Original Research Article

Understanding the Relationship Between Critical Care Nurses' Perception of Patient Safety Culture and Adverse Events

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Abstract

Background: Establishing a positive safety-culture environment is essential in healthcare settings to enhance patient care. This study aimed to determine the relationship between critical care nurses' perceptions of patient safety culture and adverse events.

Methods: A cross-sectional study was conducted among 200 nurses working in critical care units in the Damanhour Governorate in Egypt. Data were collected using a self-administered questionnaire, including the Hospital Survey of Patients' Safety Culture (HSOPSC) and information on adverse events (AEs).

Results: The study revealed areas for improvement in patient safety culture, with low positive response rates in staffing (26.6%), non-punitive response to errors (38%), handoffs and transitions (39.4%), teamwork across and within units (42.3%), and overall perception of patient safety (49.3%). The majority of critical care nurses had a moderate to high level of overall perception of patient safety at 42.5% and 42.0%, respectively. The most frequent adverse events reported daily were complaints from patients or their families (65.5%). Adverse drug events and patient falls occurred several times per week in 56.5% and 57.0% of patients, respectively. A significant association was found between low safety culture perception and higher rates of patient falls ($p = .008$), adverse drug events ($p = .005$), and patient/family complaints ($p = .030$).

Conclusion: The findings of the study indicate that nurses' perceptions of patient safety culture are moderate. Adverse medication responses, falls, and complaints from patients or their families were noted. Female nurses aged 31 to 40, especially divorced nurses, had more experience, worked fewer than 8 h daily, and had a higher education level, which appeared to influence overall safety culture perceptions. Furthermore, there was a correlation between the prevalence of adverse events and patient safety culture, with cooperation being the key factor.

Keywords

Adverse events, safety culture, critical care, perception

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Background

The Institute of Medicine (IOM) highlighted the need for healthcare institutions to establish a safety culture to prevent mistakes in treatment, which was meant to cure patients, that would cause unintentional harm (Wang et al., 2014). According to the World Health Organization (WHO), safety culture is ranked among the top 10 important human elements associated with patient safety (WHO, 2019). Adverse events can be an important key performance indicator and require tremendous effort to prevent and maintain patient safety, which can be prevented by providing adequate skills or knowledge for healthcare providers (Wang et al. 2014). Every year, approximately 43 million patient safety incidents occur with almost one in 10 individuals experiencing harm while receiving medical care (WHO, 2019). Following the publication of the IOM study "To Error is Human: Creating a Safer Health System," patient safety in the context of healthcare organizations has attracted particular attention (Engineering and Bahru, 2015).

Previous studies conducted in Egypt have emphasized the significance of healthcare providers in enhancing their patient safety culture (Ali et al., 2022; El-Sherbiny et al., 2020). According to a study conducted in Fayoum, patient safety was generally substandard in the city's public hospitals, with an overall score of 46.56%. Communication openness received the lowest reported score (17.9%), while organizational learning and continuous development received the highest mean composite score (65.36%) (El-Sherbiny et al., 2020). Another study conducted in Alexandria University intensive care units (ICUs) reported a total composite positive score of 37.3%. "Teamwork within Units" scored the highest, whereas "Non-Punitive Response to Errors" scored the lowest (Ali et al., 2022).

Review of Literature

One of the prerequisites and high priority for healthcare organizations is to build a positive safety culture environment for any healthcare organization (Abdallah et al., 2020). Patient safety is a top priority in the healthcare system, which aims to minimize the risk of unnecessary injuries and prevent avoidable harm during the medical care process (WHO, 2019). The quality of healthcare can be significantly influenced by adverse events that are closely related to factors, such as inadequate leadership, teamwork, communication, safety culture, and low staff awareness of safety procedures (Albalawi et al., 2020). Adopting a safety culture in healthcare settings has been associated with lower mortality and adverse event (AE) rates, resulting in enhanced care quality (Vikan et al., 2023). AEs can diminish nurses' work capacity and jeopardize patient safety, thereby elevating burnout and departure intention and posing further risks to patient safety (Kakemam et al., 2019).

The WHO defines AEs as harm or faults that do not relate to the underlying disease and occur during nursing care, causing significant injury or damage to the patient. Examples of AEs include medication error, misdiagnosis, infection, and inappropriate selection of therapeutic plans (WHO, 2019). The reported number of deaths due to AEs in hospitals in low- and middle-income countries is approximately 2.6 million annually (Wang et al., 2014). In addition, medical errors In the United States have been identified as the third most prevalent cause of death (Makary and Daniel, 2016). A systematic review revealed that about one-quarter of patients experienced AEs (Schwendimann et al., 2018). Several studies have shown that more than half of nurses reported that more common AEs had occurred in the past year due to work overload and exposure to occupational stress (Kakemam et al., 2019; Kang et al., 2016; Karimian et al., 2021; Wang et al., 2014).

The collective understanding of patient safety principles among hospital staff is known as the 'patient safety climate. It represents the core attitudes, practices, and beliefs about patient safety within a healthcare organization that together form the patient safety culture (Engineering and Bahru 2015; Sorra et al., 2016). To develop a positive safety culture, the initial step is to assess the existing organization's safety culture and identify staff attitudes and perceptions of patient safety that raise their awareness and plan nursing interventions and may reduce patient safety AEs (Vikan et al., 2023). Kakemam et al. 2021 reported that studied nurses had a low perception of patient safety culture, but a high perception of adverse events. Organizations must determine the necessary conditions for enhancing patient safety culture and lowering adverse event rates using a variety of tactics, including adverse event reporting systems and nursing education programs (Alrasheeday et al., 2024).

As healthcare services, governments, and researchers work to reduce damage, methods for measuring and describing patient safety have gained increasing interest (Hibbert et al., 2016). Patient safety is at risk owing to the untimely occurrence of adverse events in healthcare settings. This affects the staff confidence and workload. This event estimated millions of patients who experienced it in the hospital, which led to harm and even death (Kakemam et al., 2019). ICUs are among the most complex departments in the hospital system (Peradejordi-Torres & Valls-Matarín, 2023), and nurses play a crucial role in integrating the patient safety culture within the intensive care framework (Salem et al., 2019). Hospital administrators can gain valuable insights into the patient safety culture from nurses' perspectives, which can enhance both safe practices and patient outcomes. By evaluating CCNs' perception of safety culture and its relationship with AEs, areas for improvement can be identified, ultimately enhancing patient safety.

To the best of our knowledge, there is limited research on the relationship between patient safety culture and adverse

events among CCNs. Therefore, this study aimed to investigate CCNs' perceptions of patient safety culture and examine their relationship with AEs.

Method

Study Design

This study used a cross-sectional design.

Sample and Sampling Method

A convenience sampling technique was used to select nurses working in intensive care units, Al-Behera hospitals at Damanhour Governorate in three hospitals: Damanhour Medical National Institute, Itay Elbaroad, and Kafr Eldawar hospitals. The total capacity of beds was 50, and the total number of nurses was 415 (195 in Damanhour Medical National Institute, 110 nurses in Itay Elbaroad Hospital, and 110 nurses in Kafr Eldawar hospitals). These hospitals provide treatment to residents of the government of Alberehria who live in isolated places with little access to urban healthcare institutions. Using the OpenEpi web database version 3.01 (www.openepi.com), a sample size of 200 nurses was calculated based on the following criteria: 415 people in the population, 95% confidence level, and 5% absolute precision.

The study included all nurses who were selected through convenience sampling. Convenience sampling, a non-probability sampling technique, was used to select nurses from the study population because it is thought to be the most affordable, simplest, and quickest way to gather data from a population. All eligible participants who were accessible during the study period were approached during their break (Aaker et al., 2007; Alrasheeday et al., 2023). The total time taken to complete the questionnaire was 15–20 min. To mitigate attrition, the questionnaire was distributed to 250 nurses, of whom 220 were returned, resulting in a response rate of 80%. Twenty returned surveys were excluded from the study because they were completely blank or contained responses only on background demographics. Moreover, uniform responses across negatively worded survey items suggest that the respondents did not read the questions carefully and may invalidate their responses.

Inclusion and Exclusion Criteria

The study included all critical care nurses with at least 1 year of experience and excluded part-time or nursing students.

Instruments

Three instruments were used for the data collection. The first instrument consists of demographic characteristics and work-related questions. The questions aimed to gather information on participants' gender, age, marital status, type of hospital, years of experience, working hours, previous training in patient safety, work units, working position, and method of contact with patients.

The second instrument used was the English version of the Hospital Survey of Patients' Safety Culture (HSOPSC), which was originally developed and tested by the Agency for Healthcare Research and Quality (Sorra & Dyer, 2010). It comprises 42 items that measure 12 dimensions of patient safety culture. These dimensions include three items to measure "communication openness," three items to measure "feedback and communication about errors," three items to measure "frequency of events reported," four items to measure "handoffs and transitions," three items to measure "management support for patient safety," three items to measure "non-punitive response to error," three items to measure "organizational learning/continuous improvement," four items to measure "overall perception of patient safety," four items to measure "staffing," four items to measure "supervisor/manager expectations and actions promoting safety," and four items to measure "teamwork across and within units." The items were rated on a 5-point Likert scale ranging from strongly disagree to strongly agree.

To assess the positive attitude of intensive care nurses toward patient safety culture, the researcher computed the positive response score percentage by calculating the responses of strongly agree and agree on formulated items divided by the total number of answers for that item. The average score of the items in a certain domain was calculated to represent the overall score of that domain. Positive response scores of 75% and above indicate strength; 50–75% indicates neutrality; and less than 50% indicate areas that need improvement (Kakemam et al., 2021).

The last instrument consisted of self-reported adverse event (AEs) data collected from CCNs. Based on several studies (Kakemam et al., 2021; Najjar et al., 2015; Wang et al., 2014), the researchers investigated the most frequently reported AEs related to nursing care in the past year, which included six AEs: "pressure ulcers, patient falls, adverse drug events, surgical wound infections, patients or their family complaints, and infusion or transfusion reactions." These were rated through a seven-level rating system, "everyday = 6 to never happen = 0," estimated by nurses.

The authors, along with six proficient research assistants, gathered data. The investigators taught the nurses about the study's purpose and importance before they completed the paper-based questionnaire. Data were collected between April and July 2022.

Ethical Consideration

The study was approved by the Damanhour University Ethics Committee (ethical approval no: 64-b-2022). Written objectives of the study were provided to each participant to ensure transparency. Participation in this study was

voluntary, and the participants had the right to withdraw at any time. They were informed about the risks and benefits of the study and were then asked to provide written informed consent.

Data Analysis

After data collection, the researchers encoded it into IBM SPSS version 26. The researchers summed all the safety culture domains to obtain the total safety culture score. The Kolmogorov–Smirnov test was used to determine the normality of the distribution. Because the results indicated a normal distribution, parametric statistics, including the independent t-test and ANOVA, were applied to determine the relationship between the participants' demographic characteristics and the total safety score. Based on previous studies (Kakemam et al., 2021; Wang et al., 2014), the adverse event response system was converted from the seven-level into a dichotomous variable (no = never happened and yes = had happened "other response levels").

The composite scores (CS) were calculated by summing all items on the composite scales and dividing them by the total number of items. Additionally, an aggregate score was computed by summing all the CS and dividing it by the total number of items, then multiplying the result by 100. A perception score of 75% or above indicates a high perception; 50–75% indicates moderate; and less than 50% indicates a low perception of safety culture (Kakemam et al., 2021).

Internal consistency was assessed using Cronbach's α for patient safety culture and adverse events, yielding values of 0.82 and 0.94, respectively.

Table 1. Demographic Characteristics of Intensive Care Nurses.

Participant's characteristics		*N* (%)
Age	20–30 years	76 (38.0)
	31–40 years	81 (40.5)
	41–50 years	43 (21.5)
Sex	Male	92 (46.0)
	Female	108 (54.0)
Marital status	Single	66 (33.0)
	Married	101 (50.5)
	Divorced	16 (8.0)
	Widow	17 (8.5)
Hospital	Private	71 (35.5)
	Governmental	92 (46.0)
	Both	37 (18.5)
Experience	≤5 years	32 (16.0)
	6–10 years	92 (46.0)
	>10 years	76 (38.0)
Working hours	≤8 h	34 (17.0)
	>8 h	166 (83.0)
Previous safety courses	No	150 (75.0)
	Yes	50 (25.0)
Working units	General	140 (70.0)
	Cardiac	47 (23.5)
	Coronary	10 (5.0)
	Neurological	3 (1.5)
Position	Registered nurse	78 (39.0)
	Technical nurse	97 (48.5)
	Head nurse	25 (12.5)
Educational level	Diploma	98 (49.0)
	Bachelors	77 (38.5)
	Master	25 (12.5)
Contact with patient	Direct	178 (89.0)
	Indirect	22 (11.0)

Results

Description of Intensive Care Nurses

A total of 200 intensive care nurses were enrolled in this study. Of these, 40.5% of the CCNs in this study were between 31 and 40 years of age. More than half of the study participants were female (54.0%); 50.5% were married; 49.0% had a diploma; 70% worked in the general ICU as a technical nurse (48.5%); and 46.0% had 6–10 years of experience in the ICU. The majority of the study participants (83.0%) worked more than 8 h per day; 75% did not receive courses or training in safety literacy; and 89.0% had direct contact with patients (Table 1).

The lowest positive response rate (PRR), which requires improvement, was for staffing (26.6%), non-punitive response to error (38%), handoffs and transitions (39.4%), teamwork across and within units (42.3%), and overall perception of patient safety (49.3%). The other domains were neutral (Table 2).

The majority of CCNs (42.5%) rated their overall perception of patient safety culture as moderate, followed closely by 42.0% who rated it as high. In contrast, the smallest proportion (15.5%) rated their overall perception level of patient safety culture as low (Table 3).

Most intensive care nurses reported that adverse events occurred several times a week, followed by once a week and daily. A few intensive care nurses stated that adverse events never occurred or happened only a few times a year. The most frequent adverse events reported daily were complaints from patients or their families (65.5%). Adverse drug events and patient falls occurred several times a week in 56.5% and 57.0% of patients, respectively, as shown in Table 4.

The results of the association between participants' characteristics and overall safety perceptions are presented in Table 5. The highest mean (SD) of safety perception reported by intensive care nurses was between 31 and 40 years old, females who were divorced, worked in governmental hospitals, had more than 10 years of working experience, worked less than 8 h per day, received safety courses, worked in neuro ICU, head nurses, and had a master's educational level. There was a significant association between age, sex,

Table 2. Intensive Care Nurses' Perceptions of Patient Safety Culture.

Safety domains	PRR (%)	Judgment
"Communication openness"	54	Neutrality
"Feedback and communication about errors"	59.3	Neutrality
"Frequency of events reported"	64.5	Neutrality
"Handoffs and transitions"	39.4	Need of improvement
"Management support for patient safety"	62.5	Neutrality
"Non-punitive response to error"	38	Need of improvement
"Organizational learning/continuous improvement"	69.7	Neutrality
"Staffing"	26.6	Need of improvement
"Supervisor/manager expectations and actions promoting safety"	46.8	Need of improvement
"Teamwork across and within units"	42.3	Need of improvement
"Teamwork within hospital units"	50.8	Neutrality
"Overall perception of patient safety"	49.3	Need of improvement

PRN: positive response rate.

Table 3. Patient Safety Culture Perception Level of the Intensive Care Nurses.

Level of nurses' perception	*n* (%)
Low	31 (15.5)
Moderate	85 (42.5)
High	84 (42.0)

marital status, type of hospital, years of experience, working hours, previous safety courses, position at work, educational level, and method of contact with the patient.

Nurses with a lower perceived patient safety culture experienced more adverse events. As shown in Table 6, a significant association was found between the low perception of safety culture and a higher rate of patient falls ($p = .008$), adverse drug events ($p = .005$), and patient/family complaints ($p = .030$) (Table 6).

Discussion

To the best of our knowledge, this study is the first to examine the relationship between nurses' perceptions of patient safety culture and adverse events (AEs) in the context of critical units in rural Egypt. Data on patient safety cultures in developing and undeveloped countries are scarce (El-Gendi et al., 2017). The initial step in improving healthcare services offered in healthcare settings is patient safety culture assessment, which is vital for delivering high-quality healthcare (Foda et al., 2020).

The need to foster a strong culture of safety has grown as the healthcare industry expands, and risk management has emerged as a crucial strategy for accomplishing this objective (Riaz et al., 2023). The myriad adverse events that have been recorded may be explained by differences in research environments, the existence of critical safety measures, and a transparent culture that promotes reporting. However, adverse events are more common in critical care units than in other hospital areas with less labor-intensive care (Chacko et al., 2023). Numerous safety hazards exist in hospitals, including low job satisfaction, inadequate communication between nurses and doctors, and underreporting of errors due to fear of being discovered (El-Gendi et al., 2017).

The study found that the mean percentage of positive responses for all PSC compositions ranged from 26.6% to

Table 4. Prevalence of Adverse Events Estimated by Intensive Care Nurses in the Past Year.

Adverse events, *n* (%)	Merging all AEs to dichotomous variable		Everyday	Several times a week	Once a week	Several times a month	Once a month or less	Several times a year	Never happened
Pressure ulcer	Yes	193 (96.5)	27 (13.5)	60 (30.0)	67 (33.5)	24 (12.0)	15 (7.5)	0 (00)	7 (3.5)
	No	7 (3.5)							
Patient fall	Yes	192 (96.0)	8 (4.0)	113 (56.5)	47 (23.5)	0 (00)	24 (12.0)	0 (00)	8 (4.0)
	No	8 (4.0)							
Adverse drug event	Yes	187 (93.5)	26 (13.0)	114 (57.0)	23 (11.5)	8 (4.0)	16 (8.0)	0 (00)	13 (6.5)
	No	13 (6.5)							
Surgical wound infection	Yes	190 (95.0)	0 (00)	38 (19.0)	23 (11.5)	58 (29.0)	62 (31.0)	9 (4.5)	10 (5.0)
	No	10 (5.0)							
Patients or their family complaints	Yes	192 (96.0)	131 (65.5)	19 (9.5)	14 (7.0)	24 (12.0)	4 (2.0)	0 (00)	8 (4.0)
	No	8 (4.0)							
Infusion or transfusion reaction	Yes	189 (94.5)	21 (10.5)	52 (26.0)	45 (22.5)	31 (15.5)	30 (15.0)	10 (5.0)	11 (5.5)
	No	11 (5.5)							
Total (1200)			213 (17.7)	396 (33.0)	219 (18.3)	145 (12.1)	151 (12.5)	19 (1.6)	57 (4.8)

Table 5. Association Between the Nurses' Characteristics and Overall Safety Culture Perception.

Participants characteristics		Overall safety culture perception, $M \pm SD$
Age[b]	20–30 years	119.56 ± 25.74
	31–40 years	151.50 ± 28.45
	41–50 years	148.58 ± 12.24
p		**<0.001**
Sex[a]	Male	133.60 ± 27.94
	Female	143.11 ± 29.09
p		**0.020**
Marital status[b]	Single	126.71 ± 35.12
	Married	144.72 ± 24.84
	Divorced	147.93 ± 13.21
	Widow	141.23 ± 20.83
p		**<0.001**
Type of Hospital[b]	Private	138.05 ± 35.97
	Governmental	145.57 ± 20.09
	Both	123.05 ± 26.53
p		**<0.001**
Experience[b]	≤5 years	118.03 ± 23.94
	6–10 years	138.68 ± 34.15
	>10 years	147.52 ± 17.34
p		**<0.001**
Working hours[a]	≤8 h	155.47 ± 1.30
	>8 h	135.31 ± 30.60
p		**<0.001**
Previous safety courses[a]	No	130.20 ± 24.89
	Yes	164.36 ± 24.75
p		**<0.001**
Working Units[b]	General ICU	139.32 ± 31.42
	Cardiac ICU	140.02 ± 18.60
	Coronary ICU	119.60 ± 30.46
	Neuro ICU	155.00 ± 0.00
p		0.139
Position in work[b]	Registered nurse	147.05 ± 33.62
	Technical nurse	127.65 ± 23.80
	Head nurse	155.80 ± 1.63
p		**<0.001**
Educational level[b]	Diploma	127.69 ± 23.68
	Bachelors	147.25 ± 33.79
	Master	155.80 ± 1.63
p		**<0.001**
Contact with patient[a]	Direct	137.00 ± 30.08
	Indirect	152.81 ± 7.06
p		**0.015**

[a]Independent *t*-test.
[b]ANOVA test.
SD: standard deviation.

Table 6. Association Between Patient Safety Culture Perception and Adverse Events.

Adverse events, *n* (%)		Overall Safety Culture perception $M \pm SD$	*t*-Test	*p*
Pressure ulcer	Yes	138.16 ± 28.64	1.494	.137
	No	154.71 ± 31.56		
Patient fall	Yes	137.83 ± 27.06	2.182	**.030**
	No	160.37 ± 32.45		
Adverse drug event	Yes	137.31 ± 27.45	2.685	**.008**
	No	159.23 ± 40.89		
Surgical wound infection	Yes	137.82 ± 28.31	1.963	.051
	No	156.10 ± 35.56		
Patients or their families' complaints	Yes	137.58 ± 27.85	2.809	**.005**
	No	166.37 ± 40.61		
Infusion or transfusion reaction	Yes	138.29 ± 28.32	.900	.369
	No	146.36 ± 38.24		

69.7%. These percentages were lower than those recommended by the AHRQ. The composites with the highest and lowest positive ratings were consistent with those identified in previous studies conducted in the Middle East region (Ali et al., 2022; Alquwez et al., 2018; Khamaiseh et al., 2020). This study revealed lower positive ratings across various aspects, except for organizational learning/continuous improvement, frequency of events reported, and management support for patient safety, which was consistent with another study (Alsabri et al., 2022b).

However, these aspects were rated higher than those in previous studies, suggesting a need for improvement (Ali et al., 2022; Alquwez et al., 2018; Khamaiseh et al., 2020). The highest mean included teamwork within hospital units, the overall perception of patient safety, and teamwork across and within units. These findings indicate that the overall perception of patient safety in rural hospitals is poor and urgently requires improvement. Nurse supervisors must prioritize teamwork across hospital units, non-punitive error responses, management support for patient safety, communication openness, and overall safety perceptions. This finding is in line with that of Kakemam et al. who reported that the patient safety culture received a PRR total score of 34.1% (Kakemam et al., 2021).

All patient safety culture variables had PRR ratings that were less than 50%. These results demonstrate that teaching hospital patient safety culture requires urgent reforms. Ismail and Khalid (2022) studied the patient safety culture among healthcare professionals at a cluster hospital in Malaysia and reported that low positive answers ranged from 22% to 41% for the remaining five dimensions. Alquwez et al. (2018) explored the perceptions of 351 nurses working in different hospitals in Saudi Arabia. They found that the overall nurses' perception of six items was weak including; overall nurses' perception of patient safety, handoffs and transitions, open communication, staffing, frequency of events reported, and non-punitive response to errors. This aligns with the findings of Salih et al. (2021), who surveyed 350 Egyptian nurses on their views on patient safety and found that none of the six attitude domains of safety (job satisfaction, teamwork, safety climate, management perception, stress recognition, and working conditions) received a positive mean score above 75% (Salih et al., 2021). Similarly, a study of 644 nurses

working in 91 certified primary healthcare centers in Jordan identified a need for improvement in teamwork climate, safety climate, stress recognition, and management perception (Khamaiseh et al., 2020).

In the present study, the overall perception of patient safety was moderate. This finding is congruent with previous studies stating that nurses have limited proficiency in performing safe clinical operations for patients (Cho & Choi, 2018; Kakemam et al., 2022c; Hafezi et al., 2022). However, educational initiatives can increase patient safety competency in accordance with the WHO Patient Safety Curriculum Guide (Lee et al., 2022). Additionally, these results highlight the significance of enabling nurses to carry out safe clinical procedures in order to increase their safety competency (Alkubati et al., 2023; Lee et al., 2022; Rebeschi, 2020; Salameh et al., 2023). According to research conducted in Fayoum, El-Sherbiny et al. 2020 reported that the perception of patient safety in main urban hospitals was generally inadequate. The overall patient safety rating was 46.56%. Organizational learning and continuous development received the highest mean composite score (65.36%), while communication openness had the lowest reported score (17.9%) (El-Sherbiny et al. 2020).

These results are in line with the findings of a previous study performed at three university hospitals in Qom, Iran. The lowest scores among the study groups were attributed to staffing and non-punitive mistake responses (Hafezi et al., 2022). Non-punitive response to error had the lowest score and highest potential for development according to Han et al. (2020). Thus, room for improvement in terms of patient safety culture was the nonpunitive response to errors. This low score implies that nurses may feel intimidated when reporting mistakes. A systematic review revealed that underreporting of patient safety and medical error incidents occurs frequently in hospitals worldwide (Yusuf & Irwan, 2021). According to Foda et al. (2020), non-punitive responses to errors had the lowest score, whereas teamwork within units had the highest average percentage positive score. These findings can be interpreted as follows: a blame-and-shame culture at work undermines accountability, makes employees feel insecure, and makes them more likely to conceal their mistakes than to voice their concerns about patient safety (Alsabri et al., 2022b).

Working in such a setting would make it difficult to learn from mistakes because people would only receive criticism and punishment, while system flaws would go unnoticed (Ismail and Khalid 2022). Ramos and Calidgid (2018) reported that the dimension with the highest positive ratings was teamwork among units (91.5%), followed by continuous organizational learning improvement (86.89%), and the dimension with the lowest positive ratings was non-punitive response to error (17.65%).

AE occurrence can be a critical performance indicator that demands significant efforts to prevent and maintain patient safety (Alsabri et al., 2022a). These events can be avoided by ensuring that healthcare professionals have the necessary skills and knowledge (Wang et al., 2014). According to this study findings, most of the participating nurses stated that AEs occurred frequently, followed infrequently, and daily. The most frequent adverse events were patient or family complaints (65.5%), adverse drug events (56.5%), and falls (57.0%). This finding is supported by Kakemam et al. (2022a), who reported that over half of the surveyed nurses reported the occurrence of AEs that harm patients. This was attributed to long work hours, workplace stress, ineffective teamwork, improper shifts, low cognition, severe workload, and poor patient safety. In addition, AEs due to medication errors had 35.7% and falls 34.5%. As a result, a substantial proportion of hospitalized patients have AEs, highlighting the significance of thorough and methodical preparation by health policymakers to avoid such occurrences.

Demographic characteristics affected the perception of safety culture across the six domains. The findings indicated a correlation between participant characteristics and perceptions of overall safety. The females between the ages of 31 and 40 who were divorced, employed by government hospitals, with more than 10 years of experience, working fewer than 8 h per day, receiving safety training, working in neuro ICU, head nurses, and possessing a master's degree had the highest mean of safety perception reported by intensive care nurses. Furthermore, age, sex, marital status, hospital type, years of experience, working hours, prior safety training, position at work, degree of education, and mode of contact with the patient were all significantly correlated with one another.

Ismail and Khalid (2022) found that factors, such as age, gender, education level, workstation, involvement in patient safety training, positive perception of the incident reporting system, non-blaming nature of the system, and instructive nature of the system, were correlated with a positive patient safety culture. Kakemam et al. (2022b) revealed significant factors influencing nurses' perceptions of patient safety culture, such as age, gender, marital status, years of experience, work units, working hours, and hospital size. According to Zabin et al. (2022), there was no association between gender, length of time at the hospital, the current work area or profession, and weekly hours worked with the PSC. AEs, which continue to be a major global problem, have a substantial impact on patient safety and treatment standards of treatment (Zabin et al., 2022). A safety culture assessment provides a company insight into how management and employees view and feel about patient safety. Additionally, it aims to boost performance rather than stigmatize people (Alsabri et al., 2022a).

According to the results, higher nurses' perceptions of patient safety culture were significantly associated with lower perceptions of adverse events (patient falls, adverse drug events, and complaints from patients and their families). These results are consistent with those of another study conducted by Kakemam et al. (2021), who studied the perceptions of 2295 nurses in thirty-two teaching hospitals in

Iran. Furthermore, other studies conducted in different countries were incongruent with these study findings of an inverse association between patient safety culture and AEs (Han et al., 2020; Zabin et al., 2022).

Recommendations and Implications for Practice

Overall, the current study underscores the critical role of education and training in fostering a robust patient-safety culture and reducing the incidence of adverse events. To effectively enhance patient safety, hospitals should implement targeted interventions designed to strengthen the culture of patient safety within their institutions, such as continuous education and training programs that emphasize patient safety practices and prevention of medical errors. Additionally, hospital management should prioritize the implementation of electronic health record systems and enhance nurses' communication skills.

Limitations

There are some limitations in this study. One limitation is that this study used a cross-sectional and quantitative design. A longitudinal and qualitative design is recommended in future studies to provide more explanation and details to understand this phenomenon. Another limitation is that this study used a convenience sample, which limited the generalizability of the results.

Conclusions

This study examined intensive care nurses' perception of patients' safety culture and its relationship with adverse events in Egypt. The study revealed that nurses' perception of the patient safety culture was moderate, and the AEs reported by nurses had frequency several times a week, followed by once a week and every day. According to this study investigation, there have been adverse medication responses, patient falls, and complaints from patients or their families. 31- to 40-year-old female employees at government hospitals who were divorced, had more years of experience, worked fewer than 8 h a day, and had a higher level of education all influenced how safety culture was seen overall. The prevalence of adverse events is linked to patient safety culture, and one crucial component that influences this culture is cooperation both inside and within hospital departments. In contrast, the frequency of adverse events was not as significantly correlated with staffing numbers, non-punitive error response, handoffs and transitions, or inter- and intra-departmental collaboration as it was with patient safety culture.

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Authorship Statement

All authors listed meet the authorship criteria, and all authors are in agreement with the content of the manuscript.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Data Availability

The data utilized to support the results of the research are accessible to the corresponding author upon request.

Ethical Considerations

The study obtained ethical approval from the Damanhour University Ethics Committee (Ethical Approval No: 64-b-2022). Written objectives of the study were provided to each participant, ensuring transparency. The study was conducted with privacy and confidentiality. Participation was voluntary, with participants having the right to withdraw at any time. Consent was obtained by asking nurses to answer the questions only if they agreed with the study's objectives.

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Supplemental Material

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