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Factors affecting the perceived stress and anxiety of novice nursing students in high-fidelity simulation education: a secondary qualitative analysis of focus group interviews[†]

Original article

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Abstract: **Objective:** To gain insight into the potential factors that may cause perceived stress and anxiety in simulation education.
Methods: A secondary qualitative analysis study using qualitative thematic synthesis. A local higher education institution that conducted pre-registration nursing programs. A total of 189 undergraduate nursing students that were never attained any clinical placement prior to the parent study. Focus group interviews were conducted to collect data that were then transcribed and analyzed through the qualitative thematic synthesis approach to develop themes.
Results: Three themes were emerged from the participants' simulation experiences in terms of peoples (the observers vs the observed), actions (the prepared vs the unprepared), and settings (the realism vs the simulation).
Conclusions: By considering and reviewing the current design and development of the simulation practice, the findings of this study contribute to the body of knowledge with valuable insights on stress and anxiety that may affect students' learning in simulation.

Keywords: *high-fidelity simulation • novice nursing students • perceived anxiety • perceived stress • secondary qualitative analysis • simulation-based education*

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1. Introduction

Nursing professionals spend more time with patients than other healthcare providers; they are the key providers of quality care to ensure patient safety.[1] Although the number of nurses continues to rise, the demand is more significant than ever as there are more people and patients with more complex health conditions than in the past. Thus, competent nursing graduates who can exercise appropriate clinical judgments in supporting complex care needs of patients[2] are imperative to patient safety. This intensified need translated to the fiery call for ensuring the skills and knowledge of nursing students to seamlessly transition to registered nurses becomes the top priority in nursing education.[3]

Due to limited clinical placements and the recent Coronavirus Disease 2019 (COVID-19) pandemic, students' clinical experience in patient care and their opportunities to handle different clinical situations have been diminished.[4] Furthermore, the quantitative expansion of programs for healthcare professions to address the demand from the society has escalated the necessity for qualitative improvement in related clinical education. It is not unrealistic to conceive that students have yet to receive all the training they need before graduation. To cope with these issues, simulation-based education is a practical pedagogical approach that allows students to practice their clinical reasoning, decision-making, and skills through varied real-life situational experiences in a safe and protected environment without compromising the patient's well-being.[5] Applied as a supplementary learning technique, simulation-based education is an effective intervention for the development of clinical judgment in nursing students.[6,7] In a nutshell, simulation education, if conducted according to the established standard of practice,[8] may replace a significant portion of the student's clinical practice in authentic healthcare settings.[9]

Simulation-based education is designed to offer the opportunity to students to rehearse their nursing skills in an authentic yet safe environment. It is an experiential learning process that can be used to model clinical scenarios in a safe and controlled environment for nursing students to practise and develop critical thinking, problem solving, decision making, and interdisciplinary collaboration.[10] Simulation is often described as a continuum ranging from low-fidelity to high-fidelity simulation. Various simulation methods, with the aid of technology, can be adapted according to specific learning outcomes and educational levels. In a typical simulation practice, a student or a group of students is engaged in providing nursing care to a simulated patient (manikin) or standardized patient based on a planned scenario. The whole process of the simulation is being observed and monitored by the facilitator and educator. A debriefing session is followed to deconstruct the case scenario for providing analysis and feedback to the students.

The high-fidelity simulation aims to provide learners with intensive interactions and immersive realism underpinned by deploying full-scale computerized patient simulators.[11] This is eminently aligned with the salient focus of nursing education, that placed in the development of students' competency in critical thinking and problem solving.[12] As literatures has reported, novice students often have difficulties in grasping the theoretical components of nursing skills and translating them in practice.[13] Therefore, it is imperative that the nursing curriculum deliver these core skills to the students as early as practicable in their programs. In this regard, the deployment of high fidelity simulation in the first year course of the nursing programs may satisfy this demand. It may assist and facilitate novice nursing students to acquire a solid foundation and a higher level of confidence for future clinical practice.[14]

High-fidelity simulation in nursing education postulates a level of fidelity in which an authentic representation of a simulated environment is created. Interactions between experienced facilitators and students in the simulation environment are intensive for learning.[15] High-fidelity simulation eminently offers many educational and learning benefits, especially for earlier introduction of critical thinking and problem-solving skills to novice nursing students through an interactive learning experience.[16] However, students often experience high levels of stress during simulation education[17] that may impair the effectiveness of students' learning. It is also revealed from the literature that low level of stress and anxiety is related to optimal students' performance in simulation practice and learning.[18] In other words, unless students receive appropriate support and intervention, they may not obtain maximum learning benefit from simulation education. Although there are many studies reporting a quantitative increase in the level of stress and anxiety among students during simulation, there are few studies that reveal the qualitative aspects in simulation that contribute to this stress and anxiety. To develop appropriate strategies to reduce and control stress and anxiety of students for effective practice and learning, it is significant to understand the causes of stress and anxiety perceived by novice students in simulation education.

2. Methods

2.1. Aims and design

This secondary qualitative analysis study aims to use de-identified parent study data of novice nursing students

who participated in structured high-fidelity simulation to gain insight into the potential factors that cause perceived stress and anxiety in simulation education. The students' experiences in going through the simulation will be analyzed and translated into a detailed and in-depth conceptual description. In this regard, a qualitative approach that can generate detailed information with relevant insights in subjective experiences of particular situations[19] is the best fit for this study. The participants' experiences from their naturalistic environment are explored in both descriptive and interpretative ways to understand students' perceived stress and anxiety experiences in going through simulation education. The findings of this study will contribute to nursing simulation education in developing strategies to cope with the stress and anxiety perceived by students during high-fidelity simulation. In other words, this will guide the design of the settings and content of the simulation education.

2.2. Research questions

The following research questions will guide the inquiry of this study:

1. What are the specific stressors perceived by the nursing students in simulation education?
2. What kind of assistance and support provided by the educators that may lower the level of stress and anxiety perceived by the nursing students during simulation education?

2.3. Setting, participants, and data collection of the parent study

The data of this secondary analysis study were obtained from a de-identified parent study in which the participants were undergraduate nursing students from a local community college who were aged ≥18 years and had never attained any clinical placement before the parent study. The researchers of the parent study invited participants randomly from the undergraduate nursing program through email. A total of 189 students were recruited to participate in the parent study, and the mean age was 20.56 years. The recruited participants were arbitrarily assigned to the intervention group or the control group to undergo a high-fidelity simulation. Data were collected through focus group interviews in debriefing session of the simulation by recording for subsequent transcription.

2.4. Data analysis

The secondary qualitative analysis of this study included all the focus group interviews conducted for the parent study. The process of qualitative thematic synthesis of Thomas and Harden[20] was adopted in the data analysis of this study, where it combines and adapts both meta-ethnography and grounded theory approaches to draw on the principles of thematic analysis in primary qualitative research. Thematic synthesis involves a three-stage process that codes data systematically and generates descriptive and analytical themes.[21] The first stage of the process began with line-by-line inductive coding of the data from the parent study based on their meanings and content. The coding was then checked for consistency of interpretation, and the necessity for additional codes. The outcome of this process, by comparing the similarities and grouping of codes, generated the related descriptive themes. In the final stage of the synthesis, analytical themes were developed by the researcher's judgment and insights on the relevant descriptive themes generated in the thematic process. As a result, there were three analytical themes emerged, and they represented the factors that affected the perceived stress and anxiety of novice nursing students in simulation education, thereby addressing the research questions of this secondary qualitative analysis.

3. Results

Stress refers to the responsive activities happen in the brain and body to all kinds of demands. These responsive activities can be broadly identified as psychological manifestations, physical manifestations, and behavioral manifestations.[22] Anxiety, in terms of a negative perspective, is classified as a psychological manifestation of stress arising from a hazard in a situation or environment.[23] In this regard, anxiety is specifically depicted by feelings, worries, and changes in bodily signs such as blood pressure increase, sweating, hyperventilation, tachycardia, or trembling.[24] As revealed by literature, students' feelings of physiological stress are increased during simulation education,[25] albeit they often evaluate the simulation practice as an effective learning tool.[26] Such an increase in stress may cause profound effects on learning by affecting the relevant receptors in working memory.[27] Thus, the key to maximize the learning benefits from and achieving effective learning in simulation education largely depends on how to control stress and anxiety experienced by students. This is the objective of this secondary data analysis study to make an inquiry into the possible factors that may affect students' perceived stress and anxiety in simulation. The findings of which may guide future research in developing strategies to cope with the students' stress and anxiety in simulation education. The descriptive themes emerging through the thematic process in the data analysis of this study that captured the essence of the experiences of

students' perceived stress and anxiety in high-fidelity simulation are illustrated below in terms of *Peoples*, *Actions*, and *Settings*.

3.1. Peoples—the observers vs the observed

In a high-fidelity nursing simulation practice, students are engaged to interact with the teachers, facilitators, peer students, and simulated patients in a given setting, scenario, and limited period of time. Interactions with different people in various roles are the core activities in simulation for students. In this regard, the people or their actions in simulation often induce students' perceived anxiety. One of the most mentioned aspects by students is being watched and recorded on camera. A student commented:

> *"…being watched (by someone) on camera is always feeling nervous no matter what I am doing."*

One student further expressed that being observed by teachers and peer students would affect her performance:

> *"Being recorded on camera and observed by peers and teacher often cause me anxiety. The feeling (being watched) is so uncomfortable that I think I would have performed better in settings without recording."*

In fact, what happens behind the camera is not merely observed by the teachers and peer students, but there must be some "conversations" or discussions among them about the happenings in the simulation. At the time when the observers become being observed in the simulation, stress and anxiety come into play as they perceive similar "conversations" or discussions experienced in observing others before. This was challenging for a student who elucidated that:

> *"Actually I do participate in chats (about what has happened in the simulation) and hear teacher's comments when observing others in simulation. Exactly this experience makes me feeling more stressful when I am out there to perform in the simulation as I am very concern about the comments of the observers especially the teacher on what I should do or not do."*

Another student expressed her anxiety related to being watched in the simulation:

> *"I feel that I am not well prepared and inadequate whenever I make mistakes in front of other observers."*
> *"I may give bad impression to the teacher."*

In some cases, observing others to perform in a simulation may cause stress and anxiety. Several students identified some aspects, such as "*peers' feedback*," "*watching others struggling in simulation*," and "*too many audience making noises that may suggest critical comments (about others' performance)*," were causes of anxiety experienced in the observer role. All such feelings and concerns may translate to one's anxiety about what other observers may be saying about oneself in their simulation practice.

Revealed from the students' experiences above, the perceived stress and anxiety were derived from performance-oriented concerns. One student was feeling that "*everybody's judging*" on others' simulation performance. Simulation is somehow intended to create artificial pressure for students to gain experience similar to those prevailing in clinical situations. Judgment is one of the common phenomena experienced in an authentic clinical situation. In this regard, related anxiety arising from performance-oriented concern due to interactions with people in simulation, or worries of being judged, may cause the "*loss of normal ability to focus, think, or recall knowledge*" as reported by some students. Ironically, all of these should be the intended learning outcomes and training objectives of the simulation practice.

3.2. Actions—the prepared vs the unprepared

A lot of students expressed stress and anxiety when preparing for the simulation. Such anxiety feelings were provoked by the information and materials provided for their reference prior to the simulation. One student commented:

> *"…not sure about the flow of the simulation and how these materials are related to my tasks in the simulation."*

Many students revealed that they did not know how to use the information and materials provided to prepare their simulation practice. Some other students were trying to "*speculate how the case will unfold*" and "*prioritize tasks during preparation*" by imagination. Accordingly, students' feelings of losing direction or being uncertain in preparation were not uncommon and may translate to stress and anxiety.

Furthermore, the above perceived stress arising from the simulation preparation may continue to amplify during simulation practice, especially when there are a lot of deviations or unexpected events that happened. Many students reported that they were "*feeling helpless*," "*difficult to organize*," and "*failed to prioritize tasks in patient caring*" in actual simulation practice. One student articulated that:

"I have read the case materials before simulation and think that I understand the case and the requirement. However, in the actual (simulation) practice, I just cannot relate those situations happened with the materials provided and that I can barely recall what skills and knowledge I have learnt in the program."

Another theme captured in the experiences of perceived stress and anxiety of the students is related to the students' role identification. It is not unrealistic to expect that novice students do not have a strong sense of being in the nurse role to implement nursing care in clinical situations. However, when they are engaged in the tasks of a simulation to implement nursing care even to a manikin, they naturally feel like a nurse and begin to acquire this specific identity. One student expressed that:

"I feel the responsibility to care the person (manikin) lying the bed like a nurse. I feel nervous if I will do something wrong to the patient."

Originating from this sense of putting themselves in the nursing role to conduct patient care, students are under great stress if the patient's status is deteriorating. One student recalled that:

"Although I know I am in simulation and all (setting) is fake, I just can't help feeling anxious when hearing the sound of the equipment and manikin indicating the patient's condition is getting worse."

As revealed from the above, no matter whether it is caused by the action or inaction of the students, stress and anxiety are always perceived when situations are unexpected and not under their control.

3.3. Settings—the realism vs the simulation

In a high-fidelity simulation, the laboratory setting is purposefully designed to construct a level of realistic representation very close to the authentic clinical environment for students to practice their nursing skills and clinical reasoning. As such, students often mentioned that certain aspects of the clinical situation in simulation induced stress and anxiety in them. One of the Students' comments was:

"…the simulated case seems to test too many skills or some skills are not familiar to me…"
"…if I know the situation is not being handled very well…"
"…not knowing what to expect."

Furthermore, students reported that although most of the equipment in the simulation laboratory is not unknown to them, they still felt a lot of stress and anxiety when they actually used the equipment in the simulated case. One student expressed that:

"….even though I was given 15 minutes before the simulation session to familiarize with the equipment and setting in the laboratory, however, when I was engaged in the actual simulation, I feel the need to search for all the equipment and materials all around the room all the time. Anxiety comes from decrease in confidence as things are running out of my control. I spend too much time in searching for the things I needed (inside the laboratory)…."

In addition, there were several other dissatisfactory expressions about the usage of the equipment:

"Feeling frustration about where to find (the needed equipment), and how to use it."

Among the equipment used in simulation, many students mentioned their anxiety was largely related to the uncertainty about the interaction with and operation of the manikin. One student articulated that:

"I wonder if what we are seeing (in the laboratory) are supposed to be seeing (in the clinical ward) or they are only technical malfunctions (of the manikin)."

Another student expressed anxiety that was related to:

"…getting wrong assessment of the manikin as a result of errors. Although I know he is only a manikin, I still feel that I may do something harmful to the (real) patient."

In simulation practice, unexpected patient situations or events are often designed to occur. However, students are often not prepared to expect the unexpected. One of the students had linked anxiety with the following:

"When a patient expressed thirsty feeling repeatedly and demanded to drink water while he is supposed not allowed to, I am so confused and don't know what to do as we are taught never to give fluid to patient who are in prohibition of eating and drinking."

In other words, students had perceived strong anxiety when they felt that they were not prepared to handle the variations or deviations of the patient's needs in an actual case scenario from the information provided in the briefing prior to the simulation.

4. Discussions

Nursing education aims at training competent nurses to apply theoretical knowledge to clinical patient care. In achieving this objective, simulation practice is often adopted as an effective pedagogy to provide a safe yet structured clinical setting for students to practice their nursing skills and clinical reasoning. Inherently, nursing students are necessitated, whether planned or not, to confront stress and anxiety arising from various situations during the nursing education.[28] Given this inherent phenomenon, it is inevitable to have stress and anxiety exist throughout the programs in nursing education. In this regard, it is the focus of nursing educators to obtain maximum learning benefits by balancing and controlling, instead of avoiding and eliminating, the stress and anxiety of the students in simulation practice. As revealed from the findings, there are several perceived stressors to students in terms of Peoples, Actions, and Settings of simulation practice. Nursing educators may support the students, especially the novice, in learning how to manage stress. This not only equips the students with skills to cope with stress and anxiety in simulation practice but also in areas beyond. In other words, supporting students to manage stress in simulation not only reinforces the caring nature of nursing but also translates the benefits of achieving better clinical learning to provide competent patient care in an authentic clinical environment.[29]

Notoriously, stress and anxiety are often associated with negative aspects in learning. In fact, stress may create a positive experience for students in learning. The existence of a stressor may facilitate students' learning activities, and the key is experienced at an opportune time.[30] As revealed by the literature, stress and learning demonstrate an inverse relationship where low stress stimulates and high stress impairs students' cognitive processes in learning.[31] In other words, good control of students' stress in simulation may help them to have better cognitive performance, focused attention, and more profound memory of what is learned. This concept is important for nursing educators to design and construct the settings of simulations that aim at controlling an optimal level of stress for students' effective learning.

The components of simulation designed to provide clinical learning experiences to the students are actually the same components that create anxiety. For example, as revealed in the findings, the group of observers to those who are being observed is one of the sources of stress and anxiety. Viewing from another perspective, students can prepare for stressful situations by practicing skills and knowledge together with positive cognitive preparation and encouragement from peers. By focusing on the issues of the simulation rather than on judging the performance of individuals can encourage students to address the subject matter positively while improving their confidence and performance.[32] As such, one of the supports given by the nurse educators in simulation practice to the students for stress management is to uncover the aspects of "positive anxiety" in terms of providing a safe environment to make mistakes in simulation and building confidence through constructive feedback from teachers and peer students in debriefing of the simulation. These views are consistent with the findings of the study conducted by Cato in 2013.

Furthermore, it was reflected by some students of the study that the simulation setting was perceived as more stressful than a genuine clinical environment. This may be arising from the misconception of perceiving simulation practice as an assessment. In this case, students may experience performance anxiety in simulation. Performance anxiety refers to the fear or worries that threaten students' capability to complete a task at an anticipated level of performance.[33] Effects of performance anxiety are similar to the existence of a stressor that interferes with the cognitive performance and negatively impacts cognitive function and memory.[34] Thus, a structured guideline provided to students before simulation seems to be important information in guiding the correct concept and expectations of the students.

4.1. Implications

Simulation is an integral component of nursing curricula in pre-registration nursing education. The case scenarios designed and developed in simulation practice are aimed to engage students to congeal learning objectives gained from authentic settings and prepare them for subsequent clinical practice. It is apparent from the findings above that negative stress and anxiety have impaired students' learning in simulation. On the other hand, appropriate stress in simulation may have a positive impact on learning. Although factors perceived by students that caused stress and anxiety in simulation were identified, there is no universal tool to measure the level of stress and anxiety arising from these factors. Such measurement is imperative since stress in simulation may facilitate effective learning, and nurse educators are needed to understand the optimal level of stress that can improve students' learning before it becomes detrimental. In addition, nurse educators may develop and incorporate the elements with positive anxiety in the simulation and deploy relevant support to students accordingly. All of these are directions for

consideration of further research on managing stress and anxiety in simulation practice to obtain maximum learning benefits.

4.2. Limitations

This study is a secondary qualitative analysis of focus group interviews conducted in a randomized controlled trial. Data sets generated from the parent study may be incomplete or insufficient due to variables not properly measured and a small sample size. As a matter of fact, it is not possible to examine causality since this secondary data set is descriptive in nature.

5. Conclusions

The findings of this study contribute to the body of knowledge with valuable insights into stress and anxiety that affect the students' learning in simulation. These insights are important for nursing educators to consider and review their current design and development of the simulation practice to enhance the learning experiences of the students. Suffice it to say, life balance can only be maintained through the act of continuous moving. Thus, further research on how to determine and manage the optimal level of stress and anxiety in simulation education may be the drive for continuous exploration in the exploring the relevant knowledge.

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Authors' contributions

All authors have approved the final version of the manuscript. N.L. was responsible for student recruitment, and data interpretation, writing the draft of manuscript, and verifying final version of the manuscript. A.C. was responsible for study conception, student recruitment, and data interpretation and verifying final version of the manuscript. F.W. was responsible for study conception, design of the study, writing and reviewing draft of the manuscript, and verifying final version of the manuscript.

Availability of data and materials

The datasets generated and analyzed during the current study are not publicly available due to privacy protection and ethical considerations.

Ethical approval

This study was approved by the Research Ethics Committee of Tung Wah College (Ethics application number: REC2021102). The study was adhered to the Declaration of Helsinki and was completely voluntary, anonymous, and unpaid. All participants gave written informed consent after being informed of the research objectives. Participants could withdraw at any time without loss of benefits to ensure voluntariness. No personal identifying information was collected to ensure anonymity.

Conflicts of interest

All contributing authors declare no conflicts of interest.

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