

Perception and Utilization of Technology-Based Monitoring System Among Nurses at Selected Tertiary Hospitals, South-South, Nigeria

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Abstract

Technology-Based Monitoring Systems have become indispensable tools in the management of critically ill patients with positive health outcome. Despite their recognized benefits, there is need to determine Nurse's perception and utilization of these systems and their influence on patient outcomes. This study assessed the perception and utilization of technology-based monitoring systems among Nurses at tertiary hospitals, Akwa Ibom State, Nigeria. Two objectives guided the study with the population comprising of 158 nurses working in Intensive Care Units and Accident and Emergency Units of tertiary hospitals in Akwa Ibom State. Total population sampling was used for the study. Data was collected using a structured questionnaire and hospital ward records. Test-retest was used to ascertain the reliability of the instrument. Data generated was analysed using intraclass correlation coefficient which yielded 0.80 which was accepted as reliable. Findings revealed high utilization of monitoring technologies (mean = 3.55) and a positive perception towards the use of technology-based monitoring systems (mean = 3.31). Study concludes that positive perception of technology-based monitoring protocols enhances utilization and contributes to positive outcomes among critically ill patients.

Keywords: Perception, Utilization, Technology-based, Monitoring, System, Nurses.

Introduction

Technology-Based Monitoring Systems (TBMs) refers to the integration and application of advanced electronic, digital, and computerized devices used in monitoring, assessing, and managing patients' physiological conditions in healthcare setting (Topaz et al., 2023). It is also the use of digital tools and devices to track and manage patient health data aiming to improve care quality, reduce cost and enhance efficiency. In the past few decades, technology-based monitoring systems have become an integral part of critical care of modern Intensive Care Units (ICUs) and Accident and Emergency (A/E).

Advent of technology and the rapid advancement in healthcare has revolutionized the way it is delivered, mostly in critical care settings and other emergency departments (Olubiyi et al., 2023). In ICUs and A/E, the state of health of patients can deteriorate rapidly, requiring timely and accurate technology-based monitoring to guide clinical decisions and actions (Adegboyega & Adebayo, 2022). The introduction of these technology-based monitors in healthcare systems has gained global traction as a means of improving care delivery, they have transformed patient monitoring particularly for critically ill patients (Fernandez et al., 2020).

Globally, technology-based monitoring has been shown to reduce the burden on health care providers and its adoption in health care is essential for addressing the growing complexity of patients care in intensive care unit and emergency unit, thus leveraging technological monitoring system effectively is indispensable (Ekong & Adewale, 2023). Effective use of these technology-based monitoring has been linked to improve outcome for critically ill patients including reduce mortality rates, shorter intensive care unit stays and preventing of adverse events (Adeyemo et al., 2022). However, the successful implementation of these technology-based monitoring depends on both their technical functionality and on the perception and compliance of the nurses who operate them. Despite the potential benefits of technology-based monitoring devices, Nurses' perception and utilisation of these technology are essential for their effectiveness on the outcome of critically ill patients. Understanding how nurses interpret complex patient data, view these technology-based monitoring systems and their readiness to use them is essential for optimizing their implementation in critical care settings (Dowding, et al., 2019).

Utilization and perception of the Nurses who operate this system are pivotal to the systems success. Positive perceptions can lead to better adoption and utilization. Positive perception

is exhibited by viewing the technology as user friendly, reliable, easy to use, perceived usefulness and trust in the technology, this can directly influence their willingness to adapt and lead to a better adoption and utilization of the technology-based monitoring advancement and follow-up guidelines to their use (Brouner et al., 2021). Nurses' utilization and perception are associated with better patient outcomes, reduced mortality and few complications, thus if their perception of technology-based monitoring are positive, they are more likely to fully utilize it to enhance patient monitoring, increased acceptance, integration into nursing workflows and positive outcome (Chukwu et al., 2023; Gaudry et al., 2019). Conversely, a negative perception could lead to poor utilisation and ultimately poor patient outcome (Hawsworth et al., 2022).



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Study Population

The target population for this study consisted of all Registered Nurses working in Intensive Care Units and Accident and Emergency settings of the two tertiary hospitals (University of Uyo Teaching Hospital and Ibom Specialist Hospital). The accessible population was made up of all the registered Nurses who met the inclusion criteria in the two tertiary hospitals, working in ICU and Emergency Unit. These consisted of thirty-two (32) Nurses in ICU and forty eight (48) Nurses in Accident and Emergency Units (totaling 80) in UUTH and thirty five (35) Nurses working in ICU and forty-three (43) Nurses in Accident and Emergency (78) in Ibom Specialist Hospital, totaling one hundred and fifty eight (158) in the two tertiary hospitals.

Sample Size

The study used total sampling (census) of all accessible Nurses because of small population of Nurses working in ICU and A/E in these tertiary hospitals.

Adopting a total population sampling technique (census method) is feasible and helped to obtain elaborate and more representative data. Furthermore, ICU and A/E Units are highly technology-driven environments where critically ill patients are managed on daily basis. Including all nurses in these units for the study ensure that the study captures a comprehensive

Materials and methods

Study Design

A Cross-Sectional descriptive design was employed to assess the perception and utilization of technology-based monitoring system among nurses in the studied setting.

Study Settings

The settings of this study were University of Uyo Teaching Hospital (UUTH) and Ibom Specialist Hospital (ISH), where Technology-based monitoring system are actively used because of referred cases and critically-ill patient they care for. The University of Uyo Teaching Hospital is a Federal Hospital playing a pivotal role in the provision of excellent healthcare services to over 6 million population of Akwa Ibom State and beyond.



representation of Nurses involved in monitoring critically ill patients across different shifts, years of experience and professional cadres. Nurses in these specialized units are the primary users of TBMs such as cardiac monitors, pulse oximeters, infusion pumps ventilators and automated blood pressure monitors.

Instrument for Data Collection

The instrument for data collection was a structured questionnaire with 2 sections of close-ended questions. Section A with 20 items elicited information on Nurses perception while section B used 20 items for the respondent's utilization of technology-based monitoring system. Four likert scale questions, strongly Agreed, Agreed, Disagreed and Strongly Disagreed was used.

Procedure for data collection

For data collection, eight (8) research assistants were trained by the researcher, two from each unit of each setting, they assisted to administer the developed, pretested and validated copies of the questionnaire to the respondents on face to face bases in the two tertiary hospitals. Principle of voluntary participation and written informed consent was ensured, 158 questionnaire were distributed and filled by the respondents, all the 158 questionnaire were completely retrieved for storage, safe keeping for data analysis, giving a return rate of 100%.

Method of Data Analysis

Data was checked, cleaned and subjected to descriptive statistics to determine frequencies and percentages. Statistical Package for the Social Sciences (SPSS) version 23 was used to analyze the data. The result was presented using mean, standard deviation for survey, frequency table and percentage.

Ethical Consideration

Ethical approval was obtained from the ethical committee of the respective hospitals. Participation was voluntary, with informed verbal and written consent obtained for voluntary participation, respondents were informed that they have the right to withdraw from the study anytime without any penalty. The privacy and confidentiality was assured by asking them not to include their names in the questionnaire.

Table 1: Mean and standard deviation on the nurses' perception towards the use of Technology-based monitoring system in the management of critically ill patients

S.No.	Items	Male N=31		Female N=127		Mean Set	Decision
		x_1	SD_1	x_2	SD_2		
1	The system enhances my ability to detect patient deterioration early.	3.41	0.71	3.58	0.62	3.50	Accepted
2	Using the monitoring system improves the quality of patient care.	3.48	0.66	3.64	0.57	3.56	Accepted
3	The system reduces clinical errors in ICU management.	3.32	0.74	3.50	0.63	3.41	Accepted
4	I can operate the system without constant assistance.	3.25	0.79	3.44	0.68	3.35	Accepted
5	It is easy for me to learn to use all critical system functions.	3.29	0.76	3.47	0.65	3.38	Accepted
6	The monitoring system is user-friendly.	3.36	0.72	3.55	0.60	3.46	Accepted
7	Reliable technical support is always available when needed.	3.11	0.84	3.28	0.73	3.20	Accepted
8	I have received adequate training on system features.	3.08	0.86	3.24	0.75	3.16	Accepted
9	The system works consistently without frequent downtimes.	3.15	0.82	3.31	0.71	3.23	Accepted
10	The monitoring environment (hardware/software) is well-maintained.	3.19	0.80	3.37	0.69	3.28	Accepted
11	The system saves time compared to manual methods.	3.46	0.68	3.63	0.58	3.55	Accepted
12	Using the system increases my workload noticeably	2.74	0.91	2.88	0.83	2.81	Accepted
13	When ICU is busy, I find it hard to use the system.	2.89	0.88	3.01	0.79	2.95	Accepted
14	Colleagues routinely use the system during critical care.	3.38	0.70	3.56	0.61	3.47	Accepted
15	Hospital leadership supports training and provision of monitoring systems.	3.27	0.77	3.45	0.66	3.36	Accepted
16	My supervisors encourage use of the monitoring system.	3.42	0.69	3.60	0.59	3.51	Accepted
17	I plan to continue using the system and recommend it to peers.	3.51	0.64	3.69	0.54	3.60	Accepted
18	I regularly use the system when caring for critically ill patients.	3.44	0.67	3.62	0.57	3.53	Accepted
19	I feel confident interpreting the readings from the monitor.	3.31	0.74	3.49	0.63	3.40	Accepted
20	I trust the accuracy of the data produced by the system	3.37	0.71	3.55	0.60	3.46	Accepted
	Grand Mean/Std. Dev.	3.31	0.76	3.47	0.65	3.39	Accepted

Level of utilization of technology-based monitoring system among nurses in managing critically ill patients in Tertiary Hospitals in Akwa Ibom State

To ensure confidentiality, all questionnaires were collected from the research assistance and put in a locked cabinet in the researcher's office.

Results

Nurses' perception o of Technology-based monitoring system in the management of critically ill patients

Table below, revealed that nurses demonstrated positive perception towards the use of technology-based monitoring systems in the management of critically ill patients in the studied settings. The grand mean scores were above the criterion mean of 2.50, indicating overall positive perception. Findings indicate a favorable perception towards the adoption and continuous utilization of technology-based monitoring systems among nurses managing critically ill patients.

Table 2 shows the level of utilization of technology-based monitoring systems among nurses managing critically ill patients in tertiary hospitals in Akwa Ibom State. The overall grand mean of 3.55 indicates a high level of utilization of technology-based monitoring systems among the respondents.

Table 2: Mean and standard deviation on the level of Utilization of Technology-based Monitoring system among nurses managing critically ill patients in Tertiary

S.No.	Items	20-29 years N=31		30-39 years		40-49 years N=41		50 and above N=26		Mean Set	Decision
		x_1	SD ₁	x_2	SD ₂	x_3	SD ₃	x_4	SD ₄		
1	I use cardiac monitors regularly to track and assess patient's vital signs	3.2	0.8	3.5	0.7	3.8	0.6	3.9	0.5	3.60	High
2	I utilize pulse oximeters on critically ill patients to monitor oxygen saturation	4.1	0.6	4.3	0.5	4.4	0.5	4.2	0.6	4.25	Very High
3	I frequently use ECG, ventilators, machines during patient management and interpret their readings effectively	2.9	0.9	3.2	0.8	3.6	0.7	3.5	0.7	3.30	Moderate
4	I am confident using ventilator monitoring systems	2.5	1.0	2.8	0.9	3.2	0.8	3.1	0.9	2.90	Moderate
5	I use infusion/syringe pumps to regulate medication administration	3.8	0.7	4.0	0.6	4.2	0.5	4.1	0.6	4.03	High
6	I use monitoring systems to detect early signs of patient deterioration	3.5	0.8	3.7	0.7	4.0	0.6	3.9	0.7	3.78	High
7	I use capnography to monitor end-tidal CO ₂ in ventilated patients	2.0	1.1	2.3	1.0	2.7	0.9	2.5	1.0	2.38	Low
8	I input and retrieve data from patient monitoring devices	3.3	0.9	3.6	0.8	3.7	0.7	3.4	0.8	3.50	High
9	I monitor and interpret vital signs displayed on digital system	3.9	0.6	4.1	0.5	4.2	0.5	4.0	0.6	4.05	High
10	I use bedside monitors in making clinical decision	3.6	0.7	3.8	0.7	4.0	0.6	3.9	0.6	3.83	High
11	I document and interpret data from monitoring devices	3.4	0.8	3.7	0.7	3.9	0.6	3.8	0.7	3.70	High
12	Patients are regularly monitored through automated systems rather than manual methods	3.0	1.0	3.3	0.9	3.5	0.8	3.2	0.9	3.25	Moderate
13	I consult digital trend data to evaluate the effectiveness of treatment	3.1	0.9	3.4	0.8	3.7	0.7	3.5	0.8	3.43	High
14	I document patient parameters using electronic health record system	3.7	0.8	4.0	0.7	4.1	0.6	3.9	0.7	3.93	High
15	I assess trends in patient status using graphical monitor data	3.2	0.9	3.5	0.8	3.8	0.7	3.6	0.8	3.53	High
16	I calibrate or check the accuracy of monitoring devices before use.	2.8	1.0	3.1	0.9	3.4	0.8	3.3	0.9	3.15	Moderate
17	I use temperature probes for ongoing patient temperature monitoring	4.0	0.6	4.2	0.5	4.3	0.5	4.1	0.6	4.15	High
	Grand Mean	3.58	0.71	4.27	0.54	3.29	0.81	2.89	0.94	3.55	Moderate

Discussion of Finding

Nurses' Perception of the Use of Technology-Based Monitoring System in the Management of Critically ill Patients

The finding of this study revealed that nurses in tertiary hospitals in Akwa Ibom State possessed a highly positive perception towards the use of technology-based monitoring systems in the management of critically ill patients. The overall mean score exceeded the criterion mean, indicating that respondents generally viewed technology-based monitoring systems as beneficial, effective, and essential tools for patient management. Specifically, nurses agreed that these technologies improve patient safety, facilitate early detection of patient deterioration, enhance clinical decision-making, improve the quality of care, reduce the likelihood of medical errors, and contribute to better patient outcomes.

The finding of this study is in agreement with the findings of other studies: Ekong and Udo (2021), who reported that nurses generally maintained favourable perceptions of monitoring technologies because of their effectiveness in improving patient outcomes and supporting clinical decision-making. Their study found that healthcare professionals who perceived monitoring systems as useful were more likely to accept and utilize them in their daily practice. This agreement suggests that positive perceptions are often driven by the observable benefits of technology in enhancing patient care; Gold and Silver (2021), who reported that critical care nurses expressed positive perceptions towards monitoring technologies because such systems enhanced their ability to monitor patients effectively and respond promptly to clinical emergencies. According to the authors, nurses viewed monitoring technologies as valuable tools that support clinical judgment and improve patient safety.

This finding is in contrast with that of other studies: Hawksworth et al. (2022), who reported predominantly negative perceptions among nurses regarding the use of monitoring technologies. Johnson and Lee (2021), which observed that some nurses expressed apprehension towards technological innovations due to concerns about inadequate competency.

Level of Utilization of Technology-based Monitoring System among Nurses Managing Critically ill Patients

The finding of this study revealed that nurses in tertiary hospitals in Akwa Ibom State demonstrated a high level of utilization of technology-based monitoring systems in the management of critically ill patients. The result showed that the overall mean score exceeded the criterion mean, indicating that nurses regularly utilized monitoring devices such as cardiac monitors, pulse oximeters, blood pressure monitors, infusion pumps, and other electronic monitoring technologies in patient care. The high utilization observed suggests that nurses recognize the importance of these technologies in enhancing patient monitoring, facilitating clinical decision-making, and improving patient outcomes.

The finding of this study is in agreement with Fernandez et al. (2020), who investigated the utilization of technology-

based monitoring systems among healthcare professionals and reported a high level of utilization in critical care settings. The authors found that healthcare workers routinely employed monitoring technologies because of their ability to provide real-time patient information and facilitate prompt clinical interventions.

The present finding is also consistent with the study conducted by Chukwu et al. (2023), who reported that healthcare professionals demonstrated high levels of utilization of monitoring technologies when they perceived such technologies as useful and beneficial to patient care. Their study revealed that nurses who appreciated the clinical value of monitoring systems were more likely to utilize them consistently in their daily practice. This agreement suggests that positive perceptions and perceived usefulness play important roles in influencing technology utilization among healthcare workers.

Similarly, the finding agrees with the work of Jalal et al. (2025), who found that nurses working in technologically advanced healthcare facilities frequently utilized monitoring technologies due to continuous training, adequate technical support, and regular exposure to technological innovations.

However, the finding contrast with those of. Ogunyemi et al. (2020), who reported a low level of utilisation of technology -based monitoring systems among nurses in selected healthcare facilities in Nigeria; also Sharma et al. (2021), reported that healthcare professionals in resource - constrained settings demonstrated low utilisation of monitoring technologies due to equipment shortages and inadequate training opportunities.

Conclusion

The study on "Perception and Utilization of Technology-Based Monitoring Systems and Outcome on Critically Ill Patients among Nurses at Tertiary Hospitals in Akwa Ibom State" established that nurses in the state possess a positive perception and utilize technology-based monitoring systems in the management of critically ill patients, significantly contribute to better patient outcomes.

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