

# Iranian Nurses' Perception of Factors Contributing to Medical Errors in Intensive Care Unit: A Qualitative Study

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**Abstract-** Patient safety is a major health concern throughout the world, and medical errors are the most important factor threatening patient safety, especially in the Intensive Care Unit (ICU). To prevent errors and improve patient safety, it is necessary to identify the underlying causes of error from the perspective of nurses working in ICUs. This study aimed to explore nurses' experiences of factors contributing to medical errors in the Intensive Care Unit. The present qualitative study was conducted using conventional content analysis. The participants included 17 nurses working in ICUs in two educational hospitals affiliated with the Iran University of Medical Sciences in Tehran. Data were collected using in-depth semi-structured interviews and were analyzed through the conventional content analysis approach based on Graneheim and Lundman's model. Four main categories (a) extra-organizational challenges; (b) Organizational position; (c) The specificity of the care environment, (d) Individual reason and nine subcategories: (accreditation problems, non-native care standards, organizational management, organizational Features, critical condition of patients, physical structure of unit, neglect in the process of care, lack of clinical knowledge and experience, and physical and psychological problems) were identified. From the nurses' perspective, a series of factors associated with the health system, the organization, the ICUs, and the individual play a role in the occurrence of errors; therefore, it is necessary for planners, policy-makers, nursing managers to think about these underlying factors and with in-service training, and a positive, supportive atmosphere; lead nurses to support the patient and improve patient safety.

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## Introduction

The right to safety from harm and injury in receiving health services is a human right. Patient safety is also one of the main components of the quality of health services and one of the main concerns of health care centers. Medical errors are a threat to patient safety and a global health problem that has not yet been alleviated despite the efforts made by health policymakers. Medical errors in the health system are unavoidable, common, harmful, and sometimes irreversible errors that are considered a threat to the patient's health and well-being (1).

'Error' is doing (wrong action) or omission (not doing the right action) that leads to undesirable results or has significant potential for such an outcome. Therefore, an error in the healthcare system not only means the occurrence of harm but is also considered as the potential

for harm. Although the error-free practice is the standard expected of healthcare professionals, medical errors, including medication errors, diagnostic errors, blood transfusion errors, surgical errors, and nosocomial infections, may occur in the service delivery process from diagnosis to treatment and even in the prevention phase (2), and each type of error, if it occurs, can cause detrimental harm to patients and health care systems.

Although finding accurate statistics on medical errors is difficult, the results of a meta-analysis study showed that six patients out of 20 visiting healthcare centers have experienced preventable errors, and 12% of these errors were severe or led to death (2). Medical errors do not only cause patient harm and disability, but also impose heavy costs on the health system annually. Every year, 15% of total hospital activity and expenditures are direct result of

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Adverse events (3). According to statistics, an estimated 62% and higher of medical errors occur in moderate- and low-income countries (3,4). However, medical errors are also a health problem in advanced countries such as the United States, and an annual of 251 thousand deaths occur following medical errors in this country (5,6). In addition to harming the patient and imposing economic costs on health care systems, they can affect the quality of health services. Today, the issue of medical errors and patient safety has been raised as one of the main challenges of health care systems.

The intensive care unit of a hospital is where the most skilled nurses provide critical patients with the best care using the most advanced equipment (7). Most patients in ICUs have an unstable state due to their critical conditions; attending to the quality of care and safety of these patients is therefore imperative. Compared to patients hospitalized in other units, ICU-admitted patients are more prone to medical errors due to their conditions, including poor physiology and reduced physical immunity, need for several medications and medication calculations (8) and lack of cooperation in care. As a matter of fact, the prevalence of medical errors and unwanted incidents is 51.2% in ICUs (9). Other studies have reported the prevalence of medication errors in ICUs as 78% -46.3% (10,11). According to a study conducted in one of the hospitals of Khuzestan Province in Iran, 527 errors were committed in ICUs over a four-month period, and most of the errors were related to incorrect procedures (12). It is important to note that, given the conditions of these patients, any medical error and unwanted event can lead to disability, prolonged hospital stay or even death in this group of patients (13). Evidence suggests that most medical errors can be prevented (14,15).

Since patient safety is one of the indicators of quality of care and considering that medical errors are a threat to patient safety, it seems necessary to prevent and manage medical errors, and in this regard, the first step is to identify the underlying factors of such errors. Nurses, as members of the treatment team who are in direct contact with patients, are in a unique position to face errors and improve patient safety. On the other hand, due to the high number of medical errors in the intensive care unit and the effects of errors on hospitalized patients, identifying the underlying factors of medical errors from the nurses' point of view reduces these errors and increases patient safety and the quality of care and treatment. Numerous studies have identified human factors such as lack of pharmacological knowledge, lack of professional communication, fatigue, insufficient time, environmental

factors, and managerial factors such as lack of personnel for the occurrence of medical errors. However, the mentioned studies have been either in environments other than the environment of the intensive care unit (16,17) or have been conducted in different societies and cultures (18-22) or have been proposed from the perspective of other medical professions (23). Therefore, this study was conducted to identify the underlying factors of medical errors from the perspective of intensive care unit nurses in Iran.

## Materials and Methods

### Design

Since our aim was to describe nurses' experiences, a qualitative approach was undertaken in this study. Qualitative studies investigate various aspects of a phenomenon and lead to its better understanding. The present study was conducted from March 2019 to January 2020 using conventional content analysis.

### The participants and settings

The participants included ICU, internal, and surgery nurses of two hospitals affiliated with the Iran University of Medical Sciences in Tehran, and the first participant was selected by purposive sampling. The first participant was a surgical intensive care unit nurse with 23 years of work experience and was introduced by the head nurse of the intensive care unit, and she communicated well. The third researcher (F.K.L) introduced herself as an intensive care unit nurse with 18 years of experience and tried to gain the trust of the participants in order for the participants to express their personal experiences. In addition, an effort was made to conduct the interviews in a quiet and peaceful environment. Finally, 17 participants entered the study according to the study criteria (6 males and 11 females), with 2-11 years of work experience, among whom 4 had a Master's degree and 13 had a bachelor's degree. The study inclusion criteria were: At least two years of work experience in ICUs and willingness to take part in the study. It should be noted that this information was obtained through the participants' self-reports. For the purpose of preparation and the initial introduction, a meeting lasting a few minutes was arranged with the candidate to explain the study objectives and obtain informed consent from them. The interview time and place were then scheduled with the willing candidates. The sampling process continued until data saturation.

### Data collection

Data collection began with semi-structured interviews

using general and open-ended questions, such as: "What is a medical error in your opinion? Please elaborate", or "What causes an error? Please explain", and exploratory questions were then posed to collect more details, such as "What do you mean by what you just said?", "Please give us more details", "Could clarify with an example?". Once the questions were approved by the research team, one of the authors, Ms. F. K. guided all the interviews. The participants preferred the unit's break room as the place of the interviews, and efforts were made to conduct the interviews in a quiet setting. Almost all the interviews ended with this question: "Do you have a question in mind that I have not asked?", or "Is there another point you want to add?". This final question often led to greater clarity of the concepts. Each interview lasted about 30 minutes. All the interviews were digitally recorded. Audio files were stored on a flash drive and confidentially kept in a safe place for ethical considerations. A total of 20 interviews were ultimately held with 17 participants. The interviews continued until categories were identified and saturation of data occurred.

### Data analysis

Data collection and analysis were carried out simultaneously based on the Graneheim and Lundman's five-stage model: Verbatim transcription of each interview, reading the entire interview text to gain a general understanding of the content, finding the meaning units and initial codes, classification of the similar initial codes in more comprehensive categories according to the hidden meanings of the data, and finally determining the content hidden in the data. This method helps avoid predetermined categories, which are instead extracted from the data.

The interview text was typed up verbatim immediately after each run. To get immersed in the data, the researcher listened to and reviewed the text of each interview several times. The words, sentences, and paragraphs spoken by the participants that contained important points relevant to the study subject were taken as the meaning units. For the initial codes, in-vivo words or codes developed by the researcher according to the concepts contained in the information were used. The meaning units were extracted from participants' conversations as initial codes. The codes were reviewed and compared to each other several times, categories were

formed according to their similarities, and ultimately, the concepts hidden in the data were extracted. MAXQDA-10 was used to manage and organize the data.

### Data rigor and consistency

The rigor of the data was ensured using the Guba & Lincoln criteria (credibility, conformability, dependability, and transferability). In favor of the data credibility, F. K. has had 18 years of work experience in ICUs and was adequately familiar with the study setting. Moreover, the researcher was in contact with the participants for a long period and, once the initial codes were formed, asked for participants' views to ensure the rigor of the codes and interpretations. Corrections were made if the codes disagreed with participants' views. An external check was carried out by two faculty members specialized in qualitative studies, who agreed on the selected codes and classifications for further credibility of the data. To increase the conformability and dependability of the study, notes were taken of all the stages from start to finish in order to enable follow-up for others. Transferability was also achieved by giving rich descriptions of participants' experiences.

### Ethical considerations

The present study was approved by the Iran University of Medical Sciences. For ethical considerations, the study objective and method were explained to all the participants, and informed consent was obtained from those who agreed to take part, and they were also ensured of their own anonymity and the confidentiality of their data and audio files. The subjects had the right to withdraw from the study at any stage.

### Results

The participants included 17 nurses with a mean age of 34.05 years, work experience of two to 11 years, and mean ICU work experience of 6.7 years. Four of the nurses had master's degrees, and 13 had bachelor's degrees; two were head nurses, one was a staff nurse, and 14 were nurses (Table 1).

The study results revealed four main categories and nine subcategories, as shown in Table 2 and described in the following:

**Table 1. Participants' demographic details**

Code	Position	Gender	Age (years)	Education	Clinical Work Experience (Years)	ICU Work Experience (Years)
P1	Nurse	Male	48	BSc	23	18
P2	Nurse	Female	32	MSc	8	4
P3	Nurse	Male	46	MSc	22	11
P4	Head Nurse	Female	43	MSc	13	4
P5	Staff Nurse	Female	36	BSc	10	8
P6	Nurse	Female	36	BSc	12	9
P7	Nurse	Male	29	MSc	5	4
P8	Nurse	Male	28	BSc	8	6
P9	Nurse	Female	29	BSc	8	4.5
P10	Safety Liaison	Female	34	BSc	13	8
P11	Nurse	Male	29	BSc	5	3
P12	Shift Officer	Female	30	BSc	13	13
P13	Nurse	Female	28	BSc	4	2
P14	Nurse	Male	26	BSc	5	3
P15	Head Nurse	Female	42	BSc	15	6
P16	Nurse	Female	27	BSc	7	5
P17	Nurse	Female	36	BSc	10	8

**Table 2. The main categories and subcategories extracted from the data**

Category	Subcategory
Extra-organizational challenges	Accreditation problems
	Non-native care standards
Organizational position	organizational management
	Organizational Features
The specificity of the care environment	The critical condition of patients
	The physical structure of the unit
	Neglect in the process of care
Individual reason	Lack of clinical knowledge and experience
	Physical and psychological problems

**Extra-organizational challenges**

Based on participants' experiences, issues such as accreditation and guidelines from the Ministry of Health and their incompatibility with the national conditions may be associated with the occurrence of error.

**Non-native care standards**

The participants considered the non-nativity and incompatibility of the global standards with national ones a factor associated with the error. Most of them believed that, like other medical and care professions, the nursing profession also requires global standards and guidelines to improve the quality of care services, but naturalization and the development of infrastructures and compatible processes are necessary for the greater use of these standards. In this regard, a participant commented:

"In my view, our country is behind advanced countries. Therefore, not everything that is implemented in other countries should be implemented here as well. For instance, some of the care we have are not compatible with our culture at all. Even our hospitals don't have their appropriate infrastructures" (P15).

**Accreditation problems**

Accreditation was another concept that the participants associated with the error. Accreditation is a tool for assessing the quality of the patient's medical care and safety that targets the improvement of patient safety and the quality of services. The majority of the participants stated that the hospital measures to improve the quality of services and receive accreditation are only imposed on nurses, and nurses become involved with accreditation issues, which prevents proper patient care. For example, one of the nurses argued:

"When we have accreditation, we say it's all paperwork. The less paperwork we have, the better clinical work we can provide to the patients. All this reduces the importance of clinical work. That is why there are too many errors, and it is hard to prevent error" (P4).

**Organizational position**

Organizational position is another main concept that could be associated with error according to participants' experience. Nurses' understanding of these factors indicates that the educational or non-specialized nature of

the organization, shortage of nursing workforce, increased number of shifts, large numbers of referrals, increased workload, and the absence of a training program on the part of the organization may be conducive to the occurrence of error. These factors were classified under subcategories including organization management, organization features and training organization.

### **Organizational management**

Many participants pointed out that the shortage of nurses, low nurse-to patient ratio and successive shifts lead to increased physical problems and reduced ability and accuracy in providing care, which then results in errors. One of the participants stated:

"In my view, intense and heavy shifts are one of the causes of error. For example, I do 18 hours now, and I worked both the afternoon and night shifts yesterday, but it should not be like that for an ICU workforce, as patient care can't be ideal this way, and this gives rise to an increasing number of errors" (P8).

### **Organizational features**

Most participants stated that organizational features including the educational nature, being a general hospital, and the use of novice intern workforce in the ICU may cause errors. Based on their understanding, an educational hospital often includes students from different medical stages taking various training courses, and the compulsory medical service program workforce, who have not yet gained sufficient care and medical knowledge and experience, replace the workforce needed in the ICU, and the likelihood of error thus increases. One participant explained:

"In public hospitals, since they're educational, you work with students, and this makes for a very high possibility of error. Being a group of service program workforce who are novices and have not yet been oriented, their likelihood of making errors is increased. We've had medication errors and all kinds of errors, even causing death" (P7).

### **The specificity of the care environment**

From the participants' perspective, ICU is a unique ward, and this uniqueness may be conducive to the occurrence of error. This main category consisted of two subcategories: The critical condition of patients and the Physical Structure of the Unit .

### **The critical condition of patients**

The patients' critical condition makes their care needs vary at any moment, and some issues may become

neglected in the meantime due to the numerous physician visits required for these patients, and this negligence could lead to errors. One nurse commented:

"There are many errors, especially in the ICU. As there are many medications, the likelihood of medication interaction and error is very high. It's not like in the ward since the orders change very rapidly. The patients are very complicated here" (P7).

### **The physical structure of the Unit**

The participants of this study considered the care environment unique and believed that this difference with other wards paved the way for errors. Factors such as the multiplicity of equipment and the transfer of patients from the ward for para-clinical procedures were examples discussed by the participants. One participant commented:

"This transfer from the ward can be harmful to the patient. For example, a patient was brought back from CT and transferred to the bed, with the device unplugged. Such an important thing! Maybe I'm at his bedside, so I reconnect the device, but if there's no one there, that causes problems for the patient. A transfer can be highly risky for the patient" (P10).

### **Individual reasons**

Participants' experiences showed that personal factors could also cause errors. This category consisted of the following subcategories: Neglect in the process of care, Lack of clinical knowledge and experience, and physical and psychological problems.

### **Neglect in the process of care**

Neglect in care was one of the subcategories classified under the factors associated with the nurse in the occurrence of errors that was discussed by the participants. The majority of the participants with a high level of clinical experience pointed out that the lack of clinical experience causes reduced sensitivity and carelessness in the process of patient care. Therefore, carelessness in care is indirectly involved in the occurrence of error. For example, a participant with 13 years of clinical and ICU work experience described:

"We had a patient whose surname was similar to another patient's name, and a woman who requested blood for a patient who was in fact her namesake. For instance, transfusion had been performed for Ahmad Javadi instead of Javad Ahmadi. These names are fake and not real, since she had not been careful with the patient's name and family name. She had left the blood and gone, and had not checked on the patient in the first

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15 minutes and 30 minutes. The patient had shown blood symptoms and had developed tachycardia, and she hadn't even noticed, and had only noticed when the patient's condition had turned for the worse. I think the shift officer had noticed this and not the nurse herself" (P2).

### Lack of clinical knowledge and experience

The nurses' lack of knowledge and experience was a point discussed by the participants as another factor leading to errors. The majority of the participants who regarded knowledge and experience relevant had fairly high levels of work experience themselves. For instance, one participant stated:

"It happens very often that I check and find their magnesium has gone too high up. Some of the guys don't know the difference between CC and Milliequivalent. Sometimes, they don't know how to calculate the drips" (P7).

### Physical and psychological problems

These problems were also discussed by the participants. According to participants' experience, not providing the required workforce and increased workload cause physical and psychological problems, including fatigue and loss of vision in nurses. These problems themselves lead to the loss of concentration and accuracy and affect the process of care and pave the way for errors. One participant argued:

"They didn't have staff and had told this woman to take over the shift, and it had coincided with an error, and she'd said that she had not seen it properly and it had been a vision error. Sounded like she had not seen what the patient's actual name was" (P2).

## Discussion

The present study was conducted to investigate ICU nurses' understanding of medical errors and related factors and showed that many factors are involved in the occurrence of errors. These factors can be examined in a few categories: extra-organizational challenges, organizational position, the specificity of care environment, individual reasons.

Extra-organizational challenges constitute one of the main categories in relation to the causes of error. Incompatible and non-native standards of care may be among the factors causing the error since using these standards requires infrastructures and preliminary arrangements compatible with them. In one study, Khali & Lee proposed that health system policies, cultural differences between the patient and the nurse, and the lack of transparency about the role of nurses are some of the

causes of error (24). These causes are also associated with the unsuitable physical environment and the lack of a suitable medication preparation space, which agrees with the present findings. In the cited study, cultural differences between the nurses and patients and the role of nurses being undefined by the health system were also identified as causes of error. This disparity could be attributed to the dissimilarities in the health systems of different populations and also the distinct study settings.

The results of the present study provided a new aspect and showed that extra-organizational factors such as problems related to standards set by the healthcare system and hospital accreditation programs, despite expectations, can be associated with the occurrence of medical errors. Therefore, the direct or indirect effects of these factors can be investigated in other studies with a quantitative approach.

Organizational position comprised another main category extracted from participants' experiences and included the following subcategories: organizational management organization feature.

The present findings concurred with the results obtained by Zaree *et al.*, Heydari *et al.*, and Lall *et al.*, who considered various organizational factors in the management dimension in the incidence of nursing errors, including ineffective recruitment procedures, a disproportionate nurse-patient ratio, and fatigue due to heavy workloads (16-18). The studies conducted by Eltaybani *et al.*, and Alomari *et al.*, also proposed the involvement of the following organizational factors in the occurrence of errors in the ICU: Inadequate training and the absence of practice guidelines and policies. (19,20). In this study, What was extracted from participants' experiences was that management defects in terms of designing a human resource system can lead to unsafe activities. Human resources are the most important resource in any organization, including the health sector. Given that nurses are responsible for providing excellent-quality care, it is necessary for health organizations' managers to recruit a committed workforce in the required number, observe the proportionality of the nurse-patient ratio and distribute and employ experienced staff along the less experienced ones in order to prevent errors. Since organizational factors are the cause of inevitable errors, many errors can be prevented by changing the work conditions, such as the moderation of nurses' workload, holding training classes for nurses, and developing care guidelines. This step is very crucial in the ICU, given the patients' conditions in this ward.

One of the subcategories of the organization position was the organization features as an Educational hospital.

The results obtained by Bragottire *et al.*, agree with those of the present study. The researchers' results showed that the educational nature of the organization can be associated with and predict error. Participants in teaching hospitals identified miss nursing care significantly more than did participants from other hospitals (21). Errors occur more frequently in these organizations than non-teaching ones, although they occur less frequently in academic graduates compared to non-academic graduates, i.e. nursing school graduates. The likelihood of error is greater in students from all medical categories, because, in general, students have not yet obtained the required knowledge in all the different areas of care and treatment, including medication calculation.

The use of experienced instructors in clinical settings as well as more supervision and association of medical instructors, including nursing instructors and specialist physicians with students during the care and treatment process can be one of the suggested solutions to reduce medical errors. Face-to-face training and providing feedback by trainers stabilize behavioral skills and can reduce medical errors.

The critical condition of patients comprised one of the subcategories of the specificity of the care environment. Duarte *et al.*, argued that the patients' conditions, including the severity of the disease, their old age, the use of multiple medications, such as tranquilizers, and the need for medication calculations, and also factors associated with the environment of the ward, including the presence of different medical personnel and emergency admissions, are risk factors for increasing medical errors in the ICU. Although the process of care is the same for all patients, those in the ICU require ongoing and complex care due to their conditions and receive more care than other patients, and because of the stressful environment of this unit, overt and covert errors are commonplace (22)

Another subcategory was the physical structure of the unit. The results obtained by Bragottire *et al.*, concur with those of the present study. The researchers' results showed that factors associated with the ICU are major predictors of error (21). A study conducted by Valee *et al.*, also proposed the uniqueness of the ICU as a factor associated with error; although this result agrees with the present findings, their study also proposed factors such as the lack of sufficient equipment and poor cooperation among professional members of the staff, including the unavailability of physicians, as contributing to error (25). These results disagree with the present findings because the participants in the present study proposed the advanced equipment available as a cause of the error with

respect to the subcategory of the physical environment of the unit. In these participants' view, the lack of knowledge about the several advanced types of equipment at hand as well as the need to transfer the patient out of the ward with all the different connections and equipment and technical defects of the equipment were causes of error. This result can be explained by noting that the nursing care provided in this unit is more dependent on advanced care equipment, such as cardiac monitoring devices, ventilators, and various IV equipment. The participants in the present study did not propose the lack of cooperation among medical personnel, including the unavailability of physicians, as error-related factors associated with the ward. This disparity may be attributed to the different types of organization and management types in the two studies. Given that the teaching nature of the organization as one of its features was extracted from participants' experiences, which suggested the residents' attendance in each shift, it can be inferred that the participants had not experienced the unavailability of physicians. Although factors associated with the ICU, including the critical condition of patients and the Physical Structure of the Unit seems to be inevitable; errors can still be minimized through training the new personnel, updating the information about the processes of patient care in the ICU, updating medication information and equipment, using sufficient and appropriate equipment and making use of clear patient care guidelines.

Other subcategories of individual reasons included physical and psychological problems and lack of knowledge and experience. A study conducted by Garrouste-Orgeas *et al.*, showed that problems such as nurses' lack of knowledge and information about working with the ventilator and other equipment as well as psychological problems such as depression symptoms are an independent factor contributing to the occurrence of error (23). Gholipoor *et al.*, and Araby *et al.*, proposed fatigue due to heavy workloads, little experience and the lack of medication knowledge and information as the most important factors causing errors in nurses, which concurs with the present findings (26,27). Given that heavy workloads may cause physical and psychological problems for ICU nurses, the work environment needs to be changed, and nursing managers should prevent errors by supplying the required workforce. In the present study, Lack of clinical knowledge and experience were also considered a personal factor contributing to the occurrence of error. To promote nurses' knowledge about various care issues, training supervisors in hospitals should use retraining classes compatible with individual

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needs-assessments, and by improving the individuals' knowledge and awareness and increasing their motivation for learning, errors can also be prevented. In addition, according to the results of the study, it is recommended

that briefing meetings be provided to professionals such as pharmacists, physicians, and novice nurses by hospital administrators to familiarize them with various medical errors and prevention strategies.

### Appendix 1. Consolidated criteria for reporting, qualitative research (COREQ): a 32-item checklist for interviews and focus groups

Item	Guide questions/description	Page
<b>Domain 1: Research team and reflexivity</b>		
<b>Personal Characteristics</b>		
<b>1. Interviewer/facilitator</b>	Which author/s conducted the interview or focus group? Response: F.K.L	
<b>2. Credentials</b>	What were the researcher's credentials? e.g., PhD, MD Response: N.GH is, Associate professor, PhD, and M.AS. is, Professor, PhD, F.K.L is PhD Candidate of nursing.	
<b>3. Occupation</b>	What was their occupation at the time of the study? Response: N.GH and M.AS.F, are working Nursing Care Research Center, School of Nursing and Midwifery Iran University of Medical Sciences, F.K.L, is PhD Candidate of nursing, Nursing Care Research Center, School of Nursing and Midwifery Iran University of Medical Sciences	
<b>4. Gender</b>	Was the researcher male or female Response: Female	
<b>5. Experience and training</b>	What experience or training did the researcher have? Response: All researchers had experience working in ICU and are members of the Nursing Care Research Center	
<b>Relationship with participants</b>		
<b>6. Relationship established</b>	Was a relationship established prior to study commencement?	No
<b>7. Participant knowledge of the interviewer</b>	What did the participants know about the researcher? e.g., personal goals, reasons for doing the research	2
<b>8. Interviewer characteristics</b>	What characteristics were reported about the interviewer/facilitator? e.g., Bias, assumptions, reasons and interests in the research topic Response: All the research team members had experience working in ICU.	
<b>Domain 2: study design</b>		
<b>Theoretical framework</b>		
<b>9. Methodological orientation and Theory</b>	What methodological orientation was stated to underpin the study? e.g., grounded theory, discourse analysis, ethnography, phenomenology, content analysis	2,3
<b>Participant selection</b>		
<b>10. Sampling</b>	How were participants selected? e.g., purposive, convenience, consecutive, snowball	2
<b>11. Method of approach</b>	How were participants approached? e.g., face-to-face, telephone, mail, email	3
<b>12. Sample size</b>	How many participants were in the study?	3
<b>13. Non-participation</b>	How many people refused to participate or dropped out? Reasons?	NO
<b>Setting</b>		
<b>14. Setting of data collection</b>	Where was the data collected? e.g., home, clinic, workplace	Workplace
<b>15. Presence of non-participants</b>	Was anyone else present besides the participants and researchers?	No
<b>16. Description of sample</b>	What are the important characteristics of the sample? e.g., demographic data, date	Table 1
<b>Data collection</b>		
<b>17. Interview guide</b>	Were questions, prompts, guides provided by the authors? Was it pilot-tested? Response: yes	3
<b>18. Repeat interviews</b>	Were repeat interviews carried out? If yes, how many? Response: Yes, 3 times	
<b>19. Audio/visual recording</b>	Did the research use audio or visual recordings to collect the data? Response: Audio recording	3
<b>20. Field notes</b>	Were field notes made during and/or after the interview or focus group? Response: Yes	3



## Cont. Appendix 1

<b>21. Duration</b>	What was the duration of the interviews or focus group? <b>Response:</b> yes	3
<b>22. Data saturation</b>	Was data saturation discussed? <b>Response:</b> yes	3
<b>23. Transcripts returned</b>	Were transcripts returned to participants for comment and/or correction? <b>Response:</b> yes	3
<b>Domain 3: analysis and findings</b>		
<b>Data analysis</b>		
<b>24. Number of data coders</b>	How many data coders coded the data? <b>Response:</b> 3 coder	3
<b>25. Description of the coding tree</b>	Did the authors provide a description of the coding tree?	No
<b>26. Derivation of themes</b>	Were themes identified in advance or derived from the data? What software, if applicable, was used to manage the data? <b>Response:</b> MAXQDA-10 was used to manage and organize the data.	4
<b>27. Software</b>	Did participants provide feedback on the findings?	No
<b>28. Participant checking</b>		
<b>Reporting</b>		
<b>29. Quotations presented</b>	Were participant quotations presented to illustrate the themes/findings? Was each Quotation identified? e.g., participant number	4-6
<b>30. Data and findings consistent</b>	Was there consistency between the data presented and the findings?	4-6
<b>31. Clarity of major themes</b>	Were major themes clearly presented in the findings?	4-6
<b>32. Clarity of minor themes</b>	Is there a description of diverse cases or a discussion of minor themes?	4-6

## Study Limitations

This study was conducted in two general hospitals and on a small sample of nurses, and hence, its findings may have limited generalizability.

According to the results obtained, the error is an inevitable matter, and its occurrence is caused by various factors, such as human and organizational factors. Nursing managers are therefore expected to minimize the likelihood of error by developing and localizing care standards, observing productivity standards, and ensuring proportionate nurse-patient ratios, providing the required resources as well as specialist and capable workforce, especially nurses, holding in-service training courses, and familiarizing the workforce with evidence-based care.

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