT's present and future application and expanding use strategies are very same around the world. Hundreds of thousands of nurses and healthcare workers will be affected. Nurses must have a positive attitude toward the intended HIT measurements in order for these system installations to be successful and long- term (Huryk, L. A. 2010).

A study investigated the nurses' attitudes regarding the use of Electronic Health Records (EHR) were influenced by demographic factors and their perceptions of using EHR. Nurses' attitudes regarding technology were not shown to be influenced by their full-time or part-time job, gender, or level of education. There was a significant trend in attitudes among participants with more computer experience. The study shows a positive attitude among nurses of all ages, however those between the ages of 30 and 39, as well as those over 60, showed more positive views than the rest of the staff (Dillon et al. 2005).

In addition, nurses with more computer experience have a more positive perspective regarding the use of technology in education and there training especially with younger nurses may have a more positive attitude. (Alquraini H, 2007).

Nursing information system (NIS) provides nursing professionals with technical assistance be expected to create a significant improvement in the quality of nursing care and information management for nurses. Therefore, it is important to understand the aspects that influence the use of NIS by nurses and to design better programs to create advantages for the use of this technological device (Lin, 2017).

By utilizing developing technologies, the nursing profession is facilitating the achievement of improvement goals in the institutions. Nurses are the largest group of practicing clinicians worldwide (Haddad et al 2020). Making them the most major users of health technologies (Zadvinskis et al., 2018).

Nurses are committing to create and implement innovative techniques in order to achieve critical global health goals. Nurses act as critical change agents in the invention and deployment of technical functionality that bridges the delivery of health care and social demands, in addition to their unique and significant knowledge and ability to solve these complex health care objectives (Carroll, 2019). The tactical application of emerging technology is deeply entwined in revolutionizing healthcare and the worldwide nursing profession

(Huston, 2013).

Statement of the Problem

This research is important since there is a serious lack of studies in the Arab community about the attitude of nursing regarding the use of technology on their daily practice in the critical care units specifically in Saudi Arabia. Therefore, the researcher conducted the study to assess nurses' attitude regarding the effects of utilizing technology in nursing care practice in the Critical care units. The study was conducted in the critical care units of Dr. Soliman Fakeeh Hospital (DSFH), Jeddah.

Definition of Terms

1. **Digital Transformation:** is the application of digital capabilities to processes, goods, and assets in order to improve efficiency, provide customer value, manage risk, and find new revenue streams (Schmarzo, Bill, 2017).
2. **Nursing Care:** are those service offered by a nurse that involves the provision of care, or the planning, supervision, or delegation of the provision of care, other than any service that, by their nature and circumstances, do not require the provision of care by the nurse (datadictionary.nhs.uk).
3. **Patient Care:** ensures that the patient is pleased and comfortable while considering their overall health. It is their right to be treated with respect and decency, as well as to have their privacy respected. (chcollege.org)
4. **Technology:** Industrial arts, engineering, applied science, and pure science are all part of the branch of knowledge that deals with the invention and application of technical means, as well as their interrelationship with life, society, and the environment. (dictionary.com)
5. **Modern Technology:** Modern technology is all about efficiency and speed; it ensures face-to-face communication, connects you with healthcare provider, and empowers you by giving you more access and control over the type of treatment and service you receive. (aging.com)
6. **Caring:** is the voluntary and expressed acknowledgment of meaning and interconnectivity, and is an altruistic, active expression of love. (merriam-webster.com)
7. **Intensive Care Unit:** is a structured system for providing critical care to critically ill patients that includes intensive and specialized medical and nursing care, increased monitoring capacity, and multiple modalities of physiologic organ support to help patients survive during a period of life-threatening organ system insufficiency. (Marshall et,al , 2017)
8. **Nursing Information System:** is a component of a health-care information system that deals with patient care, particularly the management of the nursing record. The functions of such systems are examining, as they link with the basic tasks of nursing care (Liaskos, J. et al , 2002).
9. **Global Modernization:** is encompasses major shifts and transformations from traditional to modern politics, economies, civilizations, and cultures, as well as all aspects of human progress and environmental conservation. (Zi-Xing Cai ,et al, 2021)

10. **Implemented Intensive Care Information Systems:** is installed authorized information and software in intensive care units, particularly Critical Care Information System and Patient Data Management System, are included in the Intensive Care Information System. (von Dincklage, F, 2018).
11. **Attitude** is a feeling or way of thinking that affects a person's behavior a positive manner (merriam-webster.com).
12. **Practice** is doing something regular in order to do it better. A practice is one of these periods of doing something (collinsdictionary.com).

Literature Review

This chapter presents the related literature and studies after a thorough and in-depth search done by the researcher. This also presents the synthesis of the theoretical and conceptual framework to fully understand the study.

Literature Review Process

The researcher has identified a total of 49,623 related articles to the current area of research through electronic database search using the Saudi Digital Library, PubMed, CINAHL, Direct Open Access Journal, and ScienceDirect. After a thorough reading and review of the article titles, 128 articles were selected for abstract review. Following abstract review, 78 articles were saved for an in- depth review using full manuscript assessment including research design, sample participants, research focus, and study outcomes using inclusion and exclusion criteria. After a full manuscript review, the current study includes 47 published articles to be included in the study.

Empirical Review of Related Literature

A number of quantitative studies have investigated nursing attitude regarding the use of technology and has been found to have a positive attitude and improvement on nursing practice, saving time and improved the documentation. From different studies the researcher found various variables to predict positive attitude such as increase age and female gender. However, lack of support from manager, lack of training, lack of computers available in the center predicted negative nursing attitude regarding using technology.

Over the years, technology has transformed our world and daily lives. Digital technologies have considerable promise for solving existing difficulties and challenges in the healthcare industry. Many health-care systems are confronted with issues such as a labor shortage and, at the same time, rising demand for long-term care as a result of demographic shifts (Krick, T et, al, 2019). Providing care for patients in a technologically advanced workplace is difficult, especially for new nurses who may find technology captivating all of their attention. Crilly, G., et, al (2019). This is evident that nurses' experiences in critical care environment is crucial and also needs to be technology savvy in

these modern times.

Working in an intensive care unit (ICU) is becoming more complicated and physically, mentally, and emotionally demanding. The ICU work environment needs nurses to provide high quality care in more technological environments that come with increased responsibilities. Time pressure, a lack of social support at work, excessive workloads, miscommunication, poor supervision, conflict with physicians, peers, patients, or their families, high job demands, and ethical and religious distress related to end-of-life issues are all common occupational stressors for intensive care unit nurses. To assess, monitor, and effectively respond to the requirements of patients, ICU nurses must maintain specialized knowledge and advanced capabilities (El Khamali et al., 2019).

Nurses must explore how to adapt and reconfigure' technology so that it can be transformed into a nursing resource. Those technologies that aren't appropriate for nursing may not be allowed. Nurses should change those technologies that preserve the core of nursing and can contribute to a better outcome for patients, rather than just extending and increasing their activities through technological transfer. (Crocker, C., et al 2009).

A study conducted in Sweden to investigate the experience of critical care nurses in carrying out nursing care in a high-tech health care environment measured interview among 60 ICU nurses. The results showed that the nurses have advanced care provided in ICU, they

could not function without high-tech equipment even it is time consuming. Moreover, they stated that it is safer for the patient, but at the same time it adversely affects nursing care by focusing on the equipment. (Tunlind et al 2015).

Innovations and digital transformation in nursing is a vital component for the profession's advancement. Health care, as well as continuous patient monitoring, requires the use of an information-communication system. However, an effective information- communication system is needed for the efficient implementation of nursing documentation and effective health-care delivery (Friganović, 2016). Several studies show that technology improves patient safety, reduces nurses' workloads, and allows them to devote more time to patients (Tunlind et al., 2015). The advancement of nursing technologies provides a means of enhancing patient outcomes while also advancing the nursing profession. (Crocker, C., et al 2009).

Moreover, there was no agreement on whether medical devices increased the quality of care. While some nurses recognized the positive effects of medical devices on patient comfort and safety, as well as their potential to improve safety with competent use, others were concerned that device use could put patients at risk due to human error or mechanical failure, particularly with complex medical devices. Furthermore, several nurses believed that medical technology could distract a nurse's focus away from their patients, and that a reliance on equipment and the underlying assumption that they work effectively could risk patient safety. Thus, some nurses reported a conflict between using medical devices and providing holistic and person- centered care, because device use often required 'letting go' of other aspects of nursing, such as satisfying the patient's needs and

developing a caring relationship (Zhang, W., et al 2014).

In Iran, a study conducted to develop a quantitative tool to assess critical care nurses' attitude on the effect of utilizing technology on nursing practice, 200 nurses working in

critical care units participated in this study. Nurses expressed positive attitudes toward the effects of technology on their treatment, according to the findings of the study (Sabzevari et al, 2015).

Another study was conducted in Dammam, Saudi Arabia, including 150 nurses participated from Imam Abdulrahman Al Faisal Hospital at the National Guards Health Affairs (NGHA). To examine their acceptance and attitudes toward the Electronic Medical Report (EMR). According to the results, there is a significant relationship between attitude usefulness and reported efficiency of use, which has a beneficial impact on nurses' acceptability. National Guards Health Affairs (NGHA) nurses are eager to embrace electronic medical records (EMR) to improve patient care. Likewise, providing a more user-friendly system will enhance their willingness to learn the system and be less resistant to change, thus increasing their degree of acceptance (Aldosari, et al 2018).

The role of nurses in ICU requires successful integration of knowledge, goals, respect and acceptance of information technology. Acceptance can be defined as "a user group's demonstrated willingness to use information technology for the tasks it was meant to support" (Canfield et al., 2018). Another study regarding Nurses Assessment of Satisfaction Scale on the Medication Administration System, a bar coding system before and after installation. It reveals that participants experienced an improved attitude toward the bar code system after it was implemented. The bedside bar-coding system took slightly longer than the manual approach, but the extra effort was well worth it, according to nurses, because the new system improved patient safety (Hurley et al., 2007). Both studies require good attitude in accepting changes and remain positive. Technology is changing fast to be able to improve patient care.

The nurses should be involved in the team who start to implement this technological system, nurses who are interested in building systems should be chosen for involvement in focus groups or committees that are in charge of selecting and modifying HIT solutions. This

will raise awareness of the upcoming technology and increase the possibility that it will fit seamlessly into the nursing workflow and be seen as an enhancement rather than a need. Nurse supervisors must allocate enough time for training. whether it's basic computer training for individuals who have never used a computer before, or advanced system training for their employees prior to deployment and as needed afterward, in order to provide a secure learning environment (Huryk, 2010). HIT systems in nursing care offer the potential to increase safety, communication, and productivity. HIT appears to increase scores on nursing care quality measures, according to preliminary studies (Alexander et al., 2017).

A cross sectional study conducted to describe the relationship between the nursing caring attribute and technology effect in 200 nurse who working in critical care area. The positive association of caregiving attributes and

technological influences were found. Also, it was found out that female nurses had a better attitude about how technology was impacting their care compared to younger, and less experienced nurses (Bagherian et al., 2017). Thus, these factors show that gender and age affects the positive attitude towards utilization of technology in patient care.

Furthermore, a related study was conducted in Kuwait to assess nurses' attitude toward the usage of computerized health information systems in Kuwaiti hospitals including total of 574 nurse. It was found out that nurses had positive attitudes toward computerized health information systems. They are female, non-Kuwaiti, have a baccalaureate degree, and have some computer knowledge. There are significant differences in attitudes relation to nationality, education level, previous computer experience, and computer skills (Alquraini et al., 2007).

In this paper the researcher found related literature regarding age, gender, experiences and education was established, however there is limited studies regarding the nurses' attitude in terms of nationality.

Significance of the Study

The significant of this study to assess the nurses' attitude regarding utilizing technology in their daily practice. As well as what outcome will be found after implementation of new technologies, in improving patient care and reduce error and saving time and cost. According to Tunlind et al. (2015) patient safety is improved, nurse's workload is reduced, and allows them to spend more time with their patients.

The anticipation that information technology can help persons in need of care continue their independence and improve their quality of life and health, as well as support formal and informal caregivers, is motivating research on digital technologies and care. Initial research points to the positive benefits of electronic systems on patient safety and care process improvements (Billings, 2013).

It is a significant challenge for nursing in the coming years, as it will be essential to find a balance between technology and the human factor (Friganovi, 2016).

From the studies that the researcher gathered, significant improvement in patient care is noticeable with the use of new technology. Additionally, most of the studies also found that nurses have positive attitude toward technology and its applicability to patient care. Finally, the results of the studies reported that technology improved care standards, reduced lost work hours and labor force, enabled data recording, and ensured that the practices were implemented. Furthermore, the current study will focus on the attitude regarding using technology on patient care on a particular geographic location in Jeddah, Saudi Arabia where limited similar study has been performed.

Study Purpose

This study aimed is to assess the nurse's attitude regarding the effects of utilizing technology in nursing care practice among critical care nurses.

Research Questions

1. What is the demographic profile of the nurses in the critical care unties in terms of?

1.1 Age

1.2 Gender
1.3 Length of experience
1.4 Nationality

1.5 Educational qualification

1.6 Working area

2. What is the nurses' attitude regarding the effect of utilizing technology in patient care practice in Critical Care Units?
3. Is there a significant difference between the demographic characteristics of the respondents and their Attitude regarding the effect of utilizing technology in patient care practice in critical care Nurses?

Theoretical Framework of the Study

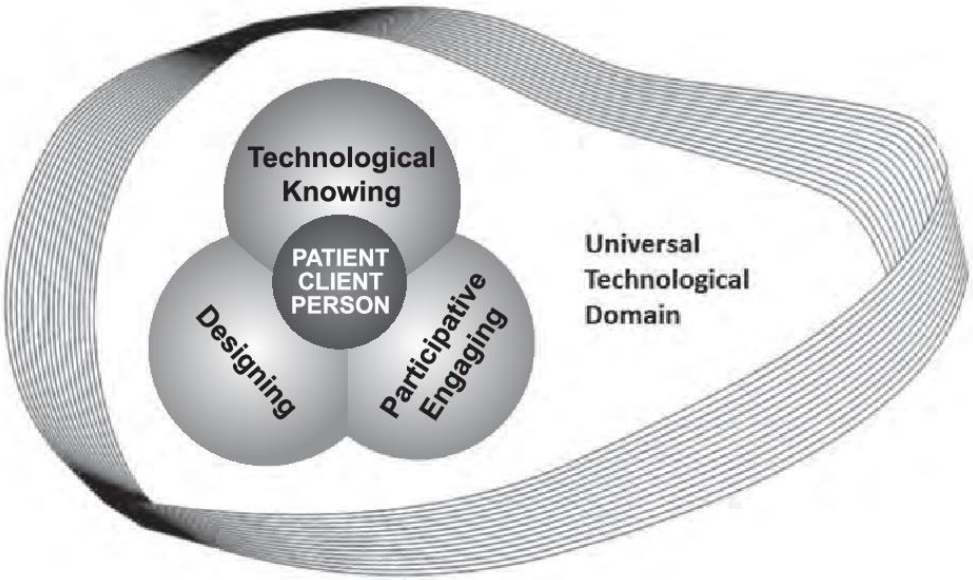
Technical Competency in Nursing is a middle-range hypothesis focusing on nursing as caring developed by Boykin et al. (2001). The philosophy of nursing as caring arose from curriculum development work at Florida Atlantic University's Christine E. Lynn College of Nursing, where both authors were part of a faculty group rewriting the caring-based curriculum for initial program accreditation. After the redesigned curriculum was implemented, they saw the value, if not the necessity, of continuing to develop and structure

ideas and themes toward a holistic statement of nursing's meaning and purpose as a discipline and profession. The acceptance that caring is the goal of nursing, not just a means to an end, and that caring is the intention of nursing, not just an instrument, was the starting point. As a result of this work, nursing's focus has been defined as "nurturing persons living caring and growing in caring." Nursing practice exemplifies it, as it is based on the peaceful co-existence of technology and caring. The theory is based on the following assumptions:

Persons are compassionate because they are human. In the moment, people are whole or complete. Knowing persons is a nursing process that allows for ongoing appreciation of people in the present moment. Technology is employed to know a person's totality in the present moment. Nursing is both a discipline and a career. In nursing, technological competency as caring is the harmonious cohabitation of technologies with caring. The harmonization of these concepts situates nursing practice within the context of modern healthcare and recognizes that these ideas can coexist. The nurse and the patient are brought closer together

by technology. Technology, on the other hand, has the potential to widen the gap between the nurse and the nursed. The nursing process is lived when technology is employed to continuously know people in the moment (Boykin et al., 2001).

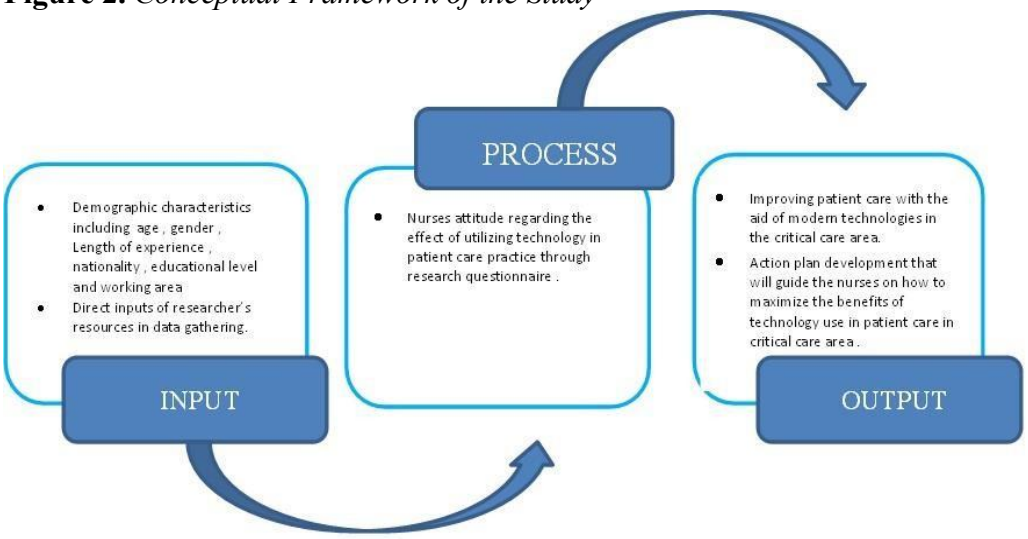
Figure 1. *Theory of Technological Competency as Caring in Nursing*



Conceptual Framework of the Study

The study framework below (Figure 2) shows the flow of the study extracting the significant difference between variables, the demographic characteristics of the respondents including age, gender, length of experience, nationality, educational qualification and working area and their attitude regarding utilizing technology in nursing care in the critical care unit. This data was collected using research questionnaire extracting the nurses' attitude regarding the effect to technology on patient care practice in the critical care units. The collected data was analyzed using the statistical formulas through the SPSS. Based on the findings of the study, an action plan was developed to improve the patient care with the aid of modern technology in the critical care unit.

Figure 2. *Conceptual Framework of the Study*



Summary

From this study the researcher is looking for the nurse's attitude regarding the effect of utilizing technology in patient care practice through research questionnaire with their demographic characteristics including age, gender, length of experience, nationality, educational level and working area. An adopted questionnaire regarding the effect of utilizing technology in patient care practice was used to gather the data.

Action plan development that will guide the nurses on how to maximize the benefits of technology use in patient care in critical care units will be part of the output to improve the patient care by using the technologies.

Methods

This chapter discusses the study design, data gathering procedure, sample selection including inclusion and exclusion criteria, study instrument and statistical treatment of data.

Study Design

Quantitative descriptive research design was used to assess the nursing attitude regarding the use of technology in nursing care practice among critical care nurses at Dr. Soliman Fakeeh Hospital (DSFH), founded and based in Jeddah, Saudi Arabia,

In order to obtain additional knowledge, a descriptive analysis "observes and explains the occurrence, frequency, or absence of characteristics of a phenomenon as it happens naturally." The primary aim of a descriptive analysis is to define a phenomenon's condition, preferences, behaviors, beliefs, concerns, or interests (Burns & Grove 2001:248; Polit & Beck 2006:189). Descriptive

research is useful for creating a benchmark. The approach is also adaptable, allowing for the collection of data from a large number of individuals. (Drummond 1998:31).

Study Respondents and Sample

The target population of the study were staff nurses who is working in the critical care units in Dr. Soliman Fakeeh Hospital. Those who met the inclusion criteria were included participants. Inclusion criteria the following a) staff who are working in critical care units more than 3 months, b) able to read and write English language and c) willing to sign the consent form. New staffs pull out and cross training staff were excluded from the study.

The sample size was 114 nurses working in the critical care units of DSFH was drawn from a total population of 160 considering all the exclusion criteria. A sample of participants is required to achieve statistically significant relationship of moderate magnitude between nurses' attitude and technology. The sample size was calculated based on the Slovins formula: n = N / (1+Ne2): 160/(1+160 x 0.052) = 114. Slovin's formula allows a researcher to take the sample population with a desired degree of accuracy (Stephanie, 2013). The researcher distributed a total of 150 questionnaires, however only 120 were retrieved from the participants which is 80% of the total questionnaires distributed.

A convenient sampling technique was utilized in selecting the sample size from the total population. According to Edgar and Manz (2017), convenience non probability sampling is a research approach in which researchers acquire market research data from a readily available pool of respondents. It is the most often used sample technique because it is extremely quick, simple, and cost-effective. Members are often friendly and willing to participate in the study. Furthermore, the researcher selects individuals only on the basis of proximity, without regard for whether or not they reflect the overall population. They can monitor behaviors, attitudes, and viewpoints in the simplest way possible using this technique.

Setting and Recruitment

The study was conducted in the critical care units of Dr. Soliman Fakeeh Hospital (DSFH), founded and based in Jeddah, Saudi Arabia, in 1978 by Dr. Soliman Fakeeh, has been a true leader in the field, it is the biggest private medical center of Jeddah holding the major international accreditations and having a considerable number of total quality recognitions.

Dr. Soliman Fakeeh Hospital has a capacity of 475 beds, ER-24 beds, ICU-24 beds, CCU-10, And RDU-40, 120 clinics and 15 operation theatres, which is expected to increase to 810 beds, 393 clinics and 39 operation theaters once its ongoing projects are completed. With a workforce of more than 3000 employees. It is currently one of the most notable healthcare providers in the region and is visited by greater than 700,000 patients every year.

Data Collection Procedure

The researcher submitted the study proposal to the Internal Review Board for review and approval. After approval, permission from the chief nursing officer for the approval to conduct the study in the critical areas of Dr. Soliman Fakeeh Hospital. The researcher distributed the questioner to the participants who met the inclusion criteria to invite them to participate in the study. The questionnaire was given to the participants by the researcher himself on an individual basis. Each participant was given a letter explaining the purpose of the study, the risks and benefits of participation, and assure that participation is completely voluntary and they can withdraw any time, Also, the participants were assured that identified data will be kept in a closed cabinet and no one will see them except the researcher. The participants were asked to sign a written consent indicating their agreement, and then completed the questionnaires. During the data collection period, the researcher was available to answer any questions raised by the participants about the questionnaire. The researcher informed each participant to hand in the completed questionnaire to them. The questionnaires took approximately 15 minutes to complete. The researcher came to the hospital for 10 days during 2 weeks for 4 hours daily for each unit to collect took the completed questionnaires from the participants and placed them in locked cabinet to maintain participants' confidentiality. The data collected was sorted and submitted to the statistician to treat the data, and then the result was sent back for analysis and interpretation.

Research Scale/Instrument

The researcher employed an adapted survey questionnaire from that divided into two (2) parts. **Part I** covered the demographic profile of the respondents including the age, gender, education, length of experience, nationality and assigned area. **Part II** the researcher used an adapted questionnaire developed by Sabzevari et al, 2015 to assess the Critical care nurses' attitudes about influences of technology on nursing care using Influences of Technology Questionnaire (ITQ). Approval was obtained from the authors to use the questionnaire in this study. The scale has twenty-three Likert-scale items: The overall rating of the questionnaire varied between 22 and 120. This instrument measures the positive as well as negative aspects. The scoring of each question a Likert-type scale from strongly disagree=1, disagree=2, Neither= 3, agree= 4, until strongly agree=5.

Internal consistency reliability coefficients of the individual transferable quota (ITQ) were checked and the questionnaire has an Alpha Coefficient (Cronbach) of 0.824. Therefore, the internal consistency of the questionnaire as a whole and the negative and positive aspect was 0.896 and 0.925 respectively (Sabzevari et al, 2015). The assessed nurses' attitude regarding the use of technology in nursing care practice among critical care nurses were based on the interval and descriptive rating references describe in Table 1.

Table 1.

Scale	Interval	Descriptive Rating	Interpretation
5	4.20 – 5.00	Highly competent	Highly positive
4	3.40 – 4.19	Competent	Positive
3	2.60 – 3.39	Moderately competent	Neutral
2	1.80 – 2.59	Slightly competent	Negative
1	1.00 – 1.79	Not competent	Highly negative

Ethical Consideration

FCMS Internal Review Board (260/IRB/2022) and DSFH obtained ethical approval for this study proposal. After approval was obtained from both the FCMS Internal Review Board and DSFH, informed consent obtained from the participants directly. The purpose of the study and any risks/benefits was explained to the participants, and if they still wish to proceed, they were informed that the study is voluntary, and they have the right to withdraw their participation at any time. They were assured that any information provided by them is confidential and held in a secured location. Informed consent obtained in writing if they agree to participate but also stating their rights to withdraw. All data assessed without the presence of personal interest or bias and overseen by senior researchers who specialize in this field.

Data Analysis

The data was analyzed using Statistical Package for the Social Science (SPSS) Version 24, which is a common tool for quantitative data analysis. Descriptive statistics such as equivalent frequency, standard deviation and percentage used to describe the characteristics of the sample and study variables. Furthermore, ANOVA Test and t-Test was used to test the differences between the demographic data and nurses' attitude.

Scope and Limitations of the Study

The results of the study cannot be generalized as it was conducted only in one hospital, and convenience sampling was used. Assessing nurses' attitude regarding the effects of using technology in critical care units can be affected by the tendency for social desirability as self- report tools were used to collect the data so, critical care nurses' response may be under or over reported. These limitations will need to be considered when considering the study findings.

Results

This chapter deals with the results of the study. The findings are presented and analyzed in a comprehensive manner. The flow of the presentation will follow the sequence of the research objectives.

Results

Table 2. *Age of the respondents*

Age of the Respondents	Frequency	Percentage
25 Years Old & Below	14	11.7
26-30 Years Old	35	29.2
31-35 Years Old	53	44.2
36-40 Years Old	15	12.5
41 Years Old & Above	3	2.5
Total	**120**	**100**

Table 2 is about the age of the respondents. Above table shows that those who belong to age bracket of 25 years and below registered a 14 frequency with an equivalent percentage of 11.7. For 26-30 years old, there were 35 respondents with a frequency of 29.2. For age bracket 31-35 years old had a total of 53 respondents with a percentage, highest among the categories. Those who belong to bracket of 36-40 years old had a frequency of 15 with a percentage of 12.5, while those who belong to 41 years old had a frequency of 3 and an equivalent 2.5.

Table 3. *Gender of the respondents*

Gender of the Respondents	Frequency	Percentage
Female	102	85.0
Male	18	15.0
Total	**120**	**100**

Table 3 shows the distribution of the respondents in terms of their gender. Female participants registered the highest percentage of 85.0 with an equivalent frequency of 102. While male participants had 18 participants with an equivalent percentage of 15.

Table 4. *Experiences of the respondents*

Experiences of the Respondents	Frequency	Percentage
Less than 1 Year	12	10.0
1-3 Years	32	26.7
4-6 Years	29	24.2
7-9 Years	25	20.8
More than 10 Years	22	18.3
Total	**120**	**100**

In terms of the working experiences of the nurses, those who said they had less than 1 year had a 12 frequency and with an equivalent percentage of 10. Those who belong to 1-3 years of experiences registered a frequency of 32 with a percentage of 26.7, highest among other groups. While those 4-6 years had 29 as frequency and a percentage of 24.2. 7-9 years had 25 as frequency and a percentage of 20.8. Lastly those who belong to more than 10 years as a nurse had a frequency of 22 and with an equivalent percentage of 18.3.

Table 5. *Nationality of the respondents*

Nationality of the Respondents	Frequency	Percentage
Saudi	23	19.2
Indian	38	31.7
Filipino	47	39.2
Egyptian	10	8.3
Sudanese	2	1.7
Total	**120**	**100**

In terms of the nationality of the respondents, those who claimed that they are Saudi had a frequency of 23 and a percentage of 19.2. Indians had a frequency of 38 and a percentage of 31.7. Those who said they are Filipinos had a frequency of 47, highest and a percentage of 39.2. Egyptians has 10 participants with a frequency of 8.3, while Sudanese had the lowest frequency of 2 and a percentage of 1.7.

Table 6. *Educational Level of the respondents*

Educational Attainment of the Respondents	Frequency	Percentage
Diploma	10	8.3
Bachelor	110	91.7
Total	**120**	**100**

Educational level of the respondents had registered 2 categories only. Diploma had 10 frequencies with a percentage 8.3, While most of them belong to bachelor with a frequency of 110 and a percentage of 91.7.

Table 7. *Working Area of the respondents*

Vorking Area of the Respondents	Frequency	Percentage
ICU	19	15.8
CCU	24	20.0
ER	30	25.0
HDU	8	6.7
NICU	12	10.0
PICU	17	14.2
ER-MCH	10	8.3
Total	**120**	**100**

For the working areas of the respondents, those who belong to ICU had a frequency of 19 with a percentage of 15.8. Those who work in the CCU had a frequency of 24 and a percentage of 20.0. ER had a frequency of 30, highest among the respondents with a percentage of 25.0. HDU however registered a frequency of 8 and a percentage of 6.7. Those who work in NICU had frequency of 12 and a percentage of 10.0. PICU had a frequency of 17 with a frequency 14.2. Lastly those in the ER-MCH had a frequency of 10 and percentage of 8.3.

Table 8. *Nurses attitude Regarding the Effects of Utilizing Technology in Patient Care Practices in Critical Care Units*

S/N	Statements	Mean	SD	Verbal Description
1	Using technology makes nurses professionally uncertain	2.88	1.24	Neither
2	Using technology in caring for patients often interferes with providing adequate nursing care	2.90	1.19	Neither
3	I am not sure that technology is useful for my practice	2.40	1.09	Disagree
4	The increased use of technology in nursing care has downgraded the nursing profession	2.54	1.18	Disagree
5	Technology enhances patient care and recovery	4.16	0.66	Agree
6	Using technology in care requires high-tech skills	3.50	1.06	Agree
7	Mastery of technology has helped nurses to control their work environment	3.95	0.78	Agree
8	Technology directs and controls medical treatment	3.66	1.03	Agree
9	Technology makes treatment more secure	3.97	0.70	Agree
10	Technology decrease nurses' workload	3.72	0.92	Agree
11	Technology is not easy to handle	3.17	1.01	Neither
12	Technology distracts nurses' ability to connect with or relate to their patients	3.15	1.04	Neither
13	Collaboration in care (interrelationship between the patients, their families, and the health team) can help the patients live with technology safely and comfortably	3.86	0.66	Agree
14	Technology can create ethical dilemma (when physician used to decide whether or not withdraw medical treatment)	3.26	0.89	Neither
15	Involving technology in care means participants demanded more time to caring for patients	3.08	0.99	Neither
16	Technology is the priority, not the patient	2.10	0.96	Disagree
17	Life sustaining technologies in intensive care unit, limit the space needed for patient care	2.80	1.11	Neither
18	Technology dose not interfere with patient care	3.65	0.89	Agree
19	Technology facilitates patient care	4.01	0.75	Agree
20	The influx of technological machines often makes nurses neglect patients	2.44	1.07	Disagree
21	Because of the application of modern machineries, in case of inevitable death of patient nurses often become frustrated.	3.07	0.99	Neither

22	I think even with the help of technology, there is not any more spare time in nursing	3.15	1.05	Neither
23	The entrance of technology has promoted the nursing profession	4.19	0.62	Agree
	Overall Average	***3.28***	***0.95***	***Neither***

1–1.79: Strongly disagree,
1.80–2.59: Disagree,
2.60–3.39: Neither,
3.40–4.19: Agree,
4.20–5.00: Strongly agree

Table 8 shows the respondents' attitude regarding the effects of utilizing technology in patient care practices in critical care units. For item 1: Using technology makes nurses professionally uncertain, it has a mean score of 2.88 and a SD of 1.24 with a verbal description of "Neither". For item 2: Using technology in caring for patients often interferes with providing adequate nursing care, had a mean score of 2.90 and a SD of 1.19 with a description of "Neither". For item 3: I am not sure that technology is useful for my practice, had a mean score of 2.40 and a SD of 1.09 with a description of "Disagree". For item 4: The increased use of technology in nursing care has downgraded the nursing profession, had a mean of 2.54 and a SD of 1.18 with a description of "Disagree". Item 5: Technology enhances patient care and recovery, had a mean of 4.16 and a SD of .66 with a description of "Agree". For item 6: Using technology in care requires high-tech skills, had a mean score of 3.50 and a SD of 1.06 and a description of "Agree". Item 7: Mastery of technology has helped nurses to control their work environment, has a mean score of 3.95 and a SD of .78 with a description of "Agree". For item 8: Technology directs and controls medical treatment, has a mean score of 3.66 and a SD of 1.03 with a description of "Agree". Item 9: Technology makes treatment more secure, has a mean score of 3.97 and a SD of .70 with a description of "Agree". Item 10: Technology decrease nurses' workload, had a mean score of 3.72 and a SD of .92 with a description of "Agree". Item 11: Technology is not easy to handle, had a mean score of 3.17 and a SD of 1.01 with a description of "Neither". For Item 12: Technology distracts nurses' ability to connect with or relate to their patients, had a mean score of 3.15 and a SD of 1.04 with a description of "Neither". Item 13: Collaboration in care (interrelationship between the patients, their families, and the health team) can help the patients live with technology safely and comfortably, had a mean score of 3.86 and a SD of .66 with a description of "Agree". Item 14: Technology can create ethical dilemma (when physician used to decide whether or not withdraw medical treatment), had a mean score of 3.26 and a SD of .89 with a description of "Neither'. Item 15: Involving technology in care means participants demanded more time to caring for patients, had a mean score of 3.08 and a SD of .99 and a description of "Neither". Item 16: Technology is the priority, not the patient, has a mean score of 2.10 and a SD .96 with a description of "Disagree". Item 17: Life sustaining technologies in intensive care unit, limit the space needed for patient care, had a mean score

of 2.80 and a SD of 1.11, with a description of "Neither". Item 18: Technology dose not interfere with patient care, had a mean score of 3.65 and a SD of .89 and a description of "Agree". Item 19: Technology facilitates patient care, had a mean score of 4.01 and a SD of .75 with a description of "Agree". Item 20: The influx of technological machines often makes nurses neglect patients, had a mean score of 2.44 and a SD of 1.07 and a description of "Disagree". Item 21: Because of the application of modern machineries, in case of inevitable death of patient nurses often become frustrated, had a mean score of 3.07 and a SD of .99 and a description of "Neither". Item 22: I think even with the help of technology, there is not any more spare time in nursing, had a mean score of 3.15 and a SD of 1.05 with a description of "Neither'. Item 23: The entrance of technology has promoted the nursing profession, had a mean score of 4.19 and a SD of .62 and a description of "Agree". Overall mean score for all items is 3.28 and a SD of .95 and a description of "Neither".

Table 9. *ANOVA Test on age of the respondents*

Demographic Profiles		Mean	SD	F	*Sig.*	Interpretation
Age	25 Years Old & Below	3.43	0.43	.856	*.493*	No Significant Differences
	26-30 Years Old	3.26	0.47			
	31-35 Years Old	3.31	0.46			
	36-40 Years Old	3.17	0.31			
	41 Years Old & Above	3.08	0.27			

aComputed at significance level of alpha .05

When tested for differences on their answers in terms of the age of the respondents, ANOVA results reveals a .493 with an interpretation of "No significant differences. This further show that their answer does not differ when age is factored among the respondents.

Table 10. *T-test on the gender of the respondents*

Gender	M	SD	F	*t*	Interpretation
Male	3.290.44		1.042	.309	No Significant Difference
Female	3.250.42				

aComputed at significance level of alpha .05

Table 10 reveals the result of the differences of their answer in terms of their gender, t-test shows a .308 that is interpreted as "No significant differences" on their responses. This can be further concluded that female answers do not differ from those of the males.

Table 11. *ANOVA Test on length of experiences of the respondents*

Demographic Profiles		Mean	SD	F	*Sig.*	Interpretation
Length of Experience	Less than 1 Year	3.32	0.26	.876	*481*	No Significant Differences
	1-3 Years	3.30	0.50			
	4-6 Years	3.40	0.46			
	7-9 Years	3.20	0.39			
	More than 10 Years	3.20	0.45			

aComputed at significance level of alpha .05

Table 11 shows difference of the answers of the nurses when their length of experiences is factored. ANOVA result shows a score of .481 with a description of "No significant differences". It can therefore conclude that nurses' responses show no difference when they are grouped according to their length of experiences.

Table 12. Test on the nationality of the respondents

Demographic Profiles		Mean	SD	F	Sig.	Interpretation
Nationality	Saudi	3.59	0.44	.971	.001	Significant
	Indian	3.30	0.49			
	Filipino	3.12	0.32			
	Egyptian	3.34	0.42			
	Sudanese	3.26	0.00			

aComputed at significance level of alpha .05

Table 12 shows ANOVA result of the nurses' responses when they are grouped according to their nationality. With a score of .001 and a description of "Significant". It can therefore conclude that their answers are significantly different when they are grouped according to their nationalities.

Table 13. *T-test on the educational level of the respondents*

Gender	M	SD	F	*t*	Interpretation
Diploma	3.36	0.66	266	.607	No Significant Differences
Bachelor	3.28	0.42			

aComputed at significance level of alpha .05

Table 13 shows the result of the difference in their answers when grouped according to their educational level. Only 2 categories registered for the variable among the respondents. Using t-test, a score of .607 was obtained with a description of "No significant difference". It can therefore conclude that their educational level does not affect their responses.

Table 14. *ANOVA Test on the working are of the respondents*

Demographic Profiles		MeanSD		*ig.*	Inter pretation
Working Area	ICU	3.35	0.48	.528	No Significant Differences
	CCU	3.38	0.56		
	ER	3.31	0.49		
	HDU	3.46	0.46		
	NICU	3.23	0.21		
	PICU	3.03	0.22		
	ER-MCH	3.23	0.18		

aComputed at significance level of alpha .05

Table 14 shows differences on their answers when grouped according to their working areas. ANOVA result reveals a score of .175 with a description of "No significant Differences". It can therefore say that their answers do not differ according to their working areas.

Discussion

This chapter summarizes the main study findings and interpret them in relation to the delineated research question. In addition, this chapter compares and contrasts the current study results in lights with previous studies.

Interpretation of the Study Findings

This is a study of the attitude of nurses regarding technology in their nursing

practice in the critical care unit. The discussions in the demographic characteristics of the participants and the effect of technology in the critical care unit as per the nurse's attitude. The methodology applied in the research was surveying where nurses as respondents were involved. Fourteen incidents were reported on average by individuals under the age of 25, an equal proportion of 11.7 for those in this age group. There were 35 respondents between the ages of 26 and 30, with a response frequency of 29.2. Unlike those above 40 years, the respondents were evenly distributed between the two age groups. The results could be because the older nurses do not prefer technology since they have no skill in using them. In contrast, those between 0 and 35 years know technology and have seen its importance rather than its disadvantages.

While overall, male nurses earn more money than female nurses, in this study it found out that there are more female nurses than men. Men are more likely to succeed in certain areas of nursing than in others, and they are less likely to get employed in some areas than in others. Still, women work part-time at a higher rate than males, impacting their salary and ability to grow in their professional careers (Tzeng et al., 2021). This could be why the captured results stated that female participants constituted the largest proportion of 85.0 percent of the total, which amounted to a similar frequency of 102 responses. Female participants had 18 attendees with a similar proportion of 15 as subjects, whereas male participants had 18 attendees with a similar percentage of 15 as subjects.

According to the summary of statistics, nurses who had an experience of less than one year had 10%, one to three years had 26.7%, four to since years had 24.2%, seven to nine years had 20.8%, and those who had more than ten years had a percentage of 18.3. Those who had experienced between one and three years had the highest percentage while those who had an experience of less than one year had the lowest percentage. The stark number of nurses with much experience was captured for these studies reflecting nurses with between one- and three years' experience have had enough contact with critical care. They thus understand the nursing care and workload present in the hospital similar to those with more than four-year experience, unlike those with less than one year (Kattari et al., 2020).

In terms of nationality, nurses for India and Filipinos had the greatest percentage while those from Sudan and Egypt had the lowest percentage. Nurses from Saudi were average. The results could give a glimpse on the domination of the migrant health care provider, in this case Indians and Filipinos against locals in the setting of the study. The study conducted at Kuwait to assess nurses' attitude toward the usage of computerized health information systems in Kuwaiti hospitals including total of 574 nurse. It shows that nurses had positive attitudes toward computerized health information systems (H. Alquraini et al , 2007). There are limited studies regarding nationality, which the researcher would like to establish as a gap of some existing related literature.

Diplomas were represented by ten frequencies and an 8.3 percent share, while bachelors were represented by 110 frequencies and a 91.7 percent share of the population. Similar results were garnered preferring those with

bachelor's degree. Nurses with a bachelor's degree are highly sought after for advanced positions in nursing specialties like pediatrics (Rony, 2021) and elderly care and the ability to focus on a particular area of interest rather than merely general practice, making them more attractive to employers (El Khamali et al., 2019).

Regarding the respondents' employment areas, those who work in ICU had a frequency of 19 and a percentage of 15.8. Those that work in the CCU had a frequency of 24 and a percentage of 20.0 in their responses. The most common response was ER, which had a frequency of 30 and a percentage of 25.0 among responders. HDU, on the other hand, recorded a frequency of 8 and a percentage of 6.7. Workers in the neonatal intensive care unit (NICU) had a frequency of 12 and a percentage of 10. The PICU had a frequency of 17 with 14.2 and 17. Finally, individuals in the ER-MCH had a frequency of 10 and a percentage of 8.3 compared to the general population. From the results, nurses from the CCU agreed that technology is helpful since they had the greatest percentage, while nurses from MCH disagreed with the lowest percentage (Subramanian et al., 2020). This is because nursing practice in MCH is nothing compared to the one in CCU; the MCH department does not require much technology since it deals mostly with healthy mothers and children who only need a check-up and follow-ups while CCU patients are critically healed and demand maximum supervision which could work best with technology (Kahn et al., 2019).

From the results, the highest mean had statements that technology is useful in nursing practice and improves nursing care. They agree on its appliance in the field. Those who disagreed had a mean score of between 2 and 2.5. They saw no importance of technology in nursing practice, while those who weren't sure about technology had a neutral statement; they had a mean of between 2.60 and 3.8.

In critical care units, nurses are responsible for meeting patients' physical and emotional needs and their families. Although technology has prompted many contradictory concerns linked to patient care in the critical care setting, it has also sparked a slew of new ones. Technology, according to Marden, is defined as modern pharmaceuticals, tools, techniques, processes, and procedures that are employed by healthcare professionals in the delivery of treatment (Dessie et al., 2020). Technology includes equipment, medical treatment, documentation systems, and the skills required to operate and maintain these items. Given the critical role that technology plays in the diagnosis, treatment, and care of a wide range of medical conditions, adequate training of nurses in the use of various technological tools, as well as an understanding of the culture and values of specialized care, can assist them in striking a balance between technological and humanized aspects of care, increasing the efficiency of specialized care, and improving the overall quality of nursing care. It is becoming more complicated to provide patient care, changing the way nursing care is envisioned and provided (Kassie et al., 2020).

Nurses used the senses of sight, touch, smell, and hearing extensively to monitor and identify changes in patient status before the widespread use of technology. Over time, these nurses' senses were supplanted by technology that could detect bodily changes in patients' health states (Urden et al., 2019). In the

science and practice of nursing, the notion of caring is often referred to as an important concept. Nursing is usually referred to be a vocation that is concerned with others. It is possible to show the notion of caring using the concepts of 'caring for' – the doing component of caring – and 'caring about' – which is connected to another person's value. In addition to the viewpoints, attitudes, and expectations of individuals caring for others, caring is actual action (Lumley et al., 2020).

There are numerous changes in contemporary healthcare due to new and re-emerging illnesses. Still, nothing will have a greater impact on how health care is delivered than the present advancements in information, communication, and technology. As a critical component of the healthcare delivery system, nursing is subjected to a constant stream of new and changing circumstances. Depending on the situation, nurses' reactions to change might range from unqualified acceptance to outright rejection. For example, the introduction of computers might trigger a wide range of emotions in nurses depending on their background.

A favorable attitude may result in a quick acceptance of computerization, accompanied by a realization of the advantages of computerization. Attempts to modernize service delivery are likely to be hampered by a less favorable attitude or outright refusal. In the information, communication, and technology era, computers are only one of the numerous components that have helped to turn the globe into a village (Naqvi et al., 2019). Computers are employed in practically every sector of life in most parts of the world, particularly in industrialized countries like the United States. A computer is a ubiquitous accessory in all areas of the economy, from the banking sector to the transportation sector to the engineering sector to the education sector to the health sector, and so on (Dikmen et al., 2018).

While several studies on the technology attitude of the nurses found out that their demographic characteristic variating in their responses, this study found out that the only differences was when they are grouped according to their nationalities. Their previous hospitals assignments and trainings with the level of applications of technology are different and applying those previous learned skills to the technology in the current hospital. While the succeeding study found out that there is a significant difference between the demographic characteristics of individuals and their attitudes regarding the effect of utilizing technology in patient care practice in critical care nurses (Kassie et al., 2020). There could be a link between age, gender, educational level, and nationality with the mean of their attitude towards the use of technology (Hossain et al., 2021). The highest record in their attitude towards technology in critical care agreed that technology has promoted the nursing profession and enhanced patient care and recovery, with a mean of 4.19 and 4.16, respectively.

When linking it with the demographic data, these respondents tend to be of age 26 to 30, of the female gender, are bachelors and from India and Filipino. When looking at the lowest mean under perception, they agree that technology harms the nursing profession. This population tends to be the opposite of those recording that technology has a positive impact, that is, 35 years and above, male gender and took diploma (Giuliano, 2020). However according to a research,

nurses with more technical expertise are likely to have more positive attitudes; education has a beneficial influence on perceptions, and younger and less skilled nurses tend to have fewer positive attitudes (Buljac-Samardzic et al., 2020).

Summary

In summary, critical care nurses are technologically educated to notice rapid or subtle changes in a patient's health and to promptly give emergency treatment. Technology aided the nurses in treating patients who are severely sick and need more frequent nurse evaluations and round-the-clock care since their status might change suddenly without notice. Nursing care in a high technology setting must be considered as multi-faceted when it comes to how it influences CCNs' experience. The sophisticated care performed in an ICU could not work without high-tech equipment, nor could care operate without expert interpersonal contact and preservation of basal nursing. That technology is perceived as a big tool and simultaneously as a hindrance to patient-centered treatment.

Summary, Conclusion and Recommendations

This chapter includes the summary, conclusion and recommendations of the current study.

Summary

The development in health care institutions and nurse's environment make the nurses profession highly tension to improve their practice with this huge intelligent technology on their daily practice in patient care. From this study the researcher focused on the nurses' attitude toward the utilizing technology in critical care units to improve their daily practice in taking care of ill patients.

There is a lot of studies to investigate the nurses' attitude toward technology in patient care including the factors that affect their attitude and their perception. The result of most of these studies found the nurses has positive attitude toward the utilizing the technology, on other hand some found this technology distracted them from patient center care due to the technology need high skills or full attention more than their patients. from there opinion we need to figure out what is the barriers and try to improve it to use the technology in the right way to maximize the benefits to increase patient care and deliver high quality of care.

The researcher was looking for the nurses' attitude regarding the effect of utilizing technology in patient care practice through research questionnaire with their demographic characteristics including age, gender, length of experience, nationality, educational level and working area.

An action plan development that will guide the nurses on how to maximize the benefits of technology use in patient care in critical care units will be part of the output to improve the patient care by using the technologies.

The results of the study show that critical care nurses are technologically educated and caring patients who are severely sick and need more frequent nurse evaluations and round-the-clock care since their status might change suddenly without notice.

Conclusion

Nurses are constantly exposed to a new technology that must be integrated into care delivery, and they are responsible for improving their professional competence in the use of these technologies to ensure patient safety. Nurses' attitudes toward using technology in their daily care practice for paint care in critical care units were investigated in the present study. The findings of this study revealed that the nurses in this sample had positive attitudes toward the use of technology in their practice. However, further studies need to be done to understand both nurses' attitudes and the factors that contribute to these attitudes. This knowledge is required to guide effective device implementation and safe device usage in an increasingly technologically rich care environment, while still acknowledging nurses' professional identity and the need of compassionate patient care.

Recommendations

Based on the result of the study, the researcher recommends the following action plan to improve the attitude of nurses towards the use of technology in critical care units:

On the practice level:

1. Nurses should be participating in the implementation of any new technology which will be used in patient care.
2. Managerial level should make training and education in using present technology to improve nurses' competence in patient care.
3. Encourage the nurses to use the technology to save time and save patient care.

On the administrative level:

1. Recruit nurses with background on using technology like basic computer since.
2. Give support training to nurses and other support staff regarding new technologies in the facility.

On the research level:

1. Future studies to explore the nurses' attitudes towards utilization of technology which includes the nationality in the demographic profile.

2. Replicate this study on a larger sample for generalization.

Reference

Aging.com (2017). What Is Modern Technology and How Is It Changing? Available from: https://aging.com/what-is-modern-technology-and-how-is-it-changing/#:~:text=Modern%20technology%20is%20all%20about,well%20as%20service%20you%20receive.

Aldosari, B., Al-Mansour, S., Aldosari, H., & Alanazi, A. (2018). Assessment of factors influencing nurses acceptance of electronic medical record in a Saudi Arabia hospital. *Informatics in Medicine Unlocked*, *10*, 82-88.

Alexander, G. L., & Madsen, R. W. (2017). A report of information technology and health deficiencies in US nursing homes. *Journal of patient safety*.

Alquraini H., Alhashem A.M., Shah M.A. & Chowdhury R.I. (2007). Factors influencing nurses_ attitudes towards the use of computerized health information systems in Kuwaiti hospitals. *Journal of Advanced Nursing*, 57 (4), 375–381. doi: 10.1111/j.1365- 2648.2006.04113.x.

Bagherian, B., Sabzevari, S., Mirzaei, T., & Ravari, A. (2017). Effects of technology on nursing care and caring attributes of a sample of Iranian critical care nurses. *Intensive & critical care nursing*, 39, 18–27. https://doi.org/10.1016/j.iccn.2016.08.011

Boykin, A., Schoenhofer, S. O., & Schoenhofer, S. O. B. (2001). Nursing as caring: A model for transforming practice. *Jones & Bartlett Learning*.

Buljac-Samardzic, M., Doekhie, K. D., & van Wijngaarden, J. D. (2020). Interventions to improve team effectiveness within health care: a systematic review of the past decade. *Human resources for health*, *18*(1), 1-42.

Canfield, C., & Galvin, S. (2018). Bedside nurse acceptance of intensive care unit telemedicine presence. *Critical Care Nurse*, *38*(6), e1-e4

Carroll, W. M. (2019). Artificial intelligence, critical thinking and the nursing process. Online Journal of Nursing Informatics (OJNI), 23(1). Available from: from https://www.himss.org/library/artificial-intelligence-critical-thinking.

Crilly, G., Dowling, M., Delaunois, I., Flavin, M., & Biesty, L. (2019). Critical care nurses' experiences of providing care for adults in a highly technological environment: A qualitative evidence synthesis. *Journal of clinical nursing*, *28*(23-24), 4250-4263.

Crocker, C., & Timmons, S. (2009). The role of technology in critical care nursing. *Journal of Advanced Nursing*, *65*(1), 52-61.

Dessie, G., Jara, D., Alem, G., Mulugeta, H., Zewdu, T., Wagnew, F., ... & Burrowes, S. (2020). Evidence-based practice and associated factors among health care providers working in public hospitals in Northwest Ethiopia during 2017. *Current Therapeutic Research*, *93*, 100613.

Dikmen, Y., Filiz, N. Y., Tanrıkulu, F., Yılmaz, D., & Kuzgun, H. (2018). Attitudes of intensive care nurses towards evidence-based nursing. *International Journal of Health Sciences and Research*, *8*(1), 138-143.

Dillon, T. W., Blankenship, R. A. Y., & Crews Jr, T. (2005). Nursing attitudes and images of electronic patient record systems. *CIN: Computers, Informatics, Nursing*, *23*(3), 139-145.

Edgar, T. W., & Manz, D. O. (2017). Exploratory Study. Research Methods for Cyber Security, 95–130. http://doi.org/10.1016/b978-0-12-805349-2.00004-2

El Khamali, R., Mouaci, A., Valera, S., Cano-Chervel, M., Pinglis, C., Sanz, C., ... & SISTRESSREA Study Group. (2018). Effects of a multimodal program including simulation on job strain among nurses working in intensive care units: a randomized clinical trial. *Jama*, *320*(19), 1988-1997.

Friganović, A. (2016). Nursing and implementation of modern technology. Signa vitae: *Journal for intensive care and emergency medicine*, 12(1.), 23-27

Giuliano, K. K. (2020). Challenging precedent: critical care nursing and medical product innovation. *American Journal of Critical Care*, *29*(4), 253-261.

Haddad, L. M., Annamaraju, P., & Toney-Butler, T. J. (2022). Nursing shortage. In StatPearls [Internet]. *StatPearls Publishing*.

Hossain, M. A., Rashid, M. U. B., Khan, M. A. S., Sayeed, S., Kader, M. A., & Hawlader, M. D. H. (2021). Healthcare Workers' knowledge, attitude, and practice regarding personal protective equipment for the prevention of COVID-19. *Journal of multidisciplinary healthcare*, *14*, 229.

Hurley A.C., Bane A., Fotakis S. et al. (2007). Nurses satisfaction with medication administration point-of-care technology. *The Journal of Nursing Administration*, 37 (7/8), 343–349.

Huryk, L. A. (2010). Factors influencing nurses' attitudes towards healthcare information technology. *Journal of nursing management*, *18*(5), 606-612.

Huston, C. (2013). The impact of emerging technology on nursing care: Warp speed ahead. Online Journal of Issues in Nursing, 18(2). doi.org/10.3912/OJIN.Vol18 No02Man01

Kahn, J. M., Rak, K. J., Kuza, C. C., Ashcraft, L. E., Barnato, A. E., Fleck, J. C., ... & Angus, D. C. (2019). Determinants of intensive care unit telemedicine effectiveness. An ethnographic study. *American Journal of Respiratory and Critical Care Medicine*, *199*(8), 970-979.

Kassie, B. A., Adane, A., Tilahun, Y. T., Kassahun, E. A., Ayele, A. S., & Belew, A. K. (2020). Knowledge and attitude towards COVID-19 and associated factors among health care providers in Northwest Ethiopia. *PloS one*, *15*(8), e0238415.

Kattari, S. K., Bakko, M., Hecht, H. K., & Kinney, M. K. (2020). Intersecting experiences of healthcare denials among transgender and nonbinary patients. *American journal of preventive medicine*, *58*(4), 506-513.

Khosravi P, Ghapanchi AH. Investigating the effectiveness of technologies applied to assist seniors: a systematic literature review. *Int J Med Inform*. 2016;85(1):17–26. doi:10.1016/j.ijmedinf.2015.05.014

Krick, T., Huter, K., Domhoff, D., Schmidt, A., Rothgang, H., & Wolf-Ostermann, K. (2019). Digital technology and nursing care: a scoping review on acceptance, effectiveness and efficiency studies of informal and formal care technologies. BMC health services research, 19(1), 1-15.

Levesque, E., Hoti, E., Azoulay, D., Ichai, P., Samuel, D., & Saliba, F. (2015). The implementation of an Intensive Care Information System allows shortening the ICU length of stay. Journal of clinical monitoring and computing, 29(2), 263–269. https://doi.org/10.1007/s10877-014-9592-4

Liaskos, J., & Mantas, J. (2002). Nursing Information System. Studies in health technology and informatics, 65, 258–265.

Lumley, C., Ellis, A., Ritchings, S., Venes, T., & Ede, J. (2020). Using the Systems Engineering Initiative for Patient Safety (SEIPS) model to describe critical care nursing during the SARS-CoV-2 pandemic (2020). *Nursing in critical care*, *25*(4), 203.

Marshall, J. C., Bosco, L., Adhikari, N. K., Connolly, B., Diaz, J. V., Dorman, T., Fowler, R. A., Meyfroidt, G., Nakagawa, S., Pelosi, P., Vincent, J. L., Vollman, K.,

& Zimmerman, J. (2017). What is an intensive care unit? A report of the task force of the World Federation of Societies of Intensive and Critical Care Medicine. Journal of critical care, 37, 270–276. https://doi.org/10.1016/j.jcrc.2016.07.015

Meißner, A., & Schnepp, W. (2014). Staff experiences within the implementation of computer-based nursing records in residential aged care facilities: a systematic review and synthesis of qualitative research. *BMC medical informatics and decision making*, *14*(1), 1-15.

Naqvi, M., Li, S., Jiang, Y., & Naqvi, M. H. A. (2019). The rise of social networking sites: an empirical investigation applying demographic differences and the technology acceptance model. *Asia Pacific Journal of Marketing and Logistics*.

Polit, D. F., & Beck, C. T. (2013). Is there still gender bias in nursing research? An update. *Research in nursing & health*, *36*(1), 75-83.

Qin, Y., Zhou, R., Wu, Q., Huang, X., Chen, X., Wang, W., Wang, X., Xu, H., Zheng, J., Qian, S., Bai, C., & Yu, P. (2017). The effect of nursing participation in the design of a critical care information system: a case study in a Chinese hospital. *BMC medical informatics and decision making*, *17*(1), 165. https://doi.org/10.1186/s12911-017-0569-3

Rony, M. K. K. (2021). Diploma in Nursing or Bachelor of Science in Nursing: Contradictory issues among nurses in Bangladesh. *Belitung Nursing Journal*, *7*(1), 57-58.

Sabzevari, S., Mirzaei, T., Bagherian, B., & Iranpour, M. (2015). Critical care nurses' attitudes about influences of technology on nursing care. Journal of Advances in Medicine and Medical Research, 1-10

Stephanie, E. (2003). Slovin's Formula Sampling Techniques. Houghton-Mifflin, New York, USA.

Subramanian, S., Pamplin, J. C., Hravnak, M., Hielsberg, C., Riker, R., Rincon, F., ... & Herasevich, V. (2020). Tele-critical care: an update from the society of critical care medicine tele-ICU committee. *Critical care medicine*, *48*(4), 553-561.

Tunlind, A., Granström, J., & Engström, Å. (2015). Nursing care in a high-technological environment: Experiences of critical care nurses. *Intensive & critical care nursing*, *31*(2), 116–123. https://doi.org/10.1016/j.iccn.2014.07.005

Tzeng, H. M., Okpalauwaekwe, U., & Li, C. Y. (2021). Older adults' socio-demographic determinants of health related to promoting health and getting preventive health care

Urden, L. D., Stacy, K. M., & Lough, M. E. (2019). *Priorities in Critical Care Nursing-E-Book*. Elsevier Health Sciences.

von Dincklage, F., Suchodolski, K., Lichtner, G., Friesdorf, W., Podtschaske, B., & Ragaller, M. (2018). Functional requirements of critical care information systems (CCIS) from the users' perspective. International journal of medical informatics, 120, 8-13

Zadvinskis, I. M., Garvey Smith J., & Yen P. Y. (2018). Nurses' experience with health information technology: Longitudinal qualitative study. JMIR Medical Informatics, 6(2), e38. https://doi.org/10.2196/medinform.8734

Zhang, W., Barriball, K. L., & While, A. E. (2014). Nurses' attitudes towards medical devices in healthcare delivery: a systematic review. *Journal of Clinical Nursing*, *23*(19- 20), 2725-2739.

Zi-Xing Cai , Lijue Liu ,Baifan Chen and Yong Wang. (2021). *Artificial Intelligence From Beginning to Date.*

Appendix A

فقيه
مستشفى د.سليمان فقيه
Dr. Soliman Fakeeh Hospital

ACHSI

فقيه
كلية فقيه للعلوم الطبية
Fakeeh College for Medical Sciences

فقيه
كلية فقيه للعلوم الطبية
Fakeeh College for Medical Sciences

INSTITUTIONAL REVIEW BOARD (IRB)
Preliminary Research Approval Form

Title of Project: Nurses' Perception Regarding the Effects of Utilizing Technology in Patient Care Practices in the Intensive Care Unit

Application No.:	**260/2022**	**Approval No.: 260/IRB/2022**
Chief Investigator/s:	**Najla Burayk Alharbi**	
Co-Investigator/s:	**Dr. Minerva Raguini**	**Dr. Grace Medalyn Castro**
Address:	**Fakeeh College for Medical Sciences**	
Contact: email:	**mpraguini@fcms.edu.sa**	**Tel: 0582667875**
Type of the study:	**Descriptive Research Design**	

The Institutional Review Board at DSFH has decided to assign the above-mentioned research protocol the following approval category:

■ Category 1: **Approved**

The Institutional Review Board hereby gives the permission to conduct the research at DSFH and urges the hospital departments to avail relevant database to the investigators.

This approval was obtained by voting of the following IRB members: Prof. Mohamed Ardawi - IRB Chairman, Dr. Dania Waggas - Research Coordinator - FCMS, Dr. Ahmed Akl - Nephrology Consultant, Dr. Hossam Elsayed - Pediatric Consultant, Dr. Nahed Jadouni – Adult Rheumatology Consultant, Dr. Ziyad Alharbi – Plastic Surgeon Consultant, Dr. Hossameldeen Eltghetany – Pediatric Consultant, Dr. Sara Zahgloul – Associate Professor, Department of Clinical Sciences, FCMS, Mdm. Bassant Hammad – Service Director, Continuous Professional Development, Dr. Syed Ashgar – Intensive Care Unit and Chest Diseases Consultant, Mr. Ahmed Hawsawi – Chief Nursing Officer.

The organization & operating procedure of the Institutional Review Board at Dr. Soliman Fakeeh Hospital are based on the Good Clinical Practice (GCP) Guidelines;
The IRB must receive a **progress report** on the course of the study and must receive a **final report** upon completion of the study.

Applicants are welcome to contact Prof. Mohammed-Salleh M. Ardawi, the Chairperson, (ext.400) if a direct response is urgently required regarding amendments. The Chairman will assess the amendment as major requiring usual procedure of submission, review & approval by the ethics Committee or as minor, in which case, the Chairperson's approval is adequate.
The REC focuses on the ethical implications of a protocol. Assuring the protection of the rights & welfare of the human subjects is primary concern. Whatever patients are expected to consider or sign papers, and the age group involves minors, protocol must clearly state the parent/ guardian involvement.

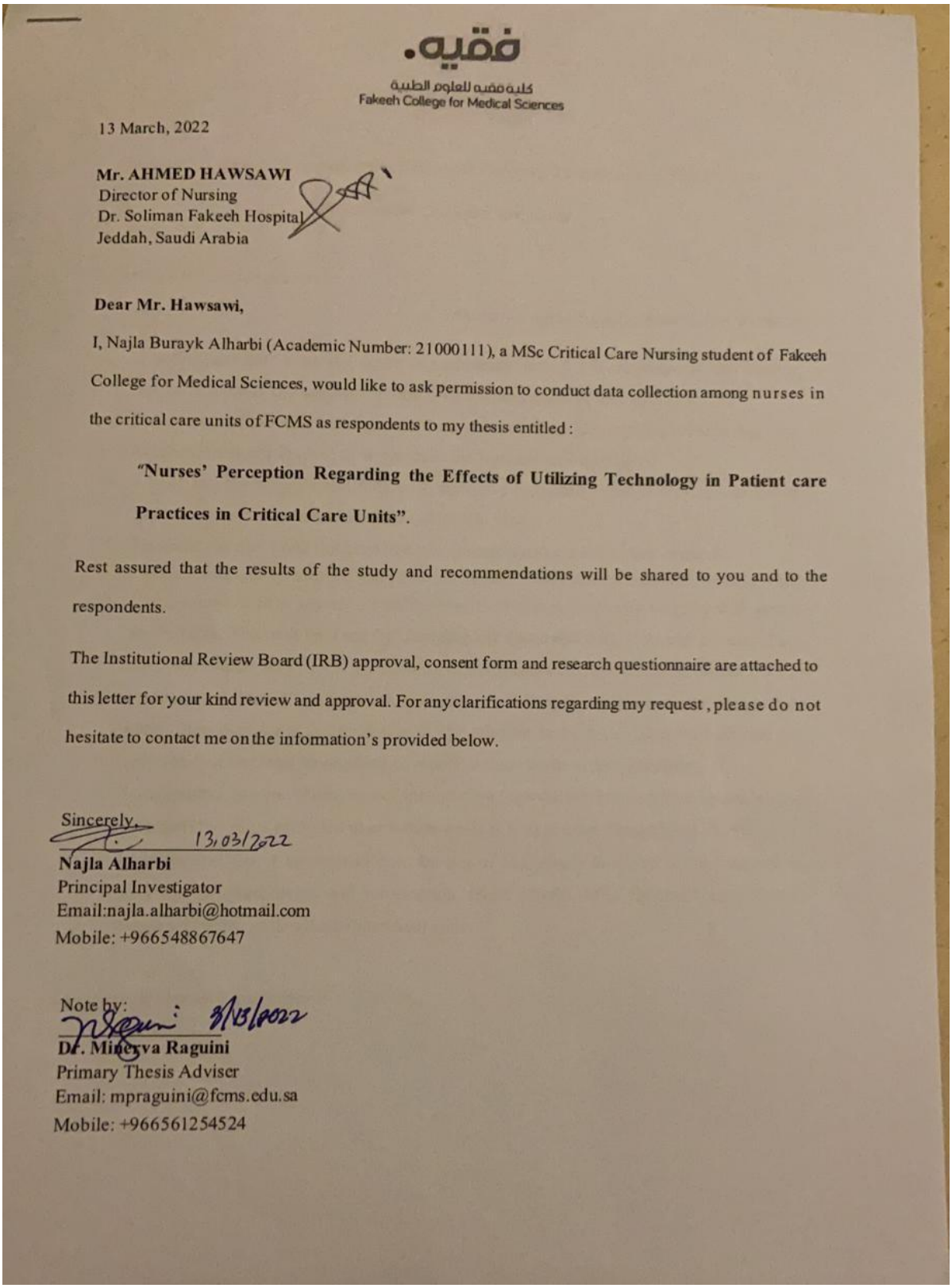
Strict compliance with the policy on "Research Approval by the Institutional Review Board" that is attached to this approval is **mandatory** (DSFH Policy No GLD-025)
The name of the Research Center **(Dr. Soliman Fakeeh Hospital)** must be mentioned in any publications arising from the approved work unless it is a multicenter trial in which none of the participating centers' names will mentioned.

□ Category 2: Some concern(s) must be addressed before approval is given.
□ Category 3: Decision is deferred pending receipt of supplementary information or documentation.
□ Category 4: Not approved. The reasons will be provided.

Professor Dr. Mohammed S. M. Ardawi Date: February/3/2022
Chairman of Institutional Review Board- DSFH

P.O. Box 2537 Jeddah 21461 – Saudi Arabia - Tel: 5544000 – Fax: 6608013 –www.dsfh.med.sa
Email college@drfakeehhospital.com
www.fakeehcollege.edu.sa

Appendix B



فقيه
كلية فقيه للعلوم الطبية
Fakeeh College for Medical Sciences

13 March, 2022

Mr. AHMED HAWSAWI
Director of Nursing
Dr. Soliman Fakeeh Hospital
Jeddah, Saudi Arabia

Dear Mr. Hawsawi,

I, Najla Burayk Alharbi (Academic Number: 21000111), a MSc Critical Care Nursing student of Fakeeh College for Medical Sciences, would like to ask permission to conduct data collection among nurses in the critical care units of FCMS as respondents to my thesis entitled :

"Nurses' Perception Regarding the Effects of Utilizing Technology in Patient care Practices in Critical Care Units".

Rest assured that the results of the study and recommendations will be shared to you and to the respondents.

The Institutional Review Board (IRB) approval, consent form and research questionnaire are attached to this letter for your kind review and approval. For any clarifications regarding my request , please do not hesitate to contact me on the information's provided below.

Sincerely,
13/03/2022
Najla Alharbi
Principal Investigator
Email:najla.alharbi@hotmail.com
Mobile: +966548867647

Note by:
13/03/2022
Dr. Minerva Raguini
Primary Thesis Adviser
Email: mpraguini@fcms.edu.sa
Mobile: +966561254524

Appendix C Consent Form

Nurses Attitude Regarding the Effects of Utilizing Technology in Patient Care Practices in Critical Care Units

Consent to take part in research:

1. I voluntarily agree to participate in this research study.
2. I understand that even if I agree to participate now, I can withdraw at any time or refuse to answer any question without any consequences of any kind.
3. I understand that I can withdraw permission to use data from my interview within two weeks after the interview, in which case the material will be deleted.
4. I have had the purpose and nature of the study explained to me in writing and I have had the opportunity to ask questions about the study.
5. I understand that I will not benefit directly from participating in this research.
6. I understand that all information I provide for this study will be treated confidentially.
7. I understand that in any report on the results of this research my identity will remain anonymous. This will be done by changing my name and disguising any details of my interview which may reveal my identity or the identity of people I speak about.
8. I understand that if I inform the researcher that myself or someone else is at risk of harm, they may have to report this to the relevant authorities - they will discuss this with me first but may be required to report with or without my permission.
9. I understand that under freedom of information legalization I am entitled to access the information I have provided at any time while it is in storage as specified above.
10. I understand that I am free to contact any of the people involved in the research to seek further clarification and information. Najla alharbi, MSc Critical Care Nursing, Contact Details: najla.alharbi@hotmail.com

Signature of research participant:

Research Instrument/Tool

Table 1. *The Sociodemographic Attributes of the Nurse Respondents*

Sociodemographic	
Age	( ) 25 years and below ( ) 26-30 years ( ) 31-35 years ( ) 36-40 years ( ) 41 years and above
Gender	( ) Female ( )Male

Length of Experience	( ) < 1 year ( ) 1-3 years ( ) 4-6 years ( ) 7-9 years ( ) >10 years
Nationality	
Educational Level	( ) diploma ( ) bachelors ( ) master
Units	( ) ICU ( ) CCU ( ) ER ( ) RDU

Table 2. *Nurses' Attitude Regarding the Use of Technological Devices ın Nursing Care Practices ITQ questionnaire*

Question's	(5) Strongly Agree	(4) agree	(3) Neither	(2) disagree	(1) Strongly disagree
1. Using technology makes nurses professionally uncertain					
2. Using technology in caring for patients often interferes with providing adequate nursing care					
3. I am not sure that technology is useful for my practice					
4. The increased use of technology in nursing care has downgraded the nursing profession					
5. technology enhances patient care and recovery					
6. Using technology in care requires high-tech skills					
7. Mastery of technology has helped nurses to control their work environment					
8. Technology directs and controls medical treatment					

9. Technology makes treatment more secure					
10. Technology decrease nurses' workload					
11. Technology is not easy to handle					
12. Technology distracts nurses' ability to connect with or relate to their patients					
Collaboration in care (interrelationship between the patients, their families and the health team) can help the patients live with technology safely and comfortably					
Technology can create ethical dilemma (when physician used to decide whether or not withdraw medical treatment)					
15. Involving technology in care means participants demanded more time to caring for patients					
16. Technology is the priority, not the patient					
17. Life sustaining technologies in intensive care unit, limit the space needed for patient care					
18. Technology dose not interfere with patient care					

1

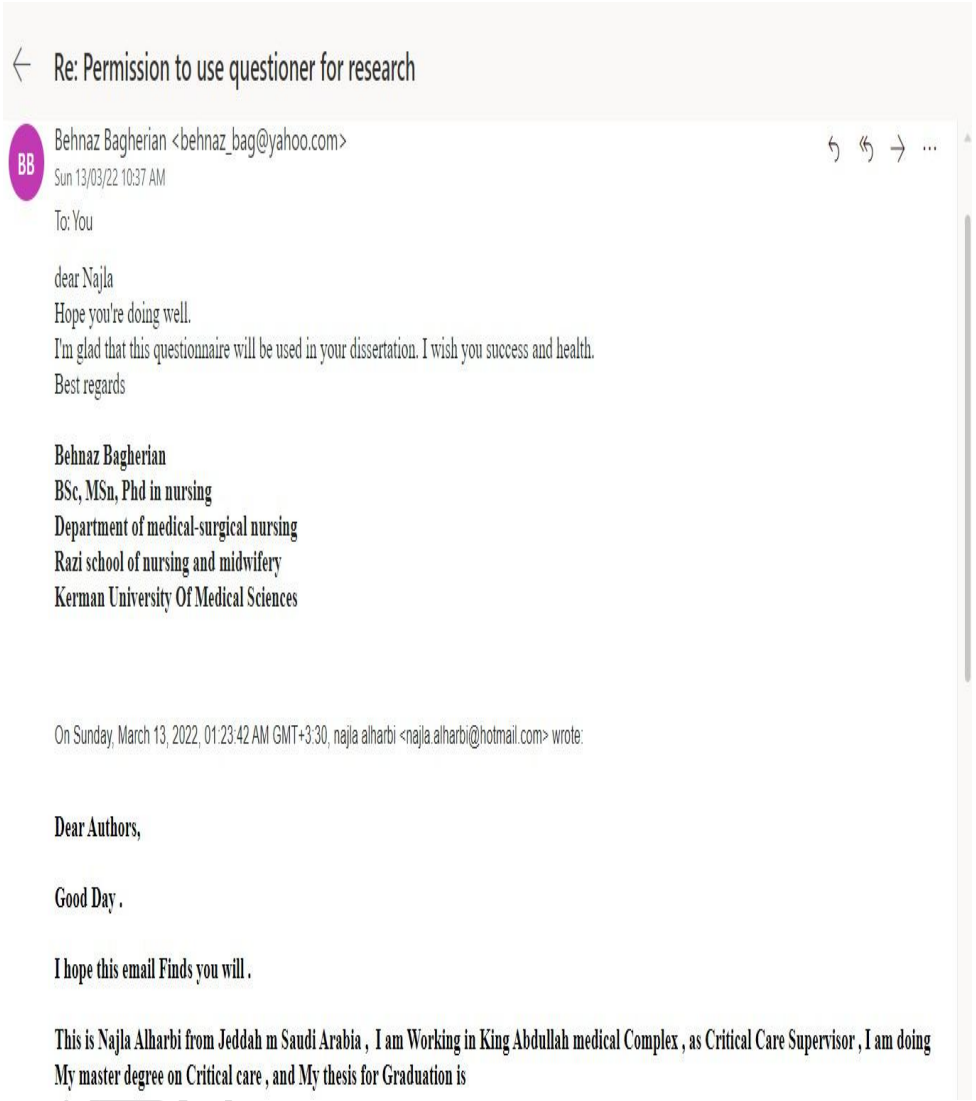
19. Technology facilitates patient care					
20. The influx of technological machines often make nurses neglect patients					
Because of the application of modern machineries, in case of inevitable death of a patient nurses often become frustrated.					
22. I think even with the help of technology, there is not any more spare time in nursing					
23. The entrance of technology has promoted the nursing profession					

2

Journal of Advances in Medicine and Medical Research	Critical care nurses' attitudes about influences of technology on nursing care	Iran	2015	Sabzevari et al, 2015.

3
4

Appendix E



Re: Permission to use questioner for research

Behnaz Bagherian <behnaz_bag@yahoo.com>
Sun 13/03/22 10:37 AM

To: You

dear Najla
Hope you're doing well.
I'm glad that this questionnaire will be used in your dissertation. I wish you success and health.
Best regards

Behnaz Bagherian
BSc, MSn, Phd in nursing
Department of medical-surgical nursing
Razi school of nursing and midwifery
Kerman University Of Medical Sciences

On Sunday, March 13, 2022, 01:23:42 AM GMT+3:30, najla alharbi <najla.alharbi@hotmail.com> wrote:

Dear Authors,

Good Day .

I hope this email Finds you will .

This is Najla Alharbi from Jeddah m Saudi Arabia , I am Working in King Abdullah medical Complex , as Critical Care Supervisor , I am doing My master degree on Critical care , and My thesis for Graduation is

Approval from the Author to Use the Tool