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# Perceptibility of medical alarms among nursing students using digital interactive multimedia for promoting client safety and care

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**Abstract**

The widespread use of medical alarms in clinical in-patient facilities and also their frequent activation disrupts patient care and raises concerns about their effectiveness. Nursing students typically encounter these alarms primarily during clinical trainings or hospital internships, making it essential to learn how to respond to them early and effectively in nursing school, despite the stress it may cause during clinical and academic experiences. Educating nursing students about medical alarms not only enhances their understanding but also improves their ability to use these devices in the clinical settings, thereby positively impacting patient safety and care.

To achieve this, forty-one nursing students were initially recruited, with thirty-one participants ultimately enrolled (response rate 75.6%). The analysis of nursing student's behaviors regarding client care revealed high scores in the subscales "Being Mindful of Client's Breathing Behaviors" (M = 4.60), "Being Sensitive to Client's Safety Behaviors" (M = 4.50), and "Ensuring Client's Hygiene and Skin Integrity Behaviors" (M = 4.62). Particularly notable scores were observed in providing guidance and support for breathing comfort (Q2, M = 4.71), prioritizing response to clinical alarms (Q5, M = 4.61), and assessing hygiene and skin integrity (Q10, M = 4.68).

Although the questionnaire demonstrated acceptable reliability in both groups, with α = .65 for the intervention group and α = .68 for the control group, two items had lower reliability coefficients (≤ .59), specifically related to providing guidance and support for client breathing comfort and creating a supportive environment for client breathing focus.

These results suggest inconsistencies in caring behaviors among nursing students. Regarding the recognition of medical alarms, eighty percent of thirty-one participants scored 90% and above on Audio Quiz 1, while ninety-six percent scored 95% and above on Audio Quiz 2. Furthermore, 97.5% of thirty-one participants achieved a perfect score of 100% on Audio Quiz 3, indicating the effectiveness of clinical alarms education in enhancing their perception of clinical alarms. The insights from this research may contribute to the need for medical alarms education in nursing school, offering consideration for patients and the healthcare team.

**Keywords:** *alarm fatigue, alarm management, nursing education, nursing need theory, behavior change, patient safety, nursing student, perception, medical alarm*

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## 1. Introduction

Nurses are the main users of healthcare alarms, and they work in complex environments with high numbers of alarms, including nuisance alarms and other factors such as task prioritization, nurse-to-patient ratio, and length of shifts. Alarm-related adverse events are common such as falls, delays in treatment, ventilator use and medication errors (Yue, 2017). Alarm exhaustion in the healthcare field is a growing problem for nurses that impacts patients' safety and impedes the ability of nurses to care for their patients. To understand the concept of alarm fatigue and its consequences, people need to be in a hospital or a nursing home and hear the various noises firsthand. Alarm fatigue occurs when nurses or other healthcare personnel have sensory overload due to noises made by alarms, which then leads to disregarding the alarms causing problems with patients' safety and their overall wellbeing. Alarms cause cognitive stress among employees, which is caused by a break in the activity performed and the distraction from it and the prioritization of the urgency of the alarm (Ruskin, 2015).

In March 2022, a nurse in Tennessee named RaDonda Vaught, was found guilty of criminal negligent homicide and gross neglect of an impaired adult. She was sentenced to three years supervised probation. She was also fired and had her nursing license revoked. Her defense was alarm fatigue or sensory overload for the mistake that cost the life of her patient. Nurses often feel overwhelmed with an excessive number of responsibilities and an uninterrupted wave of alarms. The average number of alarms generated per patient, to which a nurse reacts when on duty, is 150 to 400 (Keller, 2012). Nurses and other healthcare workers will tell you that alarms are good to monitor patients' safety but can also be burdensome and too often interfere with caring for patients.

Such unfortunate circumstances serve as the foundation of our study on the perceptibility of medical alarms among nursing students. We are advocating to both increased awareness and expose nursing students to various clinical alarms so that they will have the confidence and skills to respond conscientiously. In addition, we anticipate that by having to perceive clinical alarms frequently correctly, nursing students can meaningfully act to various alarms.

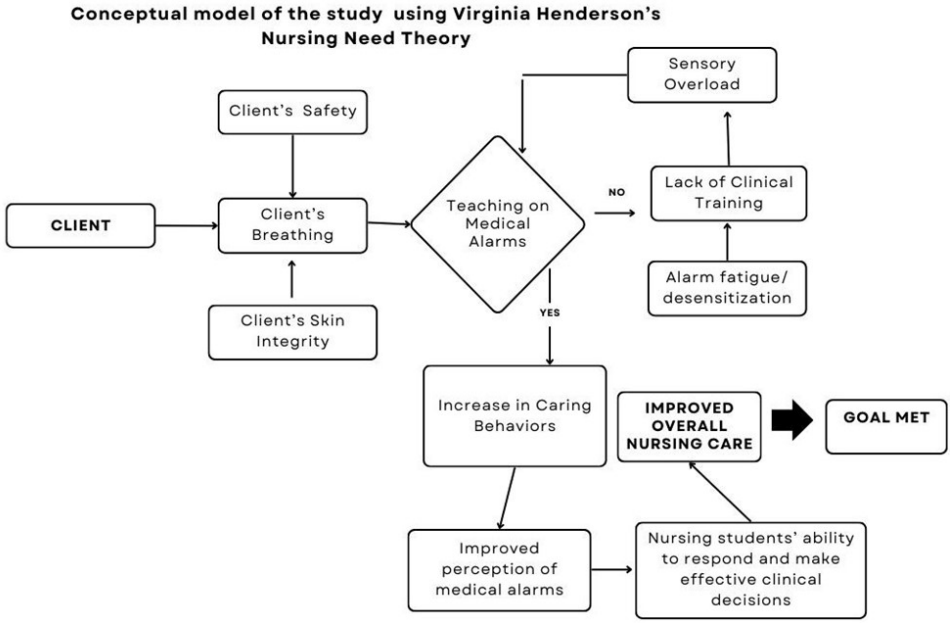
Alarm fatigue remains a critical concern in healthcare settings, posing risks to patient safety and overwhelming healthcare professionals. To address this issue, various educational strategies and training methods have been explored. Hence, we resorted to digital interactive multimedia for nursing students' education. We want to evaluate the effects of such interventions for lessening alarm weariness or sensory overload in nursing students, and future nurses, as well as reducing the excess of false and non-operating alarms, which are crucial element causing alarm fatigue in nurses.

The relevance to clinical practice is huge in terms of knowing to identify different alarm sounds and promptly respond to them will increase patients' overall safety, well-being, and satisfaction. Simply answering alarms and being able to distinguish between various noises, and alarms that unfortunately exist in healthcare settings can not only save lives but may decrease nurses' alarm fatigue or sensory overload making working less burdensome.

Clinical alarms are unavoidable and necessary constituents in any clinical or healthcare setting and they expose everyone (not just nurses) but patients alike to multiple distractions that can hinder patient safety and care. The negative consequences on a nursing student's perception of medical alarms and the effects on patient safety require the introduction of alarm management strategies and support for the need for programs to address education on clinical alarms in nursing students.

### *1.1 Conceptual Model Using Virginia Henderson's Nursing Need Theory*

***Figure 1***



The researchers created this conceptual model using Virginia Henderson's Nursing Need Theory. It illustrates the key concepts and/or sub-scales used in the research questionnaire (1) Client Safety (2) Client's Breathing, and (3) Client's Skin Integrity. Furthermore, the conceptual model helps in the visualization of the interaction between the effects of teaching on medical alarms, as well as present the outcome of "improved overall nursing care" once the Needs Theory of Virginia Henderson is used.

## 2. Methods

### 2.1. Research Design

This study used randomized controlled trials to examine the cause-and-effect relationships between virtual interactive training and perceptual (visual and auditory) evaluation of medical alarms into client care and general safety. Student nurses of Helene Fuld College of Nursing (HFCN) in the Generic Bachelor of Science in Nursing (GBS) and Associate in Applied Science (AAS) programs who have had at least one semester of clinical rotation served as the participants of the study. Based on sampling adequacy, forty nursing students were needed out of all senior nursing students in the GBS and AAS Program. A total of thirty-one student nurses participated in this study. A 14-item online questionnaire (available at https://forms.gle/NCtFu6KB67b9EG6H9) supplied the pretest and posttest results. Regarding inclusion criteria, student nurses were invited if they (a) enrolled at HCFN (b) have had one semester of clinical rotation, and (c) were willing to take part in the study.

Due to providing different post-tests to the participants, the researchers encountered pitfalls in their data analysis, and had to shift the research design from Randomized Controlled Trial (RCT) to a non-equivalent control group post-test design only which was a better fit for the collected data.

### 2.2. Participants/Setting

Student nurses of HCFN in the GBS and AAS programs who have had at least one semester of clinical rotation were the study participants. A total of forty-two student nurses initially participated and were assessed for eligibility. A 15-item online questionnaire (available at https://forms.gle/NCtFu6KB67b9EG6H9) provided the pretest and posttest results. Regarding inclusion criteria, student nurses were invited if they (a) enrolled at the Helene Fuld College of Nursing, (b) have had one semester of clinical rotation, and (c) were willing to participate.

A total of twenty-seven students from the GBS program and fifteen students from the AAS program were assessed for eligibility. Two students were excluded from continuing with the study as they did not meet the inclusion criteria. A total of forty students were allocated teaching intervention on clinical alarms. Nine students were lost to follow-up due to the following reasons: (1) withdrew participation (2) did not want to continue posttests and/or audio quizzes.

### 2.3. Data-Gathering Procedure

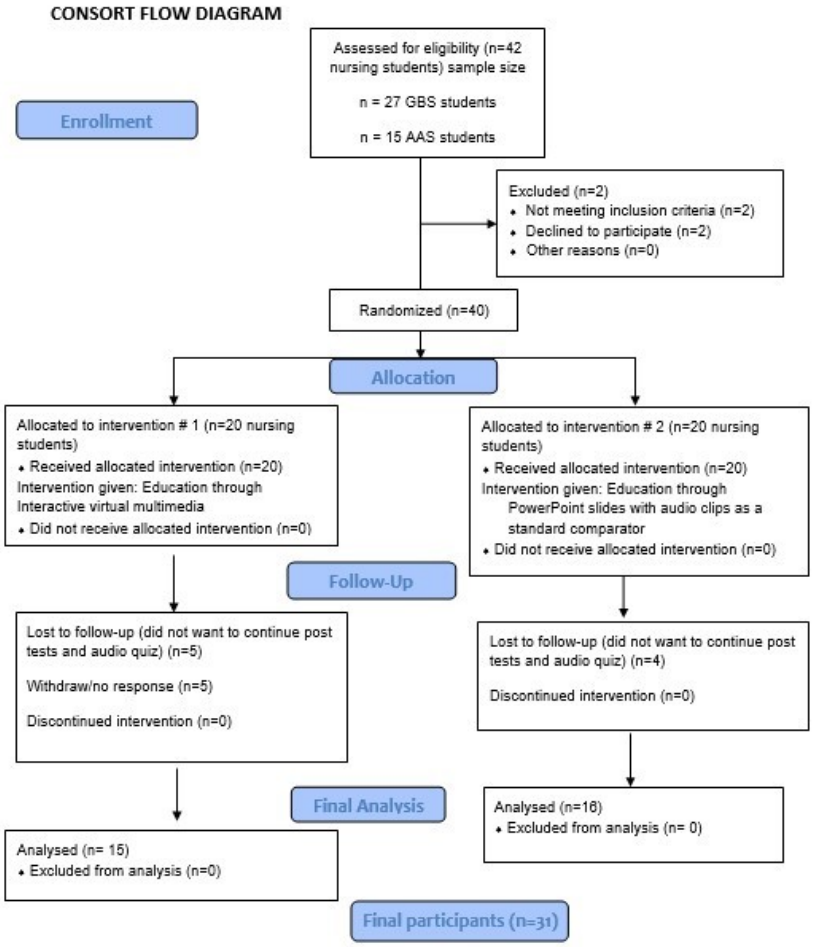
The researchers used a Google Form survey to gather the data, employing a unique link sent to nursing students. Individual responses to the survey were acquired from the participants in their free time. Although permission from the respondents to use their data was not requested, it was assumed that they had given it by filling out and submitting the questionnaire. To increase the response rate, a reminder message was sent through the email provided by the participants when asked to return the completed forms.

Educational modules were sent to each participant with the corresponding link for a pretest questionnaire. Post Test 1 questionnaires were sent a day after the educational intervention, Post Test 2 questionnaires were sent after 5 days, and finally, Post Test 3 questionnaires were sent after 9 days.

The participants' anonymity was maintained with the utmost care. The data gathering was conducted over a 7-week period from October 31st, 2023, to December 20th, 2023.

***Figure 2***




***Consort Flow Diagram*** *illustrates the enrollment and recruitment process of undergraduate nursing students from the GBS and AAS programs at HFCN. It also shows the intervention allocation between the 2 groups, follow-up, and data analysis.*

### 2.4. Interactive Modules and Questionnaires

This research on perceptibility of medical alarms for promoting client safety and care was modeled after Virginia Henderson's Need Theory. A 14-item online questionnaire which measured the caring behaviors among students' nurses in clinical settings was sent to the participants who were recruited. There are five response options ranging from 'Never' to 'Always' for each of the fourteen statements. Then they are graded by averaging the fourteen items' scores, which ranged from 1 to 5 to each statement.

After virtual interactive training, the senior nursing students had an increase in caring behavior scores a week post intervention due to the correct perception of medical alarms in the subscale "Being sensitive to the client's safety."

We included two sets of modules to assess auditory perceptibility of clinical alarms. Module one is an interactive multimedia tool while Module 2 is a PowerPoint presentation with audio clips used as standard comparator (for the Control group). For the Perception Assessment, 5 (default) medical alarms were used in both

clinical alarm modules. These alarms were: (1) nurse's call bell (2) bathroom alarm (3) vital signs machine alarm (4) ventilator alarm, and (5) bed alarm.

### 2.5. Audio Quiz of Clinical Alarms

Sound variations of different clinical alarms and medical equipment were introduced in the audio quizzes to challenge the participants to apply acoustical analysis and not simply memorize the sounds.

### 2.6. Ethical Considerations

This research was reviewed and approved by the Provost and Executive Vice President of Helene Fuld College of Nursing.

### 2.7 Statistical Analysis

Quantitative analyses were limited to descriptive statistics and item reliability by Cronbach's alpha.

## 3. Results

Statistical tests were performed in Jamovi (ver. 2.3.26).

### 3.1. Descriptive analysis (frequency, mean and SD) of demographic data

The final sample consisted of thirty-one participants (Table 1). This was largely composed of nursing students under in the Generic Bachelors of Nursing Program (58% or 18 out of 31), between 26 to 35 years old (55% or 17 out of 31), and mostly single and never married (52% or 16 out of 31) belonging to the Black or African American group (65% or 20 out of 31).

**Table 1**

***Characteristics of Nursing Student Respondents (N = 31)***

| Demographical Factors | *n* | % |
|---|---|---|
| Nursing Programs | | |
| Associate degree | 15 | 48% |
| Generic Bachelor's degree | 18 | 58% |
| Age (Years) | | |
| 18 – 25 | 5 | 16% |
| 26 – 35 | 17 | 55% |
| 36 – 44 | 5 | 16% |
| 45 – 55 | 4 | 13% |
| ≥ 56 | 0 | 0 |
| Gender | | |
| Male | 4 | 13% |
| Female | 27 | 87% |
| Other | 0 | 0 |
| Prefer not to say | 0 | 0 |
| Marital Status | | |
| Single (never married) | 16 | 52% |

| | | |
|---|---|---|
| Married | 10 | 32% |
| Domestic Partnership | 3 | 10% |
| Divorced | 2 | 6% |
| Ethnicity | | |
| White | 1 | 3% |
| Hispanic or Latino | 7 | 23% |
| Black or African American | 20 | 65% |
| American Indian or Alaskan Native | 0 | 0 |
| Asian | 3 | 10% |
| Native Hawaiian or Pacific Islander | 0 | 0 |
| Other | 0 | 0 |

### 3.2 The Nature of Nursing Practice: Caring Behavior Questionnaire Using Virginia Henderson's Need Theory

The researcher-made questionnaire has 3 subscales: "Being mindful of the client's breathing" (4 items) described nursing interventions to address client's breathing; "Being sensitive to the client's safety" (5 items) described nursing interventions to keep client safe and unharmed; and "Ensuring client's hygiene and skin integrity" (5 items) described nursing interventions to keep client clean and prevent skin breakdown. Relationship between subscales was explained in Figure 1.

These were rated by participants (n = 31) on a 5-point Likert-type scale: 1 = Never; 2 = Almost Never; 3 = Sometimes; 4 = Fairly Often; and 5 = Very Often. Scores were determined by the Mean of items per subscale. Scores were in the following interpretations: 0 – 1.66, Low; 1.67 – 3.33, Moderate; and 3.34 – 5.00, High.

**Table 2**
*Item ratings on the Modified Coping Behavior Inventory (n=31)*

| Subscale | Mean | *SD* | Interpretation | Cronbach's α |
|---|---|---|---|---|
| **Being mindful of the client's breathing** | 4.60 | 0.51 | High | .677 |
| 1. I take and record accurate vital signs | 4.48 | 0.81 | High | .773 |
| 2. I provide guidance and support to the client to ensure their breathing is at a comfortable level | 4.71 | 0.53 | High | .533 |
| 3. I facilitate and provide client with techniques or appropriate tools that can help them manage their breathing | 4.45 | 0.93 | High | .596 |
| 4. I provide a supportive and calming environment that enables client to focus on their breathing | 4.74 | 0.51 | High | .529 |
| **Being sensitive to the client's safety** | 4.50 | 0.76 | High | .873 |
| 5. I prioritize and respond to clinical alarms in the | 4.61 | 0.84 | High | .811 |

| | | | | | |
|---|---|---|---|---|---|
| | nursing unit in a timely manner | | | | |
| 6. | I ensure the alarm settings are appropriate for each patient and their individual care needs | 4.48 | 0.93 | High | .806 |
| 7. | I collaborate with other healthcare team members to ensure patient safety when responding to clinical alarms | 4.42 | 1.12 | High | .818 |
| 8. | I implement strategies to ensure that clinical alarms are not overlooked or ignored | 4.58 | 0.72 | High | .869 |
| 9. | I am familiar with the concept of alarm fatigue and its potential impact on patient safety | 4.42 | 0.99 | High | .906 |
| **Ensuring client's hygiene and skin integrity** | | 4.62 | 0.68 | High | .926 |
| 10. | I assess the client's level of hygiene and skin integrity regularly | 4.68 | 0.65 | High | .918 |
| 11. | I assess the client's skin for any signs of rashes, wound lacerations, or skin breakdown | 4.68 | 0.70 | High | .909 |
| 12. | I provide gentle and respectful hygiene care by telling client what I am going to do step by step | 4.68 | 0.79 | High | .917 |
| 13. | I provide the client with appropriate hygiene and skin care products and teach proper skin care practices | 4.39 | 0.88 | Moderate | .896 |
| 14. | I pay special attention to all high-risk areas such as bony prominences, skin folds, sacrum, and heels | 4.68 | 0.83 | Moderate | .902 |
| | **Overall** | 4.57 | 0.60 | High | .935 |

*Note.* 0 – 1.66, Low; 1.67 – 3.33, Moderate; 3.34 – 5.00, High

Nursing students had high ratings under "Being Mindful of Client's Breathing Behaviors" (M = 4.60) in the following items: "I take and record accurate vital signs" (Q1) (M = 4.48); "I provide guidance and support to the client to ensure their breathing is at a comfortable level" (Q2) (M = 4.71); "I facilitate and provide client with techniques or appropriate tools that can help them manage their breathing" (Q3) (M = 4.45); and "I provide a supportive and calming environment that enables client to focus on their breathing" (Q4) (M = 4.74).

In terms of "Being sensitive to client's safety behaviors," they scored high (M = 4.50) in the following items: "I prioritize and respond to clinical alarms in the nursing unit in a timely manner" (Q5) (M = 4.61); "I

ensure the alarm settings are appropriate for each patient and their individual care needs" (Q6) (M = 4.48); "I collaborate with other healthcare team members to ensure patient safety when responding to clinical alarms" (Q7) (M = 4.42); "I implement strategies to ensure that clinical alarms are not overlooked or ignored" (Q8) M = 4.58); and "I am familiar with the concept of alarm fatigue and its potential impact on patient safety" (Q9) (M = 4.42).

Lastly, students had high ratings under "Ensuring client's hygiene and skin integrity behaviors" (M = 4.62) in the following items: "I assess the client's level of hygiene and skin integrity regularly" (Q10) (M = 4.68); "I assess the client's skin for any signs of rashes, wound lacerations, or skin breakdown" (Q11) (M = 4.68); "I provide gentle and respectful hygiene care by telling client what I'm going to do step by step" (Q12) (M = 4.68); "I provide the client with appropriate hygiene and skin care products and teach proper skin care practices" (Q13) (M = 4.39); and "I pay special attention to all high-risk areas such as bony prominences, skin folds, sacrum, and heels." (Q14) (M = 4.68). Altogether, the results amounted to a high score (M = 4.57).

### 3.3 Item Reliability Analysis

Cronbach's alpha (α) was calculated for the scale reliability. The interpretation of Cronbach's α was referenced from Arof, Ismail, and Saleh (2018) [4] as follows: > .90, Excellent; .80 to .89, Good; .70 to .79, Acceptable; .60 to .69, Questionable; .50 to .59, Poor; and < .59, Unacceptable. The range of item-rest correlations must be between .15 and .85 while the average inter-item correlation must be between .15 and .50 (Paulsen & BrckaLorenz, 2017).

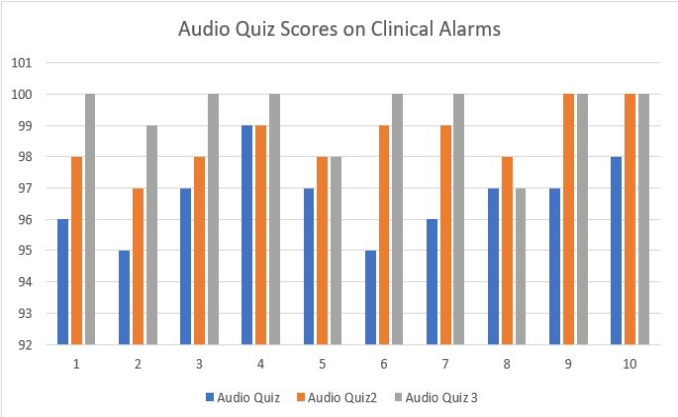
The 14-item questionnaire analyzed measurements in both intervention group and control group. The "Being Mindful of Client's Breathing" subscale consisted of 4 items (between αOverall = .68), the "Being Sensitive to Client's Safety" subscale consisted of 5 items (between αOverall = 0.87), and the "Ensuring client's hygiene and skin integrity" subscale consisted of 4 items (between αOverall = .93). There were 2 items ≤ .59 in particular, "I provide guidance and support to the client, if needed, to ensure their breathing is at a comfortable level," and "I provide a supportive and calming environment that enables the client to focus on their breathing."

The item-rest correlations were between .18 and .83, and the average inter-item correlation was between .22 in the intervention group. These met the recommended criteria. However, in the control group, the item-rest correlations were between .23 and .44 and the average inter-item correlation was between .53. These did not meet the recommended criteria. The questionnaire had acceptable reliability in both groups (intervention group and control group) (αINT = .65; αCTRL = .68).

### 3.4 Perception Assessment of Medical Alarms (Audio Quiz Scores from ClassMarker)

Three different audio quizzes were generated from ClassMarker (a web-based online testing platform) and were administered to participants as part of Posttests 1, 2 and 3. Each audio quiz was composed of 10 questions with audio clips of medical alarms which were included in the teaching intervention (nurse's call bell, bed alarm, bathroom alarm, ventilator alarm, and cardiac monitor alarm). Additional clinical alarms of different medical equipment were also used as distractors in the audio quiz to evaluate participant's sound recall and perception.

***Figure 3: Scores of research participants on Audio Quiz 1, 2, and 3***




As shown in Figure 3, eighty percent of thirty-one participants scored 90% and above on Audio Quiz 1. Ninety-six percent of thirty-one participants scored 95% and above on Audio Quiz 2. Finally, 97.5% of thirty-one participants scored 100% on Audio Quiz 3. These scores show that the clinical alarms education provided to the participants was effective and it improved their perception of clinical alarms.

### 3.5 Qualitative Data Analysis

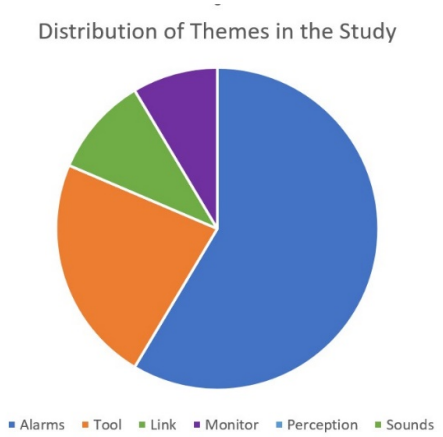
The analysis of the qualitative data related to the nursing students' perception of medical alarms identified the following categories / themes: 'alarms,' 'tool,' 'link,' 'monitor,' 'perception,' and 'sounds.'

**Table 3**

***Verbal Responses in Post Test 1 Question # 21: "How Can the Multimedia tool be improved for future learners?"***

| Theme and Definition | Example quote |
|---|---|
| Alarms – This pertains to sounds, noises, or signals from medical devices that warns abnormality or prompts a user to respond | Participant 1: "More sounds on the tool like the ones that were provided on the post quiz to compare everyday alarms that we already hear" |
| Tool– This pertains to an object that can extend an individual's ability to modify features of the surrounding environment. | Participant 2: "It was a good tool." |
| | Participant 4: "It can be used as a tool to improve future learners because there are different aspects of learning. Some learners are visual, auditory, etc. It is another form of understanding the material." |
| Link-is a relationship between two things or situations | Participant 3: "The device that connects to the nursing station, it also connects to the monitor so that it can send messages to the nurse in charge" |
| Monitor-is to watch and check a clinical scenario over a period of time | Participant 5: "the PowerPoint allow nurses to review the different medical alarms and be able to distinguish and monitor them" |
| Perception- pertains to the ability to see, hear, or become aware of something through the senses | Participant 6: "My perception of clinical alarms changed, and I feel better prepared after this" |
| Sounds- pertains to vibrating air which is perceived by our ears | Participant 7: "Variations in sounds or alarm systems" |

**Figure 4**




Themes are at the heart of any qualitative research approach. Figure 4 illustrates the distribution of themes that were identified by the researchers and were extracted from participant's responses on certain questions from the survey. During data collection, these six themes were found relevant to the study.

### 3.6 Course Evaluation Survey

All participants received a course evaluation survey at the end of each posttest. This was created to find out if the intended objectives of the course were achieved or not. The feedback received from the participants can also be used to adjust future teaching methods and research.

***Figure 5*** As part of the course evaluation survey, research participants were asked if they felt that the multimedia tool, they received was an effective teaching intervention to learn how to distinguish medical alarms. 78.6% of the participants answered Yes and 21.4% of the participants said No.

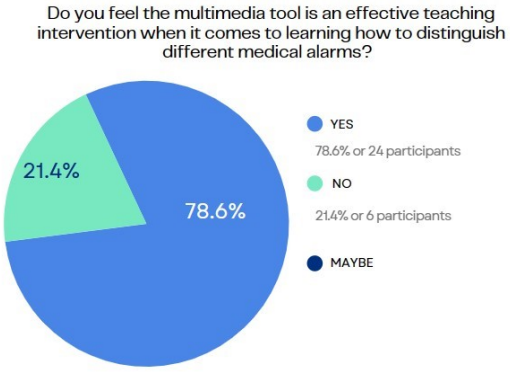


***Figure 6*** As part of the course evaluation survey, participants were also asked to rate how confident they feel in understanding medical alarms after completing the teaching intervention. 50% of the participants stated they felt very confident in using and understanding medical alarms after completing the educational module.

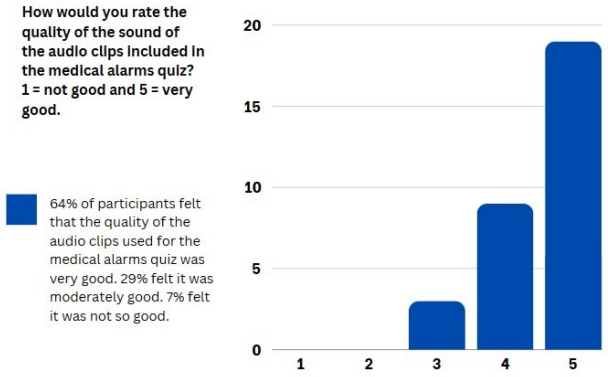
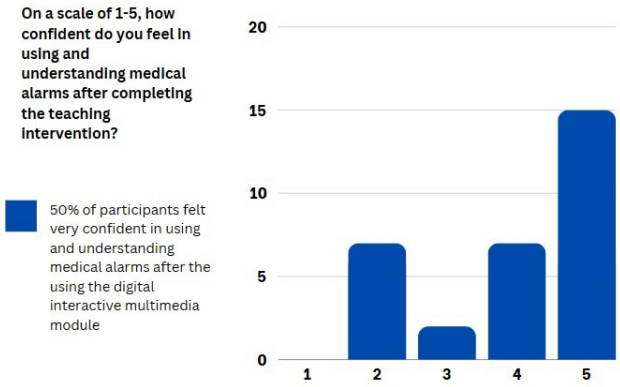



***Figure 7*** Participant's Rating of the quality of the sound in Audio Quiz on Clinical Alarms




### 3.7 Clinical Alarm Perception Survey

Nursing student's attitudes and perception of clinical alarms are key elements for designing contextually sensitive quality initiatives to fight alarm fatigue and create successful alarm management practices in various clinical settings.

***Figure 8*** Assessment on how auditory sensory overload may affect response to clinical alarms

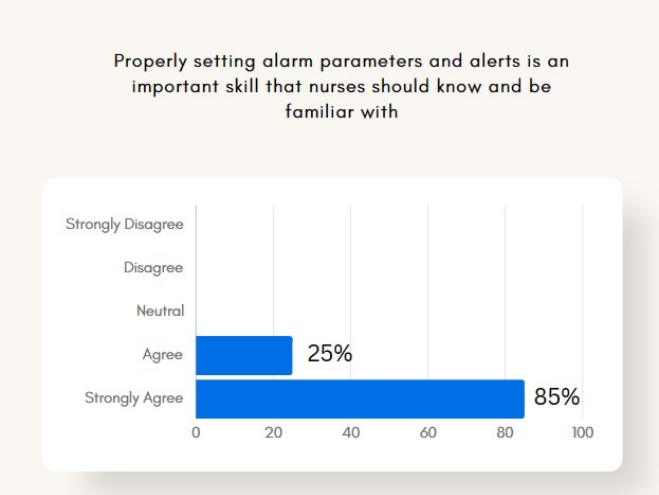
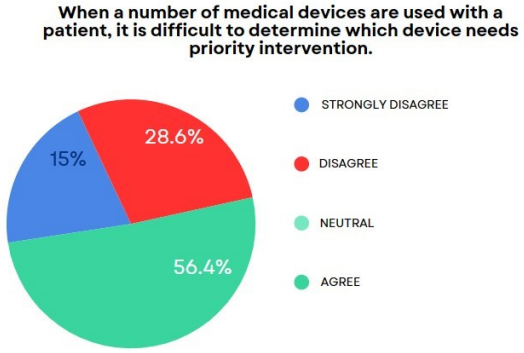



***Figure 9*** 85% of participants strongly agreed that properly setting clinical alarms parameters is an important nursing skill




Note: X-Axis represents the percentage of participants

***Figure 10*** 43% of participants believed that multiple unncessary alarms distracts health care professionals and results to disruption in patient care

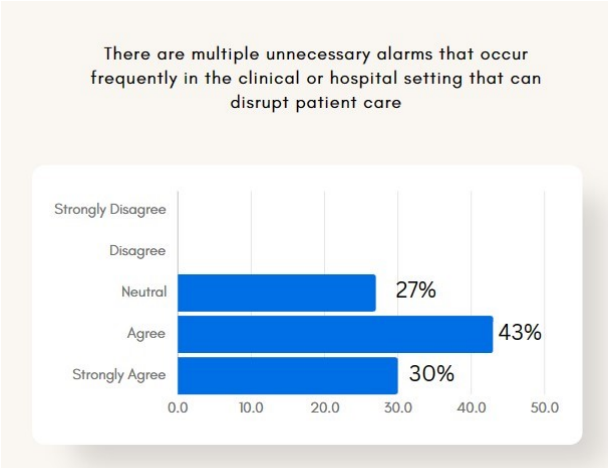
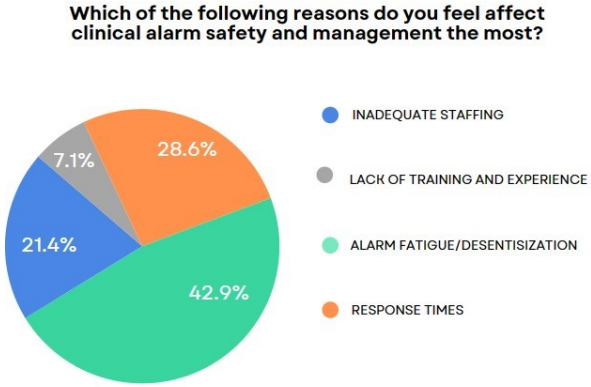



***Figure 11***




The researchers identified (1) inadequate staffing, (2) lack of training and experience, (3) alarm fatigue/desentisization, and (4) response times as reasons that may affect clinical safety and management the most. 42.9 % of the participants identified alarm fatigue and desentisization as one of the main factors that play a role in clinical alarm management.

## 4. Discussion

### 4.1 Quantitative Discussion

Bi et al. (2020) found that monitor alarm management training effectively reduces alarm fatigue. Additionally, Ferrara et al. (2023) highlighted a correlation between alarm fatigue levels and nursing students' internship experiences, suggesting the need for preventive strategies to enhance nursing education. Nyarko et al. (2022) demonstrated the efficacy of educational interventions in reducing alarm fatigue among nurses while improving their perceptions and knowledge of alarm management practices. Moreover, the findings of Soo-Joung Lee et al. (2021) suggest that fostering positive perceptions of clinical alarms and patient safety culture among nurses correlates with better alarm management practices.

In the light of the study results, the sense of presence of the student is increased, so they can build the competencies they need to make judgments and solve problems in real-life cases. While the best approach to training student nurses is to expose them to real-life conditions, it can be difficult due to considerations like cost and potential danger to the student.

With the technical skills the learners acquired, they were able to develop a sense of presence and learning achievement. As such, this support the findings of the manuscript that alarm education is beneficial for student nurses because it makes them aware of the issues they will experience when working on actual patients and allows greater sensitivity to alarm recognition in practice.

### 4.2 Qualitative Discussion

The feedback offers insights into their perceptions and interactions with clinical alarms and educational tools. They discuss the familiarity of alarm sounds and the usefulness of tools in expanding learning capabilities, especially for different learning styles. Emphasis is placed on the connections between devices and the monitoring aspect of clinical scenarios, underlining the significance of comprehending the relationships among various elements in healthcare settings. Furthermore, participants highlight shifts in their perceptions of alarms and stress the significance of auditory cues in discerning different sounds. The synthesis suggests that the educational intervention effectively enhances participants' comprehension of clinical alarms and equips them with valuable learning experiences and tools for improvement to better prepare them for real-world scenarios.

## 5. Conclusion

When nursing students are educated, exposed, and learned to distinguish between various alarms, they can not only recognize those alarms, but can also respond quickly to them to mitigate potential adverse patient conditions, and save lives. Developing a better awareness by nursing students of the criticality of alarms can enhance emphasis of the importance of training and preparation in the area of alarms in nursing education.

## 6. Recommendation

The implementation of clinical simulations in nursing education is becoming more common and it enables students to practicalize their clinical and decision-making skills for some significant issues they may face in their daily work. Incorporating various clinical alarms in lab simulations or in Objective Structured Clinical Exams (OSCE) may enhance nursing students' self-esteem and confidence, thus promoting learning. In this way, the gap between theory and practice may be substantially reduced.

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## 8. Informed Consent

Informed consent was obtained from all participants involved in the study.

## 9. Conflict of Interest

The author declares that there is no conflict of interest. This research submission is original and not being considered elsewhere. Furthermore, the authors agree to grant the first editing/publishing rights to the journal upon acceptance.

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