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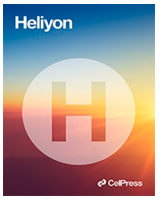

Research article

Nurses' perception of uncertainty in clinical decision-making: A qualitative study

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ABSTRACT

Background: Uncertainty is a common challenge for nurses in clinical decision-making, which can compromise patient care quality and safety. To address this issue, it is essential to understand how nurses perceive and cope with uncertainty in their practice.
Aim: This study aimed to explore nurses' perceptions of uncertainty in clinical decision-making using a qualitative approach.
Methods: This study was conducted with a qualitative approach and conventional content analysis in 2020. Participants consisted of 17 nurses from different wards of teaching hospitals in Northwestern Iran, recruited using the purposive sampling method. Data were collected through semi-structured interviews and analyzed simultaneously with data collection (June to December 2020). The data were analyzed using the content analysis approach suggested by Wildemuth. Data were managed with MAXQDA10 software. The analysis revealed four main themes and ten subthemes that described the nurses' experiences of uncertainty in clinical decision-making.
Results: The main themes were: difficult choice, difficult situation, insufficient judgment, and emotional burden.
Conclusions: The study participants defined uncertainty in clinical decision-making as a difficult choice that occurs in difficult situations, which influenced their clinical judgment and emotional well-being. These findings provide valuable insights for developing interventions to help nurses manage uncertainty and improve their decision-making skills and safety.

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1. Introduction

Accurate decision making by nurses plays a pivotal role in ensuring quality health care [1]. Clinical decision-making refers to the process of selecting the best action or solution among the available options during patient care [2]. This process involves three steps: critical thinking, clinical reasoning, and clinical judgment in nursing [3].

There are various types of decisions nurses make in clinical settings. For example, Thompson categorized nurses' decisions into six main headings: intervention, targeting, timing, communication, organizing and delivering services, and experiential understanding [4].

In nursing, as in life, some decisions must be made without considering relevant information or knowing whether the results of the decisions will make the situation better or worse [5]. During nursing care and decision-making, uncertainty is pervasive and inescapable [6]. A person is uncertain when, despite being aware of his goal, there may be several ways to reach a goal, but he is not sure which is the best [7]. According to decision-making experts, uncertainty arises when expected outcomes are unpredictable for individuals [8].

Nurses take care of many patients with complex needs requiring difficult decisions [9], which places them in uncertain decision-making situations. For instance, they may face rapid changes in patients' clinical conditions and need to make quick decisions about the best clinical intervention [10]. Thus, uncertainty during patient care seems unavoidable [11].

Uncertainty can lead to several problems and reactions such as confusion [12], feeling uncomfortable [13,14], occupational dissatisfaction, occupational burnout, low self-esteem [15], despair, anger, and agitation [16]. Persistent unresolved uncertainty and the resulting stress can make nurses morally distressed, force them to quit their jobs, and ultimately compromise patient care [17]. Therefore, improving nurses' understanding of the concept and decreasing their uncertainty in making clinical decisions can optimize the nursing workplace and improve the quality of care [18].

There are many definitions for uncertainty in different disciplines. For example, the concept of uncertainty has been studied and defined in classical probability theory. Based on this theory, decision theorists have defined uncertainty as a situation in which a person cannot accurately predict the probability of events or expected outcomes [19]. According to our review of literature, in general, the most essential attributes of uncertainty were ambiguity [20], lack of confidence and control [21], complexity [22], being on the horns of a dilemma [23], unpredictability, and unexpectedness [24]. Other attributes were probability and uncertain outcomes [25].

Using philosophical principles, Penrod (2001) proposed a theoretical definition of uncertainty as "a dynamic state in which there is a perception of being unable to assign probabilities for outcomes that prompts a discomforting, uneasy sensation that may be affected through cognitive, emotive, or behavioral reactions or by the passage of time and changes in the perception of circumstances and is mediated by feelings of confidence and control" [26].

Despite the significance of the concept of uncertainty, the attributes of nurses' uncertainty in clinical practice are yet to be completely understood [22]. Some investigators have described nurses' uncertainty in the context of clinical decision-making [19]. The findings from these studies indicated that unfamiliarity with the aspects of patient care is a source of uncertainty, and nurses tended to rely on heuristics or on the expertise of colleagues as sources of information for practice decisions. Expressing uncertainties as information needs might help guide information seeking and reduce uncertainty. However, studies indicated that nurses have difficulty recognizing or expressing uncertainties [23,27,28], resulting in information needs remaining unrecognized, and information seeking not initiated. The experience of uncertainty in clinical decision-making is a universal challenge faced by nurses worldwide, and it resonates deeply within the varied wards of Iran's healthcare system. Iranian nurses, similar to other nurses across the world, navigate through the complexities of clinical choices, often grappling with uncertainty during decision-making [29,30].The importance of understanding nurses' perceptions of uncertainty during clinical decision-making cannot be overstated. A more in-depth understanding of nurses' perceptions of uncertainty could lead to the development of strategies that support nurses in their clinical decision-making and practice. Therefore, this qualitative study aims to explore nurses' perceptions of uncertainty during clinical decision-making based on their experiences, with the goal of contributing to the effective management of nursing uncertainty in the decision-making process. The findings will not only enhance our theoretical understanding of uncertainty but will also provide actionable insights for nursing practitioners, educators, and nursing managers to support nurses in their critical role and ultimately improve patient outcomes.

2. Materials and methods

2.1. Study design

Since every person's experiences and viewpoints are distinct, the qualitative researcher can examine the significance of phenomena from their perspective by entering into their world [31]. The objective of this research was to explore Iranian nurses' perspectives on uncertainty in clinical decision-making, thus a qualitative research approach with a conventional content analysis technique was chosen. The study's description is based on the Consolidated Criteria for Reporting Qualitative Studies (COREQ) [32].

2.2. Setting and participants

Participants in this study were 17 nurses with a bachelor's degree or higher who were in four major hospitals (Sina, Shohada, Shahid Madani, and Imam Reza: emergency, intensive care units and general wards) in Tabriz city in northwestern Iran, serving as the

capital of East Azerbaijan Province. Purposive sampling method was used. At first, experienced nurses were selected. During the purposive sampling stage, participants were chosen based on their perspectives towards the phenomenon. The initial participants were experienced nurses from intensive care and emergency departments, who were more exposed to challenging decision-making situations. Subsequent participants were from general wards. The sampling process continued until data saturation was reached; sampling was stopped when the data became repetitive and no new codes were identified. An attempt was made to diversify and enrich the sampling process to gain a comprehensive view of the phenomenon. The inclusion criteria included being a nurse, holding at least a bachelor's degree, having at least one year of clinical work experience, a willingness to express personal experiences, and working in one of the four selected hospitals for sampling. Participants whose work was limited to caring for patients with dementia were excluded. The place and time of the interview were chosen by the participants, who often selected a time before or after their work shift. The interview location was typically a classroom designated for student or patient education, situated close to the department in a quiet and calm space. The research objectives were explained verbally and in written form. Informed consent to participate and publish was acquired from each participant.

2.3. Data collection

Data collection was done through semi-structured face-to-face interviews(June to December 2020). Interviews were conducted at suitable places and each lasted 45–60 min. The interviews began with general questions such as "as a nurse, what comes to your mind when you hear the term 'uncertainty'?" or "In your experience, what factors make nurses uncertain in their clinical practice?" As the interviews progressed, more specific and detailed questions were asked such as "Can you give examples?" and "What was your experience like?". Four participants were interviewed twice to expand on issues. When no new information was obtained, the data was saturated after 15 interviews. Two additional interviews were conducted to confirm the saturation of the data. In the last two interviews, the data analysis led to the emergence of repetitive codes, and no new code was obtained. Also, the decision to achieve data saturation was made by reviewing the codes and categories with the research team members and two experts other than the research team.

2.4. Data analysis

Data analysis was performed using the conventional analysis proposed by Wildemuth [33]. Conventional content analysis is usually used with a study design whose aim is to describe a concept when existing theory or definitions about it are limited. Researchers avoid using pre-conceived themes, instead allowing the themes and categories to emerge from the data [34]. MAXQDA software 10.0R250412 (developed and distributed by VERBI Software Company in Berlin, Germany) was used to manage of data.

The steps of this approach were conducted in the following order.

Step 1 Data Preparation

Initially, the interviews were transcribed verbatim and inputted into the qualitative data analysis software as a unit of analysis.

Step 2 Defining the Unit of Analysis

The interview text was read repeatedly to ensure familiarity with the data. Next, meaningful units were identified and coded accordingly.

Step 3 Developing Categories and Coding Scheme

At this stage, the analysis units were categorized based on similarities and differences, forming the initial framework of the findings. The constant comparative method was utilized for categorization and merging similar categories. Codes formed separate categories when placed next to similar codes, which served as the framework for the study. In essence, the coding framework originated from the interview data.

Step 4 Testing the Coding Scheme on a Text Sample

The first interview was coded by the first and second authors, while the second and third interviews were separately coded by the same authors. The research team compared their coding, and the process continued due to high consistency between the coders.

Step 5 Coding all Text

After ensuring consistent coding, the coding rules were applied to the rest of the text. The coding process persisted until new codes, subcategories, and categories emerged.

Step 6 Assessing Coding Consistency

One of the interviews was coded and reviewed by the second and fourth authors to ensure no human factors such as fatigue or new impressions influenced the results. The research team also continuously reviewed the texts and codes throughout the coding process.

Step 7 Concluding the Coded Data

Compatibility of codes with categories and subcategories was examined, and properties were compared with one another. The research team held meetings and discussed the compatibility of codes with categories and subcategories.

Step 8 Reporting Methods and Findings

Finally, the categories, subcategories, and their relationships were discovered and identified.

2.5. Rigour

In this study, Lincoln & Guba's criteria were used to ensure the reliability of the data [35]. The researcher established a strong rapport with the participants, which fostered trust and honesty throughout the study. To ensure accuracy and alignment with participants' experiences, the themes that emerged from the interviews, as well as semantic units and extracted codes, were presented to the participants for confirmation. Additionally, methods for ensuring dependability included the researcher's sustained involvement with the data and peer review. Two external examiners, both holding doctorates in nursing with experience in qualitative research, were invited to review the interviews, initial coding, and categories. Instances of disagreement were thoroughly discussed and resolved during team meetings, resulting in consensus-driven selection of the closest code or category.

To enhance the transferability of the study, the researchers clearly and comprehensively detailed the research population and process, enabling readers to closely follow along with the research path. To further establish conformability of the data, the research team made conscious efforts to set aside personal biases and assumptions about the topic, while meticulously documenting the research procedures and outcomes. Input from the rest of the research team also contributed to establishing the conformability of the data.

3. Results

3.1. Participants' demographic information

The participants included 14 female and 3 male nurses who were mostly 38–45 years old. Other demographic characteristics of the participants are presented in Table 1. Both female and male nurses of different ages, with differences in education and length of work experience, were included to increase variation and diversity.

The analysis of the data revealed four themes representing "difficult choices," "difficult situations," "insufficient judgment," and "emotional burden."(Table 2)

Table 1
The participants' demographic information.

Variable	Frequency %
Age (years)	
20–25	1 (59)
26–31	5 (29.4)
32–37	4 (23.5)
38–45	7 (41.2)
Gender	
Female	14 (82.4)
Male	3 (17.6)
Marital status	
Single	6 (34.3)
Married	11 (64.7)
Education Degree	
Bachelor's	5 (29.4)
Master's	12 (70.6)
Number of times being interviewed	
Once	12 (70.58)
Twice	5 (29.42)
Work experience (years)	
1–5	6 (35.3)
6–11	3 (17.6)
12–17	7 (41.2)
18–23	1 (5.9)

Table 2
Category and subcategories and attributes emerged from the data.

Category	Sub-category	Attribute	Open codes samples
Difficult choice	Confusion	Different perceptions of a situation	- Different perception of threatening clinical situation by two nurses - Different prioritization of interventions by two nurses
		Not sure about the best action	-Doubting about validity of required intervention - Doubting in choosing a solution
	Facing an unsolvable puzzlement	The inevitability of making a choice	-Choosing against one's inner desire -Feeling compelled to accept the patient's choice."
		Being on the horns of a dilemma	- Staying in two ways to solve the patient's problems - Conflict in decision making
Difficult situation	New situation	Not being an expert	-Being novice -Inexperience in dealing with complex cases multiple patients
		Unfamiliarity with a situation	-First encounter with a situation -Encountering with an unfamiliar case
	Complex situation	Situations with unpredictable outcomes	- Indecision about the outcome - Uncertainty like steamed glass
		Critical situation	-Facing with an emergency situation -Encountering with a dangerous situation:
		Care receiver's complex situation	- Dealing with a multitrauma patient - Dealing with disabled patients
	Unclear situation	Unclear guidelines	-Ambiguity in the implementation steps of the process - Ambiguity in protocols
		unresolved conflicts	- Conflict between job descriptions of the doctor and the nurse - Conflict between job descriptions and client expectations
Insufficient judgment	Weakness in information organization	Forgetting the teachings	- Forgetting what has been learned - Forgetting the knowledge that is necessary
		Unorganized thinking	- The influx of thought -Lack of concentration
		Insufficient knowledge about the care receiver	-Insufficient theoretical Knowledge - Insufficient practical Knowledge
		Ability to analyze options	-Choosing without weighing options -Inability to quickly analyze options
		Prioritizing care receivers' needs	-Assessing needs -Weighing the needs
	Making a choice regardless of the evidence	Easy choice	- Choosing the easiest solution -Choosing the most available solution
		Probability-based choice	- Choice with chance – Choice with suspicion
		Inner call-based choice	- Choice based on heartfelt feeling - Choice based on intuition
Psychological burden	Response to psychological pressure	Internal tension	-Palpitation - Anxiety
		Expressing negative feelings	-Outburst -Becoming angry
	Facing negative feelings toward oneself	Feeling guilty for potential faults	-Self-blame -Fear of the consequences of a wrong choice
		The negative perception of self-efficacy	-Inability to self-presentation - Having a low sense of empowerment
	Trying to manage confusion	Tendency to escape a decision-making situation	-Wishing for guidance -Wishing to be elsewhere
		Self-relaxation	- Self-help-Walking to reduce stress
		Normalizing critical situations	- Trying to be calm -Self-restraint

3.2. Difficult choices

Nurses understood uncertainty in decision making as a difficult choice. During the decision-making process, nurses are confused when they do not know which solution is the correct one. Nurses face a dilemma during uncertainty. The nurse is confronted with a complicated conundrum or an unsolvable puzzlement. This theme included two subthemes namely, confusion in decision-making situations, and facing an unsolvable puzzlement. Regarding the feeling of confusion in decision-making situations, one of the nurses said:

> *"I believed that the tube was placed in the trachea, but my colleague disagreed since there was no increase in oxygen saturation. Despite my initial belief that these two situations were unrelated, I found myself feeling uncertain about the situation."* (participant 1).

Another nurse said:

"*I really felt confused in that situation …"* (participant 4).

Regarding the perception of uncertainty in choosing the best course of action, another nurse said:

"Uncertainty occurs when we are not sure which option is the best for patients; it is a feeling of doubt. Even if the decision we make is ultimately beneficial to the patient, we are still not sure; we are still in doubt" (nurse 5).

Facing an unsolvable puzzlement is described by a feeling of the inevitability of making a choice in the face of a dilemma. One of the nurses stated:

"They were hard times; I had to make a choice, I had to do something … …but I am not sure …." (nurse 2).

About being on the horns of a dilemma, another nurse said:

"Sometimes, I get stuck in ethical challenges; for instance, a patient might not allow me to give him his medication; I have to consider his independence while trying to save his life at the same time" (nurse7).

3.3. Difficult situations

Nurses understand uncertainty in decision-making during problematic decision-making situations or the other words in difficult situations. Participants perceived difficult situations as when nurses encounter a patient's problem or needs for the first time, when the patient faces a complex problem or an emergency condition, when nurses cannot accurately predict outcomes, or when clinical guidelines are unclear. All these situations make decision-making difficult for nurses. Mentioning the effects of a new situation, one of the participants stated, *""I usually experience uncertainty when faced with new procedures. For instance, I was very hesitant in my decisions when I was first transferred to this department"* (nurse17). Another nurse also said: *"Inexperienced nurses encounter more uncertainty. As you become more experienced and learn the routine, the uncertainty begins to fade away"* (nurse 14).

Complex situations include unpredictable results, critical situations, and the care receiver's complex problems. One of the participants said: *"Uncertainty is like a glass that is fogged up, and the other side of it cannot be seen"* (nurse 7). Another participant said: "*It happens to me mostly in critical situations. I have worked in the ICU and the emergency room, so I have experienced it a lot."* Another participant stated, *"I face uncertainty when a patient is in a bad condition"* (nurse 12).

Unclear situations include unclear guidelines and experiences of unresolved conflict. One of the participants said:

"Recently, we wanted to remove a chest tube from a patient who had undergone heart surgery, but we were hesitant because of unclear guidelines for chest tube removal. Some surgeons believe that it can be removed if the secretion is less than 100 mL in 24 hours, while others say we can remove it if there is less than 300 mL of discharge" (nurse 10).

Another nurse said: *"The textbook recommends something, but some colleagues do something different based on their own experience, and it is routine in the ward. Therefore, when we want to do something, we are of two minds about whether to do it according to the routine or according to the books"* (nurse 14).

3.4. Insufficient judgment

Nurses believe that uncertainty in decision-making impresses their clinical judgment. Nurses described an experience of uncertainty as being faced with inefficiency in clinical judgment, characterized by weakness in information organization and choosing a decision based on insufficient evidence.

Weakness in information organization is characterized by forgetting the teachings, unorganized thinking, insufficient knowledge about the care receiver, ability to analyze options, and ability to prioritize care receivers' needs.

Regarding the weakness in organizing data, one of the nurses said, "Sometimes I know I should do something, but I do not know what is best for the patient. Should I use a bag valve mask first? Should I use an oropharyngeal airway? Should I even find a vein?" (nurse 13). Another nurse said, "A lot of things come to your mind in a short period of time, and you don't know what you should do … in such moments … I felt it was my first day at work … or perhaps I had not studied enough" (nurse 13). Another participant stated: "Some of my friends have linear thinking and do not have the ability to link different options in their minds to weigh their choices; these people encounter uncertainty more often" (nurse 11). Another participant said, "The patient who is going to go for angiography … well, he takes insulin … this patient is under the insulin protocol at 6 in the morning and his blood sugar is high. Should I give him insulin or not? If I do, there is a possibility he has to stay in NPO for 8 hours. Should I inject insulin or not?"

Making a choice, regardless of evidence, is characterized by making an easy choice, a choice based on probability, or an inner call. One of the participants said,*"I choose the easiest way, whatever it is. For example, I follow the protocol for low-dose insulin. It is dangerous if hypoglycemia occurs, so I choose the shortest and easiest way"* (nurse 4). Regarding making a choice based on probability, another participant said, *"In such situations, I tried to do what I guessed was best for the patient"* (nurse 8)." Another nurse said: *"You should do what*

your heart tells you; that's what I did" (nurse 9).

3.5. Emotional burden

Nurses believe uncertainty in decision-making bears a high emotional burden. In fact, the Nurses believe uncertainty in decision-making bears a high emotional burden. In fact, the uncertainty made them feel guilty and ineffective. In these situations, they tried to manage this burden through self-relaxation or strategies for escaping difficult situations. The experiences of participants were categorized into three subthemes: response to psychological pressure, facing negative feelings toward oneself, and trying to manage confusion. One of the participants said: *"I mean, I had palpitations in these situations."* Another participant stated, *"I feel angry and aggressive toward others in these moments."* One nurse said: *"It was really difficult for me; I did not know if I should let the patient go to the bathroom; I was afraid that the patient would experience VT or an arrhythmia. How could I tolerate the guilt if something would happen to the patient?"* Another nurse said, *"I repeatedly reproached myself for not knowing something and not being able to choose the right way."*

Trying to manage confusion is associated with escaping the situation, self-relaxation, and normalizing the critical conditions to protect themselves and the patient. One of the participants stated, *"It was very hard to decide. I wished the resident or attending physicians were there to make a final decision and resolve the situation both for me and the patient."* Another nurse said, *"You achieve self-control gradually."* Another participant said, *"I tried to hide my feelings and control myself in front of the patient's companions."*

4. Discussion

"The aim of this study was to explore how nurses perceive uncertainty in clinical decision-making based on their experiences. Our analysis uncovered four core themes: 'difficult choices,' 'difficult situations,' 'insufficient judgment,' and 'emotional burden.'

The themes of 'difficult choices' and 'difficult situations' highlight the inherent complexities in the clinical decision-making process for nurses. According to our findings, nurses perceive uncertainty in decision-making as difficult choices arising from difficult situations. Penrod (2001) characterizes uncertainty as 'a dynamic state in which there is a perception of being unable to assign probabilities to outcomes' [26]. Our results align with Bokuniewicz (2020), who suggests that uncertainty can arise from difficult situations [36]. Our results suggest that 'difficult situations' may encompass new or complex patient cases, or scenarios with ambiguous guidelines and protocols. Similar results have been reported in other studies. Chen (2020) and Ilgen (2019) note that uncertainty in decision-making arises for nurses during challenging and complex clinical situations [17,37]. Regarding complex conditions, most studies report uncertainty in decision-making when caring for older adults with multiple chronic conditions [18,38]. In the context of new and unfamiliar situations, other studies report similar findings. One study has mentioned that experienced nurses may experience uncertainty when entering new settings [39]. Another study has also mentioned the experience of uncertainty among novice nurses [40]. Concerning unclear situations, research suggests that nurses face uncertainty in decision-making when guidelines are ambiguous, such as when dealing with COVID patients and the guidelines are not clear [41].

In our research, nurses describe the nature of a 'difficult choice' or 'difficult decision' as facing an unsolvable puzzle and confusion in the face of uncertainty. These scenarios are also defined in various ways in the literature on uncertainty. Fischhoff (2020) emphasizes that uncertainty in decision-making often involves making difficult choices where clear options are not apparent [42]. Hall et al. (2023) also define uncertainty as the act of making a difficult choice [43]. Regarding the sense of confusion, other studies have described the sense of confusion nurses feel during difficult clinical decision-making, such as managing an adult patient with high fever or caring for COVID-19 patients, likening it to facing an enigma or puzzle [44,45].

Our research highlights a pivotal theme within the maze of clinical practice: nurses often find themselves at the crossroads of complex and unprecedented situations. Here, decision-making becomes an intricate interplay with uncertainty, where each step is fraught with the weight of difficult choices. This study emphasizes that nurses are not simply making decisions; they are navigating a complex array of challenges, each interwoven with the intricacies of care and the nuances of human health.

The study highlighted a significant theme: Insufficient judgment during decision-making under uncertainty. Hall [43]suggests that this uncertainty complicates the justification of decisions. Our research supports this, showing that such challenges often stem from disorganized information, leading to forgotten protocols, unstructured thinking, and inadequate patient knowledge. This manifests as an inability to analyze options, prioritize patient needs, or make evidence-based choices. During uncertain times, such as the COVID-19 pandemic, nurses reported forgetting their training and feeling inadequately prepared [46], or experiencing disorganized thinking when managing delirium in older patients [47]. The difficulty in prioritizing patient needs in uncertain care situations, such as with cancer patients, was also noted [36]. This theme underscores the need to enhance nurse training and support systems, develop strategies for better information organization and retention, foster analytical skills, and structure patient care priorities. Such improvements can equip nurses to better navigate the complexities of clinical decision-making under uncertainty.

The fourth emergent theme in our study was the psychological burden. This burden is characterized by nurses' responses to psychological pressures, such as a sense of tension, and the experience of negative feelings towards oneself while attempting to manage situations amidst clinical decision-making uncertainty. Most definition of uncertainty encompasses cognitive emotional and behavioral reaction dimensions [48]. It appears that this extracted theme relates to the emotional dimension and behavioral reactions to uncertainty. Additionally, this theme aligns with research on uncertainty situations faced by nurses. Under stressful conditions, individuals may experience an emotional burden [49]. For instance, during decision-making under challenging circumstances—such as stressful situations with information overload, time constraints, complexity, and uncertainty—nurses endure a psychological burden [50].Another study on decision-making by nurses in ICU wards revealed feelings of stress and tension when uncertain about the future

course of a disease [51]. The understanding of nurses regarding the experience of negative emotions towards themselves, such as a decrease in self-efficacy in situations requiring decision-making under uncertainty, has also been cited in a study concerning uncertainty in decision-making among newly graduated nursing bachelors [52]. Regarding the management of situations, a study on the emotional challenges faced by medical students found that they struggle to manage emotions during, generating feelings of uncertainty during decision-making [53].

Regarding the implications of this study, the identified themes of 'difficult choices,' 'difficult situations,' 'insufficient judgment,' and 'psychological burden' reveal the profound challenges nurses face during clinical decision-making. These challenges call for a unified approach from both nurse educators and managers to support and enhance nurses' decision-making capabilities. Nurse educators should integrate training that bolsters nurses' abilities to make informed decisions amidst ambiguity, including enhancing critical thinking skills, promoting evidence-based practice, and improving information retention. Simulation-based learning could be particularly effective in preparing nurses for the complexities they will encounter in real-world scenarios. Meanwhile, nurse managers play a vital role in fostering a supportive work environment that recognizes and alleviates the psychological stress associated with clinical uncertainty. They should ensure access to resources that assist in decision-making, such as current clinical guidelines and protocols. Furthermore, the implementation of support systems that cater to the emotional well-being of nurses, like peer support groups or counseling services, is crucial in managing the emotional burden underscored by the study.

5. Strengths and limitation

One of the strengths of this study is its qualitative approach, which allowed for an in-depth exploration of nurses' experiences. The use of conventional content analysis enabled the emergence of rich, nuanced themes that might not have been captured through quantitative methods. Additionally, the diverse backgrounds of the participants provided a broad spectrum of insights, enhancing the study's relevance to various nursing contexts. This study has some limitations. Firstly, the data collection was conducted in Tabriz, Iran, where cultural conditions may have influenced the findings. Nonetheless, the conventional content analysis method employed allowed for data interpretation within the specific context and situation. Secondly, the data collection occurred during the COVID-19 pandemic, which could have impacted the results. However, the focus was on the general experiences of nurses rather than the pandemic's specific effects. This aspect offers future researchers an opportunity to further investigate the pandemic's impact on nurses' uncertainty. Thirdly, the study did not examine the factors that contribute to uncertainty among nurses but focused on their perceptions of uncertainty in clinical decision-making. This approach provided insights into uncertainty from the nurses' perspective. Future research could delve into the factors that influence uncertainty and strategies to manage it. Fourthly, the participants did not include those exclusively working in palliative care or with patients with dementia, limiting the generalizability of the findings to such settings. Despite this, the diverse sample of nurses from general, critical care, and emergency wards may enhance the transferability of the findings to other contexts.

6. Conclusion

The study participants defined uncertainty in clinical decision-making as a difficult choice that occurs in difficult situations, which influenced their clinical judgment and emotional well-being. These findings highlight the importance of understanding the realities and challenges that nurses or nursing students face in clinical environments. This study also suggests that training programs should be designed to equip nurses and nursing students with the skills and knowledge to make informed decisions with proper management of uncertainty. Moreover, this study recommends that nurses should receive appropriate training on how to cope with the emotional stress that uncertainty can cause. By implementing these interventions, the quality of clinical decision-making can be improved while minimizing the personal and professional impact of uncertainty on nurses. This study is an important step in identifying and managing uncertainty in clinical decision-making and can be useful for nurses, nurse managers, nurse educators, and nurse researchers.

Ethical approval statement

Ethical approval was obtained from the Ethics Committee of Tabriz University of Medical Sciences (Ethics code: IR.TBZMED.REC.1399.148). Ethical considerations included informed consent, voluntary participation, and permission for recording the interviews. Moreover, the research objectives were explained verbally and in written form. Informed consent to participate and publish was acquired from each participant.

Human experiments

Our study was a qualitative research using interviews. The participants were nurses who were informed of the study objectives before participating and gave their informed consent. Ethical approval was obtained from the Ethics Committee of Tabriz University of Medical Sciences (Ethics code: IR.TBZMED.REC.1399.148). Ethical considerations included informed consent, voluntary participation, and permission for recording the interviews. This study did not involve any clinical trials and did not require any.

Clinical trial

No clinical trial.

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Data availability statement

Due to ethical considerations, the data from this research are not available in a publicly accessible repository. Data supporting the findings of this study are available from the corresponding author upon reasonable request.

CRediT authorship contribution statement

Mitra Mousavi Shabestari: Writing – review & editing, Writing – original draft, Validation, Resources, Methodology, Investigation, Data curation, Conceptualization. **Faranak Jabbarzadeh Tabrizi:** Writing – original draft, Validation, Resources, Methodology, Investigation, Data curation, Conceptualization. **Fariborz Roshangar:** Writing – review & editing, Validation, Methodology, Investigation. **Akram Ghahramanian:** Writing – review & editing, Validation, Investigation, Conceptualization. **Vahid Zamanzadeh:** Writing – review & editing, Validation, Methodology, Investigation. **Parvin Sarbakhsh:** Writing – review & editing, Validation, Methodology, Investigation. **David A. Agom:** Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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