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NURSES' PERCEPTIONS REGARDING THE INFLUENCE OF TECHNOLOGY IN CRITICAL CARE SETTINGS: A QUANTATIVE CROSS-SECTIONAL APPROACH

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Abstract

Background: *This research explores how nurses perceive the use of medical technology in critical care settings. Nurses are vital in patient care, and their views on technology can impact healthcare practices. The study includes both trained and non-trained nurses to understand how their education and experience shape their perceptions of technology in nursing. Knowing these differences helps us find ways to make technology more effective in nursing, ensuring it enhances patient care without making nurses overly dependent on machines. This can lead to better training programs and a balanced use of technology that supports nurses while maintaining the personal touch in healthcare.*

Objectives: *The main objectives of this study are to:*

1. *Identify the perception of nurses in critical care settings regarding the influence of technology.*
2. *Assess the significance of training on nurses' perceptions.*
3. *Evaluate the quality of skills, guidelines, and knowledge of nurses regarding the use of technology.*

Methodology*: A 19-item valid questionnaire was distributed to nurses working in critical care units to gather data on their demographics, training, and views on medical technology. The Pearson chi-square test was used to analyze the relationship between training and perceptions. Data were analyzed using SPSS version 29.0.1.*

Results*: The study found that most nurses were young, held nursing diplomas, and had limited experience in critical care. Generally, nurses had positive views of technology, highlighting its benefits for patient safety and care efficiency. However, some trained nurses expressed concerns about the potential downsides, such as increased dependence on devices and reduced personal interaction with patients. The analysis revealed no significant link between training and positive perceptions, but specific negative views were associated with training status.*

Conclusion*: Although most nurses view technology positively,but there are concerns among trained nurses about over-reliance on devices. Training status influenced certain negative perceptions, but overall, it did not significantly impact the positive views of technology in critical care.*

INTRODUCTION

The Critical Care Unit is a special department of a hospital or health care facility that offers intensive care to serious and end of life patients and presents the biggest challenge for machine technology in nursing. In these environments, machines play a critical role in patient care by providing life support and managing patient care. The creation of ICU facilities enabled the treatment of severely ill patients (1).

Critical care settings are undergoing rapid changes in patient demand and patient care delivery due to continuous research and the development of new technologies (2). Innovative improvements and the use of new technologies in medical services have had a significant impact on nurses' work. The heightened use of technology requires nurses to repeatedly develop new expertise, skills, and abilities. While this creates in-progress learning demands, technological advances are also expected to advance the quality of care and make nurses' duties easier in healthcare organizations (3).

A crucial aspect of modern nursing practice is the use of advanced and innovative technologies. This includes contemporary instruments such as pumps, transducers, and ventilator systems, which are essential for monitoring and managing patient care. These technologies ensure that patients' physiological and biological processes are maintained effectively (4). Nevertheless, Preserving, adjusting, and using this equipment safely can be challenging for nurses in critical care settings. A further difficulty is putting policies in place to identify device abuse and notify the relevant authorities of any unfavorable incidents connected to the use of these devices (5).

When it comes to medical devices, nurses have different perspectives. Some believe that technology can improve patient outcomes, while others think it is stressful and time-consuming and encroaches on nursing autonomy. Using technology in nursing practice can lead to both positive and negative experiences for nurses (6). Technical support staff can enhance patient care by efficiently and effectively managing issues with various ICU devices through the use of user-friendly technology (5).

Critical attention, in addition to prescribing medications for invasive treatments, including renal replacement therapy, fluid and inotrope delivery, and ventilation, nurses are also playing an increasingly important role in decision-making. They can use clinical guidelines and protocols to get positive results (7). Advancement in technology have significantly changes the work environment for healthcare professionals, requiring them to adjust on a daily basis. Prior to technological advancements, nurses relied on their senses to monitor patients' vital signs and general health. By observing changes in a patient's skin tone, mental state, or smell, they could determine the patient's current condition and the need for care (8).

Furthermore, health care service providers need to have a strategy in place to keep an eye on how privacy is being implemented within their own domain. Although, some researchers suggest that inequality in use of appropriate technology in care may be caused by nurses. As an example, in various cities, residents have access to a variety of services; therefore, certain patients have no access to the same technology due to proficiency or essential equipment (6), (9), (10), and (11). Negative perceptions of technology were based on a lack of understanding, clinical advice, ongoing education and lack of training is causing the nurses to feel incompetent and uncomfortable (12).

The aim of this study is to assess the perceptions of critical care setting nurses regarding technological devices. Our study focus upon the importance of updating nurses' knowledge through training on new innovations. With updated knowledge, nurses' perceptions of technology become highly positive, leading to instant adoption. Equipped with new guidelines, skills, and expertise, nurses can effectively utilize technologies to provide superior patient care. While our research study explore to assess that as training affect views of nurses regarding the use of technological devices it critical care settings

Objective(s):

1) To identify perception of Nurses working in critical care settings regarding the influence of technologies.
2) To identify the significance of training on nurses' perceptions.
3) To assess the quality of skills, guidelines of hospitals, and knowledge of nurses toward the use of technology by evaluating their perceptions.

Research Questions

1) What are the perceptions of nurses working in critical care settings regarding the influence of technologies?
2) What is the significance of training on nurses' perceptions?
3) How do the quality of skills, guidelines, and knowledge influence nurses' perceptions toward the use of technology?

Review of Literature

Literature Review

Technology in healthcare settings and new innovations are constantly changing over time. Nurses, with limited knowledge and guidelines on new technologies, can impact patient safety. The interaction of nurses with technology in critical care settings is essential for improving patient health. This research topic, "Nurses' Perceptions Regarding the Influence of Technologies in Critical Care Settings: A Quantitative Cross-Sectional Approach," measuring the need for continuous updates and evaluation criteria to keep nurses' knowledge current with new technologies. The following literature review explores key findings and insights from relevant studies in this field.

A study concluded that nurses and technicians could work more efficiently with patients if they received proper training in new technology and its correct usage (13). Additionally, using technology requires a certain level of expertise, which can be particularly challenging for new nurses. Younger, less experienced nurses often hold negative views about the impact of technology on nursing care, feeling that it may complicate rather than enhance their ability to provide effective care. (12).

Many nurses similarly believe that nursing technology can enhance the quality of care, provided that the equipment is suitable and they are properly trained to use it. When care technology is applied correctly, it can significantly improve patient safety by making procedures safer and more precise. Studies have supported this view, showing that nurses who feel confident in using technology perceive patient care as safer, which ultimately contributes to increased patient safety. (14) (15).

Research highlights that a lack of training leaves many nurses feeling unskilled and uncomfortable when using technology in the nursing profession, often leading to negative emotions. Insufficient technical support can further discourage nurses, while the lack of adequate equipment and colleagues misusing available devices contribute to decreased job satisfaction. These factors can create a challenging work environment, where nurses feel less confident in their ability to provide effective care. (15).

It has been revealed that if nurses are not adequately trained in using basic technology, it can lead to situations that put patient well-being at risk. Nurses expressed concerns that their lack of skill in handling nursing technology could potentially harm patients. Patient safety is jeopardized when nurses are unsure how to use equipment properly. Additionally, many nurses reported feeling uncertain about using new technology due to a lack of proper education and training, further highlighting the importance of thorough preparation. (16).

A study revealed a statistically significant difference between age and knowledge scores among nurses. Additionally, there was a notable correlation between years of experience and practical skills in the context of patient safety in intensive care units. These findings suggest that both age and experience play important roles in shaping nurses' knowledge and practice when it comes to ensuring patient safety. (17).

A study on critical care nurses' perceptions of safety while using complex medical devices found that the majority of participants were female. This finding highlights the gender dynamics within the nursing profession, particularly in critical care settings, and suggests a need for further exploration of how these dynamics may influence perceptions of safety and the use of technology in patient care. (18).

In contrast, a study on medical device-related pressure injuries revealed that more than half of the nurses involved were male. This discrepancy in gender representation across different studies suggests that the nursing workforce can vary significantly based on the specific area of practice, which may impact the knowledge and experiences of nurses regarding medical device safety and patient care. (19).

Additionally, a study on patient safety culture in Palestine found that the majority of the nurses evaluated were male. This further illustrates the variations in gender representation within nursing populations and highlights the need to consider how

these differences might influence perceptions of safety and practice in various healthcare contexts. (20).

Research assessed nurses' perceptions of using technological devices in critical care units at a selected hospital in Chennai. The study revealed that most nurses agreed that the increasing reliance on technology tends to shift the focus towards equipment and technical skills, which can often lead to the neglect of patients' physical needs. This finding emphasizes the importance of balancing technological advancements with a continued commitment to patient-centered care. (21).

In conclusion, the literature undervalues the importance of knowledge, skills, and training related to technological devices in critical care settings, which significantly impact nursing practice. The cited studies provide valuable insights into various factors that influence nurses' competencies and perceptions, emphasizing the need to enhance training and knowledge about technology in critical care settings to foster a more positive perception of its use for effective patient care.

Methodology

4.1 Study Design**:**

Quantitative Descriptive Cross-Sectional

4.2 Study Settings:

Medical Teaching Institute**,** Mardan Medical Complex Khyber Pakhtunkhwa

4.3 Study population:

The population for this study consists of all registered nurses working at the Medical Teaching Institute, Mardan Medical Complex, who have been exposed to critical care duties for two months or more than two months.

4.4 Sample Size:

Using Raosoft software, the sample size is calculated 137 with 5 % error, 95% confidence level, based on the total population of 211 nurses at Medical Teaching Institute Mardan Medical Complex

4.5 Sampling Technique:

Convenience Sampling:

Given the practical challenges of evaluating a specific hospital and securing participation, convenience sampling is employed to select a sample of nurses from the hospital. This approach allows for a more manageable and efficient way to gather data while still focusing on the relevant population

4.6 SAMPLE SELECTION:

Inclusion Criteria: Participants must be registered nurses who have been working in a critical care settings for two or more than two months.

Exclusion Criteria: Nurses who were not present during data collection and those who are not willing to participate in the study.

4.7 OPERATIONAL DEFINITIONS:

Perceptions: beliefs, attitudes, and opinions held by nurses regarding the use and impact of technologies.

Critical Care setting/Intensive Care Unit: Specialized hospital departments that provide intensive treatment and monitoring for patients with severe and life-threatening illnesses or injuries.

Influence: The effect or impact that technological devices have on the work practices, efficiency, and patient care outcomes within the critical care settings.

Technologies: Those medical devices and equipment which is used in the critical care settings to monitor, diagnose, and treat patients. Examples include ventilators, infusion pumps, transducers, and advanced monitoring systems.

4.8 DATA COLLECTION PROCEDURE:

Data collection has commenced following approval from the Graduate Committee. A written permission letter from the head of the college to the Nursing Director of MTI MMC Mardan has been processed. With permission granted, informed consent and a validated questionnaire have been presented to the participants. The questionnaire uses a five-point Likert scale and is divided into two sections: Section (a) covers sociodemographic characteristics, while Section (b) addresses both positive and negative perceptions of technological devices. The questionnaire was validated with a Cronbach's α coefficient test, yielding a value of 0.922 for the 19 items (2).

4.9 DATA ANALYSIS PROCEDURE:

The data is analyzed using SPSS version 29.0.1. Descriptive statistics such as mean, median, mode, and standard deviation are used to summarize the sociodemographic variables. A chi-square test is conducted to assess the association between the independent variable (training status) and the dependent variable (positive or negative perceptions regarding the use of technological devices).A p-value of less than 0.05 was considered statistically significant.

4.10 Ethical considerations:

The Nursing Director of the Medical Teaching Institute at Mardan Medical Complex granted permission for the study. Ethical principles, such as obtaining informed consent and ensuring the protection of participants' rights, were carefully followed throughout the research process.

4.11 Limitations:

This study had a small sample size and was conducted in a single hospital, which may limit generalizability.aditionaly, the questionnaire design may have introduced social desirability bias. Future studies should consider larger, more diverse samples and objective measures to validate findings.

4.12 Significance of the study:

This study highlights the importance of updating nurses' knowledge through training on new innovations. With updated knowledge, nurses' perceptions of technology become highly positive, leading to instant adoption. Equipped with new guidelines, skills, and expertise, nurses can effectively utilize technologies to provide superior patient care.

4.13 Method:

A quantitative cross-sectional study was conducted among registered nurses at the Medical Teaching Institute, Mardan Medical Complex, who had been exposed to critical care duties for two months or more. The study included a sample of 137 registered nurses, selected through convenience sampling. This method was chosen to ensure accessibility to participants from a single location and various departments within the institute.

To participate, nurses needed to meet certain **inclusion criteria**, specifically being registered nurses with at least two months of experience in critical care settings. Conversely, nurses who were absent during data collection or unwilling to participate were excluded. The data collection tool used was a questionnaire, validated and modified for the research "Relation between Nurses' Perception of Using Technological Medical Devices and Patient Safety at Intensive Care Units, which ensured its relevance to the study" (2).

The research tool was divided into two main parts. The first part gathered sociodemographic information such as age, gender, years of ICU/CCU experience, education level, and training background. The second part explored perceptions of nurses regarding technological devices, split into two sections: section (a) addressed the positive aspects, while section (b) covered the negative aspects. The second part had a total score of 14, measured using a Likert scale. A chi-square test was used to assess the significance of relationships between variables, with a p-value of less than 0.05 indicating statistical significance.

Before collecting data, the benefits and risks of the study were clearly explained to the participants, and informed consent was obtained. Each participant received a brief 5-minute explanation of the questionnaire to ensure they understood it. Data collection took place from 13 September to 25 September 2024, five days a week from Saturday to Thursday. It was conducted during the morning shift (8:00 AM to 2:00 PM), the afternoon shift (2:00 PM to 8:00 PM), and the night shift (8:00 PM to 8:00 AM). Nurses were selected based on convenience. The data were gathered using a written questionnaire, which took about 20 to 30 minutes for each nurse to complete.

Finally, the data was analyzed using SPSS version 29.0.1. Descriptive statistics, including mean, median, mode, and standard deviation, were used to summarize sociodemographic variables. A chi-square test, alongside contingency tables, was applied to assess the relationship between training status and perceptions (positive or negative) regarding technological devices. The analysis helped identify significant associations between training and nurses' perceptions towards technology in critical care

Analysis & Results

Table (1): Demographic characteristics of the nurses in the study sample (n=137)

Table 1 shows that more than half of the nurses in the study (70.8%) were aged between 20 and 30, with the majority being female (78.8%). In terms of nursing qualifications, most of the participants (48.9%) held a nursing school diploma. Additionally, over half of the nurses (59.1%) had experience in a critical care unit for two months to one year. Furthermore, 73.7% of the total sample had received training on medical technologies.

Table 2: Percentage distribution of nurses' perception regarding the positive aspects of using technology with training and non-trained nurses

Table (2) presents the perception results for both trained and non-trained nurses. Of the 101 trained nurses, 52.5% "agree" that having training enhances care effectiveness and improves patient outcomes. Similarly, 67.7% of the 36 non-trained nurses "agree" that technology provides better care effectiveness and helps achieve improved patient outcomes. Both groups also believe that technology enables adequate and direct care through continuous physiological monitoring. Regarding patient safety, 50.7% of the trained nurses "agree" that technology ensures safety by promptly recognizing complications or adverse effects, while 41.7% of non-trained nurses also "agree."

Additionally, 33.7% of trained nurses "agree," and 44.4% of non-trained nurses "strongly agree," that technology makes nursing tasks faster and easier, reducing fatigue and workload through continuous monitoring and documentation. Similarly, 50.5% of trained and 44.4% of non-trained nurses perceive that technology saves time by automating nursing tasks and procedures.

In terms of professional improvement, 46.5% of trained nurses "strongly agree" that technology provides opportunities to gain new skills and knowledge, while 47.2% of non-trained nurses "agree" with this. Lastly, 36.7% of trained and 44.4% of non-trained nurses "agree" that technology helps nurses manage the shortage of staff.

Table 3: Assessing the association between nurses' positive perception of technology use and their training

Table 3 In discussing the Pearson chi-square test, the significance level (p-value) is set at 0.05. The results show that there is no clear association between nurses' positive perceptions and their training. One reason for this could be that 70.8% of the nurses in the study are aged 20-30, and a majority (59.1%) have only 2 months to 1 year of experience in the critical care unit, while 35.8% have 1-5 years of experience.

Experience plays a key role in developing expertise, and as nurses gain more experience, they naturally acquire more knowledge and confidence, whether or not they receive formal training. The chi-square test shows no significant relationship because the calculated p-value is greater than the threshold of 0.05, meaning the difference is not statistically significant.

Table 4: Percentage distribution of nurses' perception regarding the negative aspects of using technology with training and non-trained nurses

Table 4 Shows that while many of the negative aspects of using technology were unfamiliar to the nurses in the study, some nurses did identify concerns. Among trained nurses, 42.6% "agree" that technology increases patient risk due to mechanical failures, such as equipment malfunctions caused by defective manufacturing or poor maintenance. Similarly, 52.8% of non-trained nurses also "agree" with this point. Likewise, the increased risk of complications from nursing errors, such as improper handling of devices or misinterpreting data from machines, was acknowledged by 33.7% of trained nurses and 52.8% of non-trained nurses.

When asked whether technology diverts attention from patients by focusing too much on devices and technical skills, 35.6% of trained nurses and 38.9% of non-trained nurses "disagree." Additionally, 39.6% of trained nurses "disagree" and 30.6% of non-trained nurses "strongly disagree" with the statement that technology wastes patients' time by prioritizing device management over direct patient care.

Regarding increased dependence on other healthcare professionals and limited decision-making due to lack of skill or mechanical errors, 37.6% of trained nurses and 44.4% of non-trained nurses "agree." Similarly,

concerns about technology minimizing attention to the emotional and psychosocial needs of patients, or overlooking their human aspects, were "agreed" upon by 39.6% of trained nurses and 44.4% of non-trained nurses.

In addition, 39.6% of trained nurses and 44.4% of non-trained nurses "agree" that technology increases pressure on nursing staff, particularly psychological pressure and uncertainty about unpredictable negative effects due to the complexity and number of devices connected to patients. Finally, 35.6% of trained nurses and 36.1% of non-trained nurses "agree" that technology makes nurses feel a lack of self-confidence and low self-esteem due to inexperience with medical devices.

Table 5: Assessing the association between nurses' negative perception of technology use and their training

Table 5 The analysis shows that there is a significant relationship between training and negative perceptions for two specific concerns. The first is "Wasting patients' time, such as spending a lot of time on medical devices instead of caring for patients," which has a significance value of 0.15. The second is "Increased dependence on other healthcare professionals and limited decision-making due to lack of skill or mechanical error," with a significance value of 0.042. For all other negative perceptions, there is no significant association between training and the nurses' views. This indicates that these two concerns are more closely related to whether or not the nurses received training, while other negative perceptions seem unaffected by training status.

In conclusion, the study reveals that there is a significant relationship between training and certain negative perceptions regarding the use of technology in nursing practice. Specifically, trained nurses are more likely to feel that technology wastes patients' time by focusing on devices rather than direct patient care, and also increases dependence on other healthcare professionals while limiting decision-making due to a lack of skill or mechanical errors.

These findings suggest that while training helps nurses become familiar with technology, it also highlights specific challenges that may arise from its use. However, for most other negative perceptions, such as the risk of mechanical failures or the impact on patient interaction, training does not appear to have a significant effect. Therefore, addressing these key concerns through enhanced training and support may help mitigate negative perceptions and improve the integration of technology in nursing care.

Discussion

According to many technology experts, the introduction of new technology has significantly affected the nursing field. Nursing and technology have always been closely connected. This relationship has shaped modern nursing practices and principles, greatly influencing patient safety. In critical care settings, technological tools are considered essential components of clinical care (22).

In the current study, nearly all staff nurses were between the ages of 21 and 30, with a mean ± standard deviation of 1.34 ± 0.59 years. This could be because most of the nurses held ICU diploma degrees, which likely exposed them to the latest technologies, equipping them to handle the demanding work environment—something that may be reflected in their younger age (Figure 1).

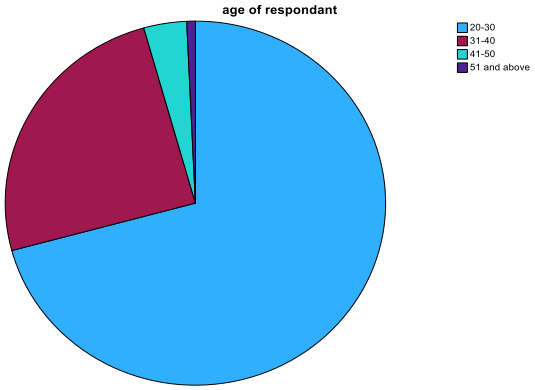

Figure 1

Similarly, another study revealed demographic findings that align closely with the results of this research. This consistency suggests that the characteristics of the nursing population may be similar across different settings, highlighting the importance of understanding these trends for effective training and support programs. (23). Who assessed the impact of introducing an educational program on preventive nursing measures for medical device-related pressure injuries on nurses' performance and patients' clinical outcomes, and found that most participating nurses were between the ages of 21 and 30.

In contrast to the current study, research on nurses' perceptions and experiences with medical devices found that more than two-thirds of the participating nurses were aged between 31 and 40 years. This difference in age distribution underscores the variability in nurse demographics across different studies, which may influence their perspectives and experiences with technology in healthcare settings. (24). Similarly, a study assessing the effects of technology on nursing care among Iranian critical care nurses reported that the majority of participants were also in the 31 to 40 age group. This trend further emphasizes the prevalence of this age demographic in nursing, suggesting that nurses within this range may share common experiences and perceptions regarding the use of technology in their practice. (12).

Regarding gender, the present study found that more than half of the nurses were female. This may be attributed to the nature of the nursing profession in Pakistan, where nursing has historically been a female-dominated field. Additionally, nursing education in Pakistan was restricted to females in universities and schools until about 10-15 years ago, when males were introduced based on open merit. (Figure 2)

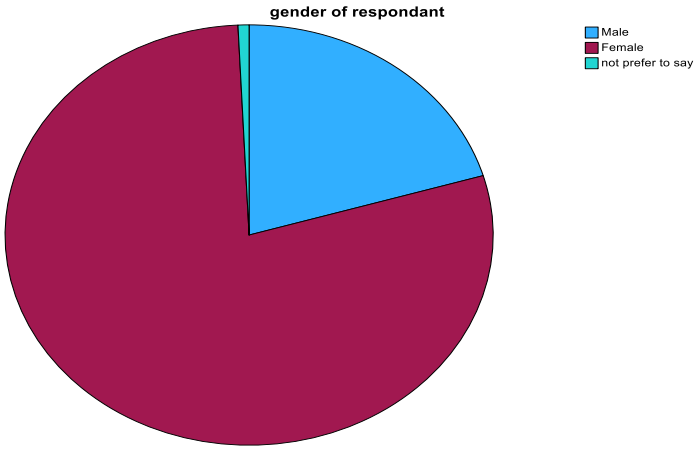

Figure 2

Supporting this observation, another study on critical care nurses' perceptions of safety while using complex medical devices found that the majority of participants were also female. This consistent gender representation highlights the ongoing prevalence of women in nursing roles and underscores the need to consider gender dynamics in nursing research and practice. (18).

However, a study that explored nurses' knowledge of medical devices found that more than half of the participating nurses were male. This finding highlights a contrasting gender representation in nursing, suggesting that specific areas of nursing practice may attract a more diverse demographic. Such variations in gender distribution across different studies emphasize the importance of considering the context and focus of research when examining trends within the nursing profession (25).

A similar observation was made in a study on patient safety culture in Palestine, where most nurses were male. This finding further illustrates the variations in gender representation within the nursing workforce, particularly in different geographical and cultural contexts. Such insights are important for understanding how gender dynamics can influence perceptions and practices related to patient safety in nursing. (26).

Regarding educational level, more than half of the nurses in this study held a diploma. This trend may be linked to the 2018 amendment in Pakistan, which

transitioned the 2-year nursing diploma to a 4-year bachelor's degree. Similarly, another study on technology-based care in ICU and ER settings found that most nurses also held diploma degrees. This highlights a common educational background among nurses, reflecting the evolving landscape of nursing education in response to changes in healthcare requirements (22). (Figure 3)

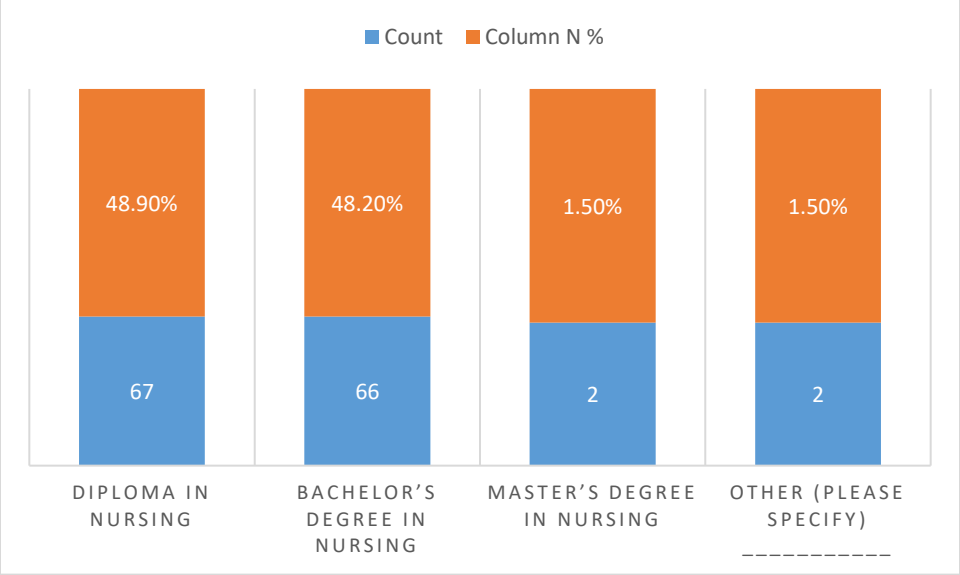

Figure 3

Conversely, another study reported that the majority of nurses had a bachelor's degree. This finding suggests that there may be differences in educational attainment among nurses in various settings, reflecting the ongoing evolution of nursing education and its alignment with healthcare standards. Such variations highlight the need to consider educational backgrounds when evaluating nurses' skills and competencies in practice. (27)

In terms of years of experience, more than half of the nurses in this study had between 2 months to one year of experience, likely reflecting their younger age. Similarly, another study on competencies and patient care quality in ICUs found that less than half of the nurses had fewer than 5 years of experience. This suggests a common trend of relatively inexperienced nurses in critical care settings, which may impact the overall quality of patient care and highlight the importance of ongoing training and support for newer nurses (28). (Figure 2)

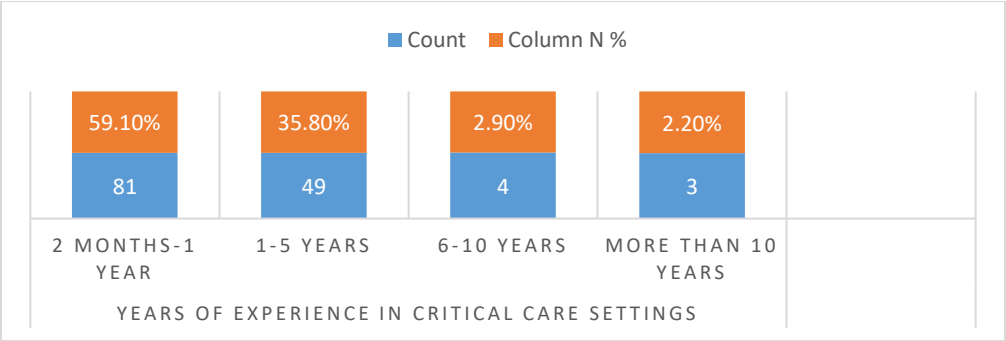

Figure 4

Finally, this study found that more than half of the nurses had received training on technological equipment. This aligns with findings from another study, which noted that over half of the nurses had received in-service training on medical devices in ICUs. This emphasis on training highlights the importance of equipping nurses with the necessary skills to effectively use technology in their practice, ultimately enhancing patient care and safety (25). (Figure 5)

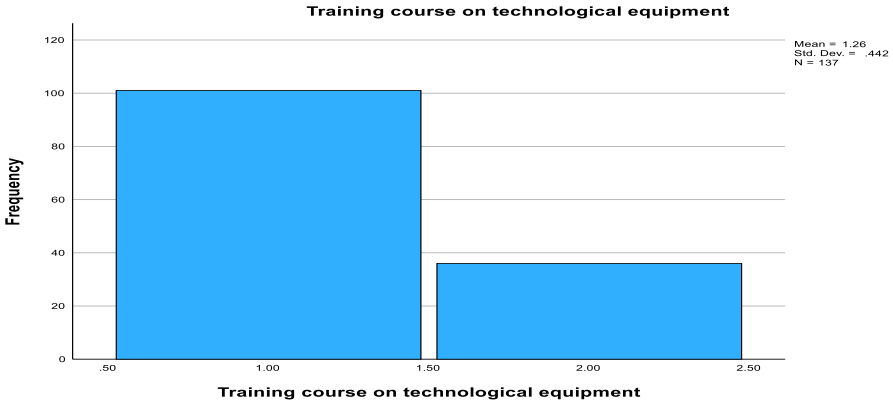

Figure 5

In contrast, another study found that more than half of the nurses had not received any training. This disparity highlights the ongoing challenges in providing adequate training for nurses, which can impact their ability to effectively use technology and ensure patient safety. Such findings underscore the need for targeted training programs to address gaps in knowledge and skills within the nursing workforce. (2).

The current study found that approximately two-thirds of trained and non-trained nurses agreed that using technological medical devices enhances patient safety by promptly recognizing complications or adverse effects through safety features that help control critical situations. Additionally, they believed that these devices provide professional growth opportunities for nurses by offering updated knowledge and allowing them to learn new skills. The majority also agreed that technology helps address nurse shortages by saving time and effort.

This may be attributed to the fact that modern medical technology helps reduce complications for ICU patients, enhances nursing care processes, and compensates for staffing shortages. By utilizing computerized systems, nurses can save time that would otherwise be spent on manual tasks, enabling them to focus more on patient care. Efficient tools that manage data effectively are crucial for nurses to handle their workloads, as emphasized in recent findings. This underscores the importance of integrating technology into nursing practice to improve overall care quality and efficiency. (29).

However, a study on nurses' perceptions of technology used during hospital discharges found contrasting results, with most participants expressing negative views about the positive aspects of information technology. This highlights the complexity of nurses' experiences with technology, suggesting that while some may see the benefits, others may have concerns that affect their overall perception and acceptance of technological advancements in their practice (30).

In contrast, while another study found a statistically significant positive perception associated with training, the current study did not identify any significant association between training and positive perceptions. This discrepancy, as revealed by the Pearson chi-square test, suggests that the relationship between training and nurses' perceptions of technology may vary across different contexts and populations, indicating the need for further investigation into the factors influencing these perceptions. (14). Both trained and non-trained nurses in this study shared almost the same positive perception of technology.

Regarding negative aspects, the current study noted that most trained nurse's disagreed, and non-trained nurses strongly disagreed, with the idea that using medical technology wastes patients' time by focusing on devices instead of patient care. Similarly, about half of both trained and non-trained nurses disagreed that technology diverts attention from patients by prioritizing devices and technical skills over their physical and emotional needs. This suggests that the real benefits of technological devices in the ICU—such as helping nurses focus on patient care and saving time—were reflected in their perceptions.

These findings are consistent with research on ICU patients' experiences, which reported that some nurses tended to focus more on machines than on their patients. This shift in attention can lead to

feelings of neglect and dehumanization among patients, resulting from poor communication and a lack of personal attention. Such insights highlight the importance of maintaining a balance between technology use and patient-centered care to ensure that patients feel valued and attended to during their treatment (31).

Additionally, the current study found a statistically significant relationship between training and two specific negative perceptions. The first is "Wasting patients' time by spending too much time on medical devices instead of caring for patients," and the second is "Increased dependence on other healthcare professionals and limited decision-making due to lack of skill or mechanical error." ((Figure 6 & 7)

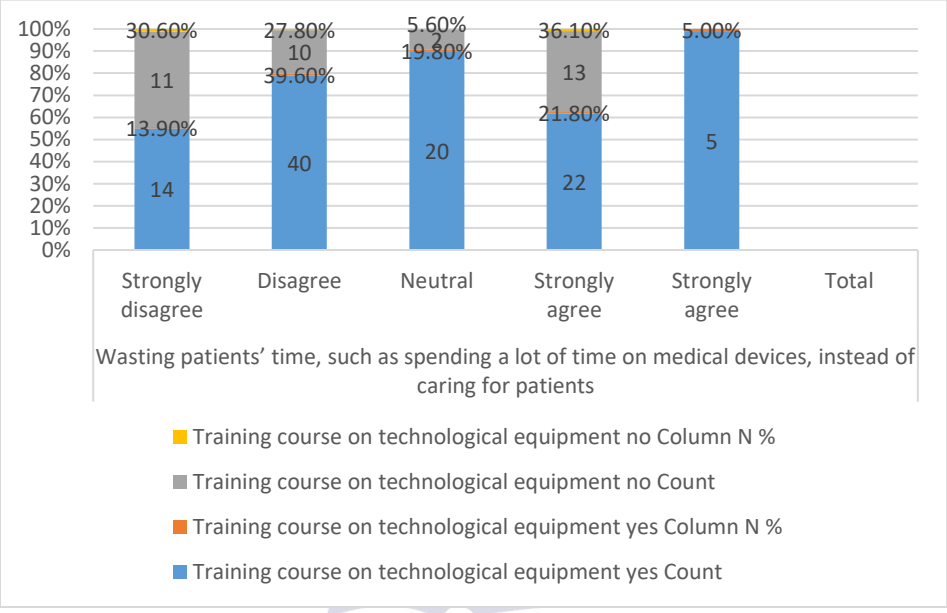

Figure 6

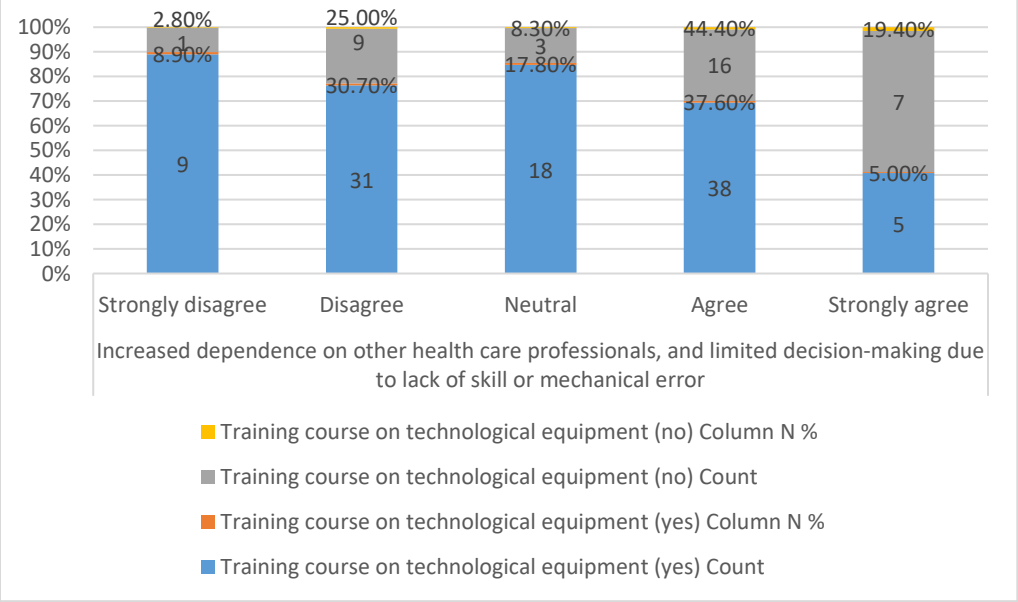

Figure 7

In conclusion, both trained and non-trained nurses had a positive view of technology, agreeing it improves patient safety and nursing care, and helps with staff shortages. There was no clear link between training and positive perceptions. Most nurses did not think technology takes away from patient care. However, training was linked to concerns about wasting time on devices and relying more on other healthcare professionals.

Conclusion & Recommendations

Conclusion

This study explored how both trained and non-trained nurses perceive the use of technology in healthcare, particularly in intensive care settings. The findings showed that the majority of nurses, regardless of their training, viewed technology as a valuable tool for improving patient safety and nursing care. They agreed that technology helps in the early detection of complications and provides opportunities for nurses to acquire new skills. Additionally, many nurses believe that technology reduces the workload by saving time and making nursing tasks more efficient, which helps address staff shortages.

Interestingly, the study revealed no significant difference in the positive perceptions of technology between trained and non-trained nurses. Both groups recognized the benefits of using technological devices, suggesting that training did not significantly impact their views. This could be because, even without formal training, non-trained nurses are still exposed to and use medical devices regularly in their work, allowing them to appreciate the advantages these tools bring to patient care.

On the other hand, when it came to the negative aspects of technology, most nurses disagreed that using devices took away from patient care or wasted time. They did not feel that technology diverted their attention from patients' physical or emotional needs. This shows that overall, nurses do not see technology as a barrier to providing high-quality, compassionate care. Instead, they view it as something that supports their ability to care for patients effectively.

However, two specific negative concerns showed a significant link to training. Nurses who had undergone training were more likely to express concerns about spending too much time on devices and relying more on other healthcare professionals due to a lack of skill or fear of mechanical errors. This highlights the need for more comprehensive training to help nurses feel confident in using technology without feeling overwhelmed or dependent on others.

In conclusion, while the majority of nurses in this study have a positive outlook on the use of technology in healthcare, training appears to play a role in shaping concerns related to time management and professional independence. Addressing these concerns through better training and support could help nurses fully embrace technology while maintaining confidence in their decision-making and ability to provide direct patient care.

Recommendations

Recommendations for Hospitals

Hospitals should offer regular, comprehensive training programs that teach nurses not only the technical skills needed for using medical devices but also how to integrate them into patient care. These programs should address concerns such as feeling dependent on devices or spending too much time on them. By increasing nurses' confidence and competence, they can prevent errors and reduce reliance on other professionals. Continuous support, such as troubleshooting workshops and technical assistance, should also be provided to ensure nurses feel capable and secure using these tools.

Hospitals should also ensure the availability of instructional booklets from manufacturers that explain the use of medical devices in patient care, as well as handouts on equipment maintenance, usage guidelines, and risks. Additionally, ensuring there are adequate supplies for patient care is essential.

Moreover, hospitals need to develop guidelines that encourage a balance between technology use and personal patient care. Nurses should understand that technology is there to enhance care, not replace the personal, human touch. By promoting patient-centered care, hospitals can ensure that nurses use technology effectively without losing focus on the emotional and physical needs of patients.

Recommendations for Government

Governments should invest in nursing education by requiring hands-on experience with medical technology as part of the national nursing curriculum. This will ensure that nurses are well-prepared for the

demands of modern healthcare. Government policies should also encourage hospitals to provide ongoing professional development programs to keep nurses updated on the latest medical devices.

Governments can further support healthcare institutions by providing funding for advanced medical technology. This will help ensure nurses have access to the latest devices, improving patient care and reducing concerns about outdated or malfunctioning equipment.

In addition, governments should support hospitals by offering funds to improve infrastructure and acquire the newest technology. This will enhance patient outcomes and the efficiency of nursing care.

Recommendations for Nursing Practice

Nurses should deepen their understanding of both the benefits and challenges of using medical technology, especially in critical care settings, while ensuring patient safety. Nurses should be encouraged to participate in structured educational programs that keep them updated on technological equipment. Regular evaluations of nurses' competencies in advanced technology are essential, and self-evaluation after continuous use of medical devices should also be encouraged.

Recommendations for Student Curriculum

Nursing curricula should include practical training on medical devices early in the education process. This hands-on experience will build students' confidence in using technology before they enter the workforce. Such training should be integrated into clinical placements, allowing students to manage devices in real patient care situations.

The curriculum must emphasize both the theoretical knowledge and practical skills related to technology in critical care units. This should include the history and ethics of nursing as they relate to technology, as well as emerging trends in healthcare technology. In addition, students should learn how to balance technology with compassionate, direct patient care.

Recommendations for Future Studies

Further research should focus on the long-term effects of educating nurses about the positive and negative aspects of technology in critical care units. This study should be conducted with a larger sample and in different settings to confirm the findings. Future studies should also explore how nurses' perceptions of technology impact patient outcomes in critical care settings.

DECLARATION

We, the undersigned students, hereby declare that the thesis titled "Nurses' Perceptions Regarding the Influence of Technology in Critical Care Settings: A Quantitative Cross-Sectional Approach" is our original work.

We confirm that this thesis has been prepared following the academic guidelines and requirements for the Generic Bachelor of Science in Nursing (BSN) degree. We affirm that the contents of this thesis represent our own research, except where otherwise acknowledged and properly referenced.

We declare that this work has not been submitted in any form to any other institution for any degree or qualification

DECLARATION CERTIFICATE

I hereby certify that Sayed Waseem Hassan, Afaq Zaman and Kamal Shah have been working under my direct supervision, for the Generic Bachelor of Science in Nursing (BSN) degree.

The enclosed thesis titled "Nurses' Perceptions Regarding the Influence of Technology in Critical Care Settings: A Quantitative Cross-Sectional Approach" was prepared according to the thesis guidelines under my direct supervision. I have read the thesis and found it satisfactory for further submission and review/viva by external examiners.

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Appendix
Annexure 2
Table (1): Socio-demographic characteristics of nurses in the study sample (n=137)

		Count	Column N %	Mean	Median	Mode	Standard Deviation
age of respondent	20-30	97	70.8%				
	31-40	34	24.8%				
	41-50	5	3.6%				
	51 and above	1	0.7%				
	Total			1.34	1.00	1.00	.59

gender of respondent	Male	28	20.4%				
	Female	108	78.8%				
	not prefer to say	1	0.7%				
	Total			1.80	2.00	2.00	.42
years of experience in critical care settings	2 months-1 year	81	59.1%				
	1-5 years	49	35.8%				
	6-10 years	4	2.9%				
	More than 10 years	3	2.2%				
	Total			1.48	1.00	1.00	.67
Education Level	Diploma in Nursing	67	48.9%				
	Bachelor's Degree in Nursing	66	48.2%				
	Master's Degree in Nursing	2	1.5%				
	Other (please specify) _____	2	1.5%				
	Total			1.55	2.00	1.00	.61
Training course on technological equipment	yes	101	73.7%				
	no	36	26.3%				
	Total			1.26	1.00	1.00	.44

Annexure 2

Table 2: Percentage distribution of nurses' perception regarding the positive aspects of using technology with training and non-trained nurses

		Training course on technological equipment			
		yes		no	
		Count	Column N %	Count	Column N %
Providing higher care effectiveness and achieving better patient outcomes. Enable adequate and direct care by ongoing physiological measurement activity	Strongly Disagree	5	5.0%	5	13.9%
	Disagree	5	5.0%	1	2.8%
	Neutral	10	9.9%	2	5.6%
	Agree	53	52.5%	24	66.7%
	Strongly agree	28	27.7%	4	11.1%
	Total	101	100.0%	36	100.0%
Ensure patient safety as prompt and proper recognition of complications or adverse effects through safety features that help to control critical situations	Strongly Disagree	11	10.9%	2	5.6%
	Disagree	4	4.0%	1	2.8%
	Neutral	7	6.9%	4	11.1%
	Agree	51	50.5%	15	41.7%
	Strongly agree	28	27.7%	14	38.9%
	Total	101	100.0%	36	100.0%
Enable faster and easier completion of nursing duties by performing nursing tasks with less fatigue and workload through continuous monitoring of vital parameters and Documentation	Strongly Disagree	6	5.9%	1	2.8%
	Disagree	13	12.9%	5	13.9%
	Neutral	15	14.9%	3	8.3%
	Agree	34	33.7%	11	30.6%
	Strongly agree	33	32.7%	16	44.4%
	Total	101	100.0%	36	100.0%

Saves a considerable amount of nursing time by taking over nursing procedures and performing nursing tasks	Strongly Disagree	6	5.9%	4	11.1%
	Disagree	4	4.0%	0	0.0%
	Neutral	11	10.9%	5	13.9%
	Agree	51	50.5%	16	44.4%
	Strongly agree	29	28.7%	11	30.6%
	Total	101	100.0%	36	100.0%
Provide professional improvement for nurses by acquiring updated knowledge and providing the opportunity to learn new skills	Strongly Disagree	5	5.0%	2	5.6%
	Disagree	5	5.0%	1	2.8%
	Neutral	7	6.9%	0	0.0%
	Agree	37	36.6%	17	47.2%
	Strongly agree	47	46.5%	16	44.4%
	Total	101	100.0%	36	100.0%
Help the nurse overcome the shortage of nurses	Strongly Disagree	6	5.9%	3	8.3%
	Disagree	13	12.9%	1	2.8%
	Neutral	12	11.9%	4	11.1%
	Agree	38	37.6%	16	44.4%
	Strongly agree	32	31.7%	12	33.3%
	Total	101	100.0%	36	100.0%

Annexure 3

Table 3: Assessing the association between nurses' positive perception of technology use and their training

Pearson Chi-Square Tests		
		Training course on technological equipment
Providing higher care effectiveness and achieving better patient outcomes. Enable adequate and direct care by ongoing physiological measurement activity	Chi-square	7.850
	df	4
	Sig.	.097[a]
Ensure patient safety as prompt and proper recognition of complications or adverse effects through safety features that help to control critical situations	Chi-square	2.984
	df	4
	Sig.	.560[a]
Enable faster and easier completion of nursing duties by performing nursing tasks with less fatigue and workload through continuous monitoring of vital parameters and Documentation	Chi-square	2.505
	df	4
	Sig.	.644[a]
Saves a considerable amount of nursing time by taking over nursing procedures and performing nursing tasks	Chi-square	2.832
	df	4
	Sig.	.586[a]
Provide professional improvement for nurses by acquiring updated knowledge and providing the opportunity to learn new skills	Chi-square	3.580
	df	4
	Sig.	.466[a]
Help the nurse overcome the shortage of nurses	Chi-square	3.226
	df	4
	Sig.	.521[a]
Results are based on nonempty rows and columns in each innermost subtable.		
*. The Chi-square statistic is significant at the .05 level.		

Annexure 4

Table 4: Percentage distribution of nurses' perception regarding the negative aspects of using technology with training and non-trained nurses

		Training course on technological equipment			
		yes		no	
		Count	Column N %	Count	Column N %
Increased patient risk due to mechanical failures, such as equipment failure due to defective manufacturing or poor maintenance	Strongly Disagree	11	10.9%	2	5.6%
	Disagree	19	18.8%	5	13.9%
	Neutral	14	13.9%	2	5.6%
	Agree	43	42.6%	19	52.8%
	Strongly agree	14	13.9%	8	22.2%
	Total	101	100.0%	36	100.0%
Increased complications resulting from nursing staff errors, such as improper handling of devices and misinterpretation of data provided by machines	Strongly Disagree	10	9.9%	4	11.1%
	Disagree	24	23.8%	4	11.1%
	Neutral	19	18.8%	4	11.1%
	Agree	34	33.7%	19	52.8%
	Strongly agree	14	13.9%	5	13.9%
	Total	101	100.0%	36	100.0%
Divert attention from patients by focusing attention on medical devices and technical skills rather than their physical needs	Strongly Disagree	14	13.9%	4	11.1%
	Disagree	36	35.6%	14	38.9%
	Neutral	32	31.7%	9	25.0%
	Agree	16	15.8%	4	11.1%
	Strongly agree	3	3.0%	4	11.1%
	31.00	0	0.0%	1	2.8%
	Total	101	100.0%	36	100.0%
Wasting patients' time, such as spending a lot of time on medical devices, instead of caring for patients	Strongly disagree	14	13.9%	11	30.6%
	Disagree	40	39.6%	10	27.8%
	Neutral	20	19.8%	2	5.6%
	Strongly agree	22	21.8%	13	36.1%
	Strongly agree	5	5.0%	0	0.0%
	Total	101	100.0%	36	100.0%
Increased dependence on other health care professionals, and limited decision-making due to lack of skill or mechanical error	Strongly disagree	9	8.9%	1	2.8%
	Disagree	31	30.7%	9	25.0%
	Neutral	18	17.8%	3	8.3%
	Agree	38	37.6%	16	44.4%
	Strongly agree	5	5.0%	7	19.4%
	Total	101	100.0%	36	100.0%
Minimizing attention to the emotional/psychosocial needs of patients or overlooking the human characteristics of patients	Strongly disagree	13	12.9%	7	19.4%
	Disagree	21	20.8%	3	8.3%
	Neutral	19	18.8%	6	16.7%
	Agree	40	39.6%	16	44.4%
	Strongly agree	8	7.9%	4	11.1%
	Total	101	100.0%	36	100.0%
Increased pressure on the nursing staff, such as psychological pressure and a	Strongly disagree	11	10.9%	6	16.7%
	Disagree	24	23.8%	6	16.7%
	Neutral	11	10.9%	3	8.3%

feeling of uncertainty about unpredictable harmful effects, due to the nature and complexity of medical devices and many devices connected to the patient	Agree	40	39.6%	16	44.4%
	Strongly agree	15	14.9%	5	13.9%
	Total	101	100.0%	36	100.0%
Feeling the nurses of lack of self-confidence and low self-esteem due to lack of experience in dealing with devices	Strongly disagree	11	10.9%	3	8.3%
	Disagree	27	26.7%	5	13.9%
	Neutral	8	7.9%	4	11.1%
	Agree	36	35.6%	13	36.1%
	Strongly agree	19	18.8%	11	30.6%
	Total	101	100.0%	36	100.0%

Annexure 4

Table 5: Assessing the association between nurses' negative perception of technology use and their training

Pearson Chi-Square Tests		
		Training course on technological equipment
Increased patient risk due to mechanical failures, such as equipment failure due to defective manufacturing or poor maintenance	Chi-square	4.497
	df	4
	Sig.	.343[a]
Increased complications resulting from nursing staff errors, such as improper handling of devices and misinterpretation of data provided by machines	Chi-square	5.560
	df	4
	Sig.	.234[a]
Divert attention from patients by focusing attention on medical devices and technical skills rather than their physical needs	Chi-square	7.280
	df	5
	Sig.	.201[a,b]
Wasting patients' time, such as spending a lot of time on medical devices, instead of caring for patients	Chi-square	12.340
	df	4
	Sig.	.015[a,*]
Increased dependence on other health care professionals, and limited decision-making due to lack of skill or mechanical error	Chi-square	9.900
	df	4
	Sig.	.042[a,*]
Minimizing attention to the emotional/psychosocial needs of patients or overlooking the human characteristics of patients	Chi-square	3.665
	df	4
	Sig.	.453
Increased pressure on the nursing staff, such as psychological pressure and a feeling of uncertainty about unpredictable harmful effects, due to the nature and complexity of medical devices and many devices connected to the patient	Chi-square	1.663
	df	4
	Sig.	.798[a]
Feeling the nurses of lack of self-confidence and low self-esteem due to lack of experience in dealing with devices	Chi-square	4.026
	df	4
	Sig.	.403[a]
Results are based on nonempty rows and columns in each innermost subtable.		
*. The Chi-square statistic is significant at the .05 level.		