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# Nurses' attitudes towards safety and their association with nurses' perceptions of adverse events and quality of care: a cross-sectional study

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## Abstract

**Aims:** To explore nurses' attitudes towards safety and their association with nurses' perceptions of adverse events and quality of care in Saudi Arabian hospitals.
**Design:** A cross-sectional study using a web-based survey.
**Methods:** A web-based survey was administered to nurses working in five hospitals in Saudi Arabia. Nurses' attitudes regarding safety, nurses' perceptions of the frequency of seven adverse events, and nurses' views on quality of care were collected. Descriptive and predictive analyses were performed.
**Results:** Nurses' attitudes regarding safety ($n = 653$) were classified as less than positive, with an overall score of 68.96%. The highest subscale mean score was for safety behaviour (73.1%), which was followed by job satisfaction (72.6%); the lowest subscale mean score was for working conditions (61.7%). Positive attitudes towards safety were associated with a lower frequency of pressure injuries, patient falls, healthcare-

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associated infections and unexpected deaths due to deterioration; positive attitudes towards safety were also associated with higher quality of care.
**Conclusion:** Nurses' attitudes towards safety contribute to preventing avoidable adverse events and to improving quality of care. This study builds on the growing body of evidence that demonstrates fostering a strong safety culture is essential for improving patient outcomes.

**Keywords**
adverse events, nurses, patient safety, quality of care, safety attitude

## Introduction

Quality and safety are crucial in the healthcare system and can be monitored by examining adverse events. *Adverse events* refer to an unintended action or unanticipated effect caused by procedures or healthcare workers' practices that are unrelated to the patients' primary diagnoses or the reason they were admitted to the hospital (Kakemam et al., 2019). Adverse events that are considered sensitive to nursing care include pressure injuries, patient falls and healthcare-associated infections (Sim et al., 2019). The rate of adverse events among hospitalised patients globally is well reported, ranging from 3.5% to 21.9% (Kakemam et al., 2019; Murphy et al., 2021). Many adverse events are considered preventable, can significantly impact patient safety and quality of life and can lead to disability or death (Murphy et al., 2021). Adverse events also have financial consequences on health services; the cost of pressure injuries alone in Australian public hospitals is approximately AUD $9 billion per year (Nghiem et al., 2022).

Nurses have a key role in reducing adverse events (Murphy et al., 2021) and are a critical part of promoting patient safety. Nurses provide continuous surveillance of patients in healthcare settings and implement strategies, such as risk assessments and management plans to impede pressure injuries and falls, to prevent adverse events (Kritsotakis et al., 2022). Individual nurses' attitudes towards safety practices may contribute to the rate of adverse events and influence patient safety (Alanazi et al., 2022). Scholars have examined the relationship between nurses' attitudes towards safety and adverse events, but evidence is limited on the association with nursing care (Ausserhofer et al., 2013; Han et al., 2020; Hessels et al., 2019). To date, this issue has not been studied in Saudi Arabia.

### *Background*

Nurses' attitudes towards safety have been proven to be associated with nurses' beliefs, perceptions, or feelings towards safety practices, procedures and policies in healthcare settings (Alanazi et al., 2022). Individual's attitudes regarding safety form an organisation's collective safety culture, which evolves over time and requires periodic evaluations that can be achieved by measuring individual staff attitudes towards safety (Edgar et al., 2021). *Safety culture* is the 'staff values, beliefs and norms about what is important in a healthcare organisation, how organisation members are expected to behave, what attitudes and actions are appropriate or inappropriate and what processes and procedures are rewarded and punished, concerning patient safety' (Kakemam et al., 2021: 2). Safety culture encompasses the structures and processes that promote the execution of measures that lower the risk of adverse events, enhance the quality of care and ensure patient safety (Bagnasco et al., 2020).

The relationship between nurses' attitudes towards safety and adverse events has been widely examined and summarised (Alanazi et al., 2022); however, there is limited evidence of

the association between safety attitude subscales and adverse events, especially those events that are considered sensitive to nursing care. Taylor et al. (2012) employed the Safety Attitudes Questionnaire (SAQ) in their early study, reporting that positive teamwork scores are correlated with fewer pressure injuries. Conversely, the authors of five subsequent studies have employed the hospital survey on patient safety culture, finding no association between teamwork both within and across units and pressure injuries (Brown and Wolosin, 2013; Han et al., 2020; Kakemam et al., 2021; Wang et al., 2014; Yesilyaprak and Demir Korkmaz, 2021). Additionally, few studies have presented associations between safety attitudes and patient falls. Three studies have offered a mixed association between nurses' positive attitudes towards safety and reduced rates of patient falls (Han et al., 2020; Kakemam et al., 2021; Yesilyaprak and Demir Korkmaz, 2021), whereas the authors of four other studies have found no association (Ausserhofer et al., 2013; Hessels et al., 2019; Taylor et al., 2012; Wang et al., 2014); two of these studies have presented examinations of unexpected associations (Brown and Wolosin, 2013; Kakemam et al., 2021). Similarly, the associations between safety attitudes and healthcare-related infections vary across studies. Han et al. (2020) found that nurses' attitudes regarding safety correlated with the occurrence of Urinary Tract Infections (UTIs) and ventilation-associated pneumonia but were not related to bloodstream infections. Yesilyaprak and Demir Korkmaz (2021) reported that nurses' attitudes towards safety were associated with bloodstream infections and ventilation-associated pneumonia but not with UTIs.

The present study was guided by Donabedian's (1988) conceptual framework of structure-process-outcome and explains how nurses' attitudes towards safety are related to adverse events and quality of care. This framework includes an assessment of the quality of healthcare settings as well as a description of how structural elements such as nurses' characteristics impact the process of care and nurses' attitudes towards safety, which in turn influence patient outcomes. Patient outcomes are examined using nurses' perceptions of adverse events and the quality of care provided in their units.

## Materials and methods

### *Aims*

This study presented an exploration of individual nurse's attitudes towards safety and their impact on adverse events and quality of care in Saudi Arabia. The research questions are as follows:

1. What are the levels of nurses' attitudes towards safety and their perceptions of adverse events and quality of care in Saudi Arabia?
2. What is the relationship between nurses' attitudes towards safety and their perceptions of the frequency of adverse events and quality of care in Saudi Arabia?

### *Design*

A cross-sectional study was conducted to examine the associations between nurses' attitudes regarding safety, nurses' perceptions of the frequency of adverse events that occurred in their unit, and nurses' views on the quality of care. The Strengthening the Reporting of Observational Studies in Epidemiology guidelines were used to report the findings (von Elm et al., 2007). This research is a component of a broader doctoral project (Alanazi, 2023). This paper reports on data from the cross-sectional survey.

## Participants

This study invited all 947 registered nurses who worked in the 35 in-patient nursing units at five hospitals in Saudi Arabia to participate. Participating hospitals were acute-care public hospitals that were purposely selected because of their participation in data reporting to the Ministry of Health (MOH). Eligible nurses had been employed for at least 3 months in a participating unit (medical, surgical, mixed medical and surgical or intensive care) and could read and understand English. Nurses with less than 3 months of experience were excluded, as they were still completing orientation.

## Ethical considerations

Ethical approval was obtained from the Human Research Ethics Committee of the University of Wollongong, Australia (Approval No. 2021/214). Other ethical approvals were sought from the Saudi Arabia MOH (Approval No. 1443-206207), King Saud Medical City (Approval No. H1RI-18-Jul21-01), and King Fahad Medical City (Approval No. 21-296E).

## Data collection

A web-based survey was distributed to nurses in the 35 participating units, and project information with a survey link was emailed to all eligible nurses through their official hospital email. The survey's launch page included a participant information sheet, and participation was voluntary. The survey comprised demographic questions and the SAQ. Nurses were also asked to provide their perceptions of the quality of care and frequency of adverse events.

## Study variables

The variables examined in this study are nurses' attitudes regarding safety, nurses' perceptions of the frequency of adverse events and nurses' ratings of their unit's quality of care.

*Attitudes towards safety.* Attitudes towards safety were measured using the SAQ (short form), which was developed by Sexton et al. (2006) to collect information about individual attitudes and perceptions regarding safety factors. Original subscales included teamwork climate, safety climate, job satisfaction, stress recognition, perceptions of management and working conditions (Sexton et al., 2006). The perceptions of management subscale in this study included both unit and hospital management. Additionally, the safety behaviour subscale (three items related to collaboration and communication; Items 33, 34 and 35) was included in keeping with other recent researchers who have used the SAQ (Dickens et al., 2021; Elsous et al., 2017). The stress recognition subscale score was excluded from the total SAQ score due to its negative correlation with other subscales; additionally, recent evidence indicates the benefit of its exclusion (Taylor and Pandian, 2013). The SAQ includes 41 items, and responses were recorded on a 5-point Likert scale ranging from 1 = "Strongly disagree" to 5 = "Strongly agree". The SAQ items were transformed to fit a scale from 0 to 100 (mean/5 × 100); a positive attitude towards safety was indicated by a score of 75 or greater (Edgar et al., 2021).

*Adverse events.* Adverse events were examined through nurses' perceptions of the frequency of seven potentially adverse events that occurred in their unit. All adverse events were

nursing-sensitive patient outcomes (Sim et al., 2019): (a) pressure injuries, (b) patient falls with injury, (c) patient falls without injury, (d) patient death (unexpectedly or due to a deterioration in patient condition) and three types of healthcare-associated infections, (e) bloodstream infections, (f) UTIs, and (g) pneumonia. Nurses were asked to estimate the occurrence of adverse events over the past year using a 7-point Likert scale ranging from 1 = 'Never' to 7 = 'Daily'. The responses were then dichotomised for analysis to form a binary variable: 0 indicated that an event never occurred or occurred several times per year, and 1 indicated that an event occurred once per month or more frequently.

*Quality of care.* Nurses' perceptions of the quality and safety of care have been used in many studies (Aiken et al., 2017; Bagnasco et al., 2020). This study the RN4CAST approach to formulate four questions to evaluate nurses' perceptions of the quality and safety of care in their units and hospitals (Smith et al., 2020). Participants answered using a 4-point Likert scale, where 1 = 'Poor' and 4 = 'Excellent'. Responses were classified into two categories: favourable (good and excellent) and unfavourable (poor and fair), which were represented by binary variables (1 for favourable and 0 for unfavourable).

## *Validity, reliability and rigour*

The SAQ is a valid, reliable instrument that has been widely used to evaluate healthcare professionals' attitudes regarding safety (Churruca et al., 2021) and has been translated into many languages (Alanazi et al., 2022). In this study, the original English SAQ was used, as English is the official language employed in MOH hospitals in Saudi Arabia. The SAQ's factor structure was assessed by multilevel confirmatory factor analysis (Sexton et al., 2006), although in this study, the internal reliability was tested using Cronbach's alpha. The values of each subscale are presented in Table 2. The SAQ's overall Cronbach's alpha score was 0.956. Additionally, the items that measure adverse events and quality of care have been validated in similar populations and contexts, thus ensuring their appropriateness for this study. This contributes to the findings' robustness.

## *Data analysis*

IBM Corp. Released 2021. IBM SPSS Statistics for Windows, Version 28.0. Armonk, NY: IBM Corp was utilised to conduct data analyses. After data cleaning, a missing value analysis as conducted to locate absent data; the overall percentage of missing data for SAQ items was less than 2.1%. Multiple imputation was used to manage data that was assessed as missing at random or not at random (Boussat et al., 2021). A variety of descriptive analyses were performed to summarise the data, including determining frequencies for categorical variables as well as means and standard deviations for continuous variables in nurses' responses. Pearson's $r$ was used to assess the strength of the correlation between SAQ subscales. Furthermore, the associations between SAQ subscales and adverse events were examined using bivariate regression models. Logistic regression models were created with adverse events and quality of care as the dependent variables and SAQ subscales as the independent variables. The models were controlled for the type of unit and nurses' characteristics, as they are known to mediate these relationships (Audet et al., 2018). Significant associations were observed at $p < 0.05$; however, the odds ratio and 95% confidence interval are also reported. The odds of an adverse event occurring were calculated based on a one-point change in the mean subscale score of 5 for SAQ items.

## Results

### Demographics

Of the 947 nurses invited to participate, 755 accessed the online survey and completed the consent portion of the survey. Participants with incomplete demographic data were excluded. Thus, a total of 653 completed surveys were returned, for a response rate of 68.95%. The majority of participants were female (83.9%), and more than half were aged between 30 and 39 (62.6%). Most of the participants were staff nurses (77.9%); 80.2% held a bachelor's degree. Nearly half of the participants were from the Philippines (45.3%). Table 1 provides the participants' demographic characteristics.

### Nurses' attitudes towards safety

The overall SAQ mean score was 68.9 (SD = 12.2), which indicates that nurses had less-than-positive attitudes towards safety. Approximately 35.2% ($n = 230$) of participants recorded overall SAQ scores that were greater than 75, indicating that they held positive attitudes towards safety. The highest percentage of positive scores across subscales was recorded for the safety behaviour subscale (51.8%) and related to collaborations with healthcare professionals, whereas the lowest percentage was for perceptions of hospital management (26.3%). Analysis of the eight subscales identified that the highest mean score was for safety behaviour (Mean = 73.1, SD = 14.9), which was followed by job satisfaction (Mean = 72.6, SD = 16.3), and the lowest mean score was for working conditions (Mean = 61.7, SD = 17.1), perceptions of hospital management (Mean = 63.5, SD = 15.5), and stress recognition (Mean = 65.5, SD = 18.6). The average scores for nurses' attitudes towards safety are presented in Table 2.

### Adverse events and quality of care

The majority of nurses indicated that adverse events occurred a few times a year; this response was followed by the options of at least once per month and several times per month. A small number of nurses reported that adverse events occurred at least once a week; this response was followed by the options of several times a week and daily (Table 3). The frequency of adverse events was merged into a binomial variable that represented whether events never occurred or occurred occasionally. The adverse events that were seen most frequently were pressure injuries (42.6%), and the least frequent adverse event was patient falls with injuries (8.7%). Nurses' perceptions about the quality of care in their hospital and unit are presented in Table 4. Most nurses reported that their hospital and unit's overall quality of care was good, which was followed by fair.

### Correlation among subscales regarding attitudes towards safety

A Pearson's $r$ correlation was used to identify associations and multicollinearity between SAQ subscales. There was a strong to very strong positive correlation between all SAQ subscales except stress recognition. The strongest correlation was found between the overall SAQ score and job satisfaction ($r = 0.873$, $p = 0.01$),whereas the lowest weak positive correlation was observed between stress recognition and safety behaviours ($r = 0.119$, $p = 0.01$). Only stress recognition revealed no statistical significance with unit management ($r = -0.028$, $p = 0.480$). Additionally, stress recognition was negatively correlated with the overall SAQ scores and all subscales. These results indicated that stress recognition cannot be included in the overall SAQ score, and each subscale should be modelled separately due to high multicollinearity between SAQ subscales.

**Table 1.** Characteristics of individual nurses ($n = 653$).

| Variables | *N* | (%) |
|---|---|---|
| Age (years) – missing | 8 | 1.2 |
| 22–29 | 153 | 23.4 |
| 30–39 | 409 | 62.6 |
| 40–49 | 74 | 11.3 |
| ⩾50 | 9 | 1.4 |
| Gender – missing | 0 | |
| Male | 87 | 13.3 |
| Female | 548 | 83.9 |
| Prefer not to say | 18 | 2.8 |
| Nationality – missing | 2 | 0.3 |
| Saudi | 140 | 21.5 |
| Filipino | 296 | 45.3 |
| Indian | 196 | 30 |
| Egyptian | 10 | 1.5 |
| Sudanese | 8 | 1.2 |
| Jordanian | 1 | 0.2 |
| Highest qualification – missing | 0 | |
| Diploma | 77 | 11.8 |
| Bachelor | 524 | 80.2 |
| Graduate certificate | 23 | 3.5 |
| Masters | 29 | 4.4 |
| Experience (years) – missing | 28 | 4.3 |
| ⩽1 | 39 | 6 |
| 2–5 | 113 | 17.3 |
| 6–10 | 246 | 37.7 |
| 11–15 | 174 | 26.6 |
| 16–20 | 38 | 5.8 |
| ⩾21 | 15 | 2.3 |
| Unit categories | | |
| Critical care unit ($n = 8$) | 314 | 48.1 |
| Medical unit ($n = 10$) | 111 | 17 |
| Surgical unit ($n = 8$) | 87 | 13.3 |
| Medical-surgical unit ($n = 9$) | 141 | 21.6 |
| Shift duration – missing | 4 | 0.6 |
| 8 hours | 224 | 34.3 |
| 12 hours | 415 | 63.6 |
| Other | 10 | 1.5 |
| Job category – missing | 1 | 2 |
| Registered nurse | 509 | 77.9 |
| In-charge nurse | 96 | 14.7 |
| Head nurse | 36 | 5.5 |
| Nurse educator | 11 | 1.7 |
| Job status – missing | 7 | 1.1 |
| Permanent | 585 | 89.6 |
| Temporary | 45 | 6.9 |
| Casual employment | 16 | 2.5 |

**Table 2.** Total score of the Safety Attitudes Questionnaire sub-scale ($N = 653$).

| SAQ sub-scale | Cronbach's α** | Mean (SD) | 95% CI*** | % +ve scores (>75/100) |
|---|---|---|---|---|
| Overall SAQ score* | 0.956 | 68.96 (12.23) | 68.0–69.9 | 35.2 |
| Teamwork Climate | 0.772 | 71.48 (12.98) | 70.5–72.5 | 40.6 |
| Safety Climate | 0.807 | 72.17 (12.26) | 71.2–73.1 | 40.9 |
| Job Satisfaction | 0.894 | 72.64 (16.29) | 71.4–73.9 | 52.5 |
| Perceptions of Unit Management | 0.801 | 68.21 (13.65) | 67.2–69.3 | 37.2 |
| Perception of Hospital Management | 0.834 | 63.51 (15.55) | 62.3–64.7 | 26.3 |
| Stress Recognition | 0.837 | 65.49 (18.57) | 64.1–66.9 | 38.0 |
| Working Condition | 0.820 | 61.73 (17.13) | 60.4–63.0 | 28.5 |
| Safety Behaviour | 0.837 | 73.10 (14.91) | 71.9–74.1 | 51.8 |

*Not including the subscale stress recognition.
α**Coefficient of reliability.
***CI: 95% Confidence Interval

## *Association between attitudes towards safety, adverse events and quality of care*

Table 5 summarises the associations between attitudes towards safety, frequency of adverse events, and quality of care reported by nurses. The associations were adjusted for nursing unit type and individual nurses' characteristics, including age, gender, qualification, background, experience, position, shift duration and job status. The logistic regression results highlight that attitudes regarding safety affected nurses' perceptions of adverse events and quality of care.

*Nurses' attitudes towards safety and their perceptions of the frequency of adverse events and quality of care.* Nurses' positive attitudes towards teamwork and safety behaviour significantly decreased the frequency of all adverse events. For every one-unit increase in the score for teamwork climate, the odds of pressure injuries occurring decreased by 43.7% (OR = 0.563, 95% CI = 0.410–0.733), patient falls with injury decreased by 47.4% (OR = 0.526, 95% CI = 0.300–0.922), patient falls without injury decreased by 55.6% (OR = 0.444, 95% CI 0.269–0.734), bloodstream infections decreased by 43.4% (OR = 0.566, 95% CI = 0.396-0.809), UTIs decreased by 57.8% (OR = 0.422, 95% CI = 0.295–0.605), pneumonia decreased by 50.7% (OR = 0.493, 95% CI = 0.351-0.693), and unexpected death decreased by 38.6% (OR = 0.614, 95% CI = 0.446–0.846).

A strong safety climate and job satisfaction among nurses were significantly associated with a lower frequency of six of the seven adverse events. A one-unit increase in the safety climate and job satisfaction scores led to the odds of UTI occurrences decreasing by 64.3% (OR = 0.357, 95% CI = 0.239–0.532) and 45% (OR = 0.550, 95% CI = 0.415–0.728), respectively. There were no statistically significant associations between safety climate and job satisfaction and the occurrence of patient falls with injury.

Positive overall SAQ score, hospital management, working conditions and stress recognition were significantly associated with reduced occurrence of five of the seven adverse events. A one-unit increase in the overall SAQ, hospital management and working conditions scores led to a decrease in the odds of unexpected deaths occurring of 63.7% (OR = 0.363, 95% CI = 0.252–0.525), 49.7% (OR = 0.503, 95% CI = 0.382–0.664) and 51.6% (OR = 0.484, 95% CI = 0.375–0.624), respectively. There was no statistically significant relationship between overall SAQ, hospital management and working conditions scores and the occurrence of patient falls. Additionally, stress recognition was not significantly associated with patient falls without injury or pneumonia. However, a one-unit increase in the stress recognition score was associated with a 210.1% increase in the odds of patient falls with injury (OR = 2.111, 95% CI = 1.327–3.358).

**Table 3.** Nurses' perceptions of the frequency of adverse events on their unit in the last year ($N = 620$*).

| Adverse events | Never happened | | Happened | | | | |
|---|---|---|---|---|---|---|---|
| | Never | Few times a year | At least once per month | Several times per month | At least once a week | Several times a week | Daily |
| | *N* (%) | *N* (%) | *N* (%) | *N* (%) | *N* (%) | *N* (%) | *N* (%) |
| Pressure injuries | 84 (12.9) | 258 (39.5) | 146 (22.4) | 54 (8.3) | 29 (4.4) | 25 (3.8) | 24 (3.7) |
| Patient falls with injuries | 347 (53.1) | 216 (33.1) | 13 (2) | 8 (1.2) | 8 (1.2) | 6 (0.9) | 22 (3.4) |
| Patient falls without injuries | 275 (42.1) | 277 (42.4) | 24 (3.7) | 6 (0.9) | 9 (1.4) | 5 (0.8) | 24 (3.7) |
| Urinary tract infections | 240 (36.8) | 242 (37.1) | 74 (11.3) | 27 (4.1) | 8 (1.2) | 7 (1.1) | 22 (3.4) |
| Pneumonia | 194 (29.7) | 250 (38.3) | 75 (11.5) | 46 (7) | 17 (2.6) | 17 (2.6) | 21 (3.2) |
| Blood stream infections | 260 (39.8) | 216 (33.1) | 65 (10) | 31 (4.7) | 21 (3.2) | 10 (1.5) | 17 (2.6) |
| Patient died unexpectedly due to deterioration | 158 (24.2) | 249 (38.1) | 69 (10.6) | 75 (11.5) | 14 (2.1) | 30 (4.6) | 25 (3.8) |

*Thirty-three participants were excluded from the study: 12 participants had less than 1 year of experience, and 21 participants did not complete the items.

**Table 4.** Nurses' perceptions about quality and safety in their hospital/unit (*N* = 620*).

| Variables | Poor | Fair | Good | Excellent |
|---|---|---|---|---|
| | N (%) | N (%) | N (%) | N (%) |
| Hospital quality of care | 59 (9) | 191 (29.2) | 292 (44.7) | 78 (11.9) |
| Unit quality of care | 32 (4.9) | 159 (24.3) | 315 (48.2) | 114 (17.5) |
| Unit safety of care | 30 (4.6) | 129 (19.8) | 338 (51.8) | 123 (18.8) |
| Last shift quality of care | 31 (4.7) | 130 (19.9) | 333 (51) | 126 (19.3) |

*Thirty-three participants were excluded from the study: 12 participants had less than 1 year of experience, and 21 participants did not complete the items.

Individual nurse's attitudes towards safety significantly impacted their perceptions of care quality (see Table 5). All SAQ subscale scores were positively associated with care quality for both hospital and unit. Higher overall SAQ scores were likely to correlate with an increase in the quality of hospital care by approximately 28 times (95% CI = 16.223–50.842) and unit level by 23 times (95% CI = 13.182–41.089). Subscale score analysis revealed that a better safety climate was likely to increase hospital quality of care approximately 10 times (95% CI = 6.532–16.164) and unit quality of care nine times (95% CI = 6.174–15.473). Lower stress recognition scores were associated with an approximately 43% higher hospital quality of care (95% CI = 0.469–0.707) and an approximately 39% higher unit quality of care (95% CI = 0.495–0.761).

## Discussion

This study's findings indicate that nurses who have positive attitudes towards safety report less frequent adverse events and higher quality of care, which is consistent with international literature on the influence of safety-conscious attitudes on adverse events and quality of care (Kakemam et al., 2021; Wang et al., 2014). However, this study is the first in Saudi Arabia to examine these concepts. The findings presented in this study advance the evidence on the association between attitudes regarding safety and adverse events and were determined by using the SAQ, which captures the psychological, behavioural and situational elements of safety culture (Ellis et al., 2020). The analysis included the concept of safety behaviour and examined specific adverse patient events that are considered sensitive to nursing care.

Adverse events significantly affect patients and the healthcare system and should be prevented. The findings presented in this study highlight that nurse-reported adverse events in Saudi Arabia occur at a relatively high rate. Just under half of all nurses ($n$ = 278, 42.6%) reported that pressure injuries happened at least once per month, which is higher than the occurrence reported in international literature (Ausserhofer et al., 2013; Kakemam et al., 2021; Wang et al., 2014). The increased rates of adverse events noted in this study may be due to patient acuity and the impact of presentations during the COVID-19 pandemic as well as stressful working conditions associated with COVID (Al Muharraq, 2021), which may have exacerbated low staffing levels and longer shift durations.

Adverse events impact the safety and quality of care and increase healthcare costs. Despite global evidence on the economic costs of adverse events (Nghiem et al., 2022), there is limited research on this topic in the Saudi Arabian context. A recent study quantifies Saudi Arabian paediatric intensive care's mean cost per patient as SAR3.63 million (equivalent to US$0.97 million) in 2014 (Temsah et al., 2021). Although there is no available evidence on the cost of adverse events in Saudi Arabia, the higher rates of hospitalisation suggest a higher cost of treating adverse events,

**Table 5.** Binary logistic regression – the association between individual nurses' safety attitudes and adverse events.

| | Pressure injury | Patient falls (injury) | Patient falls (no injury) | Bloodstream infections | Urinary tract infections | Pneumonia | Unexpected death | Hospital quality | Unit quality |
|---|---|---|---|---|---|---|---|---|---|
| | OR (p) 95% CI | | | | | | | | |
| 1* | 0.499 (<0.001)<br>0.354–0.703 | 0.761 (0.346)<br>0.431–1.343 | 0.608 (0.065)<br>0.358–1.031 | 0.399 (<0.001)<br>0.266–0.599 | 0.383 (<0.001)<br>0.257–0.570 | 0.452 (<0.001)<br>0.311–0.657 | 0.363 (<0.001)<br>0.252–0.525 | 28.719 (<0.001)<br>16.223–50.842 | 23.273 (<0.001)<br>13.182–41.089 |
| 2 | 0.563 (<0.001)<br>0.410–0.773 | 0.526 (0.025)<br>0.300–0.922 | 0.444 (0.002)<br>0.269–0.734 | 0.566 (0.002)<br>0.396–0.809 | 0.422 (<0.001)<br>0.295–0.605 | 0.493 (<0.001)<br>0.351–0.693 | 0.614 (0.003)<br>0.446–0.846 | 6.819 (<0.001)<br>4.534–10.256 | 7.514 (<0.001)<br>4.889–11.549 |
| 3 | 0.507 (<0.001)<br>0.358—0.719 | 0.645 (0.123)<br>0.370–1.127 | 0.547 (0.022)<br>0.326–0.916 | 0.437 (<0.001)<br>0.294–0.651 | 0.357 (<0.001)<br>0.239–0.532 | 0.438 (<0.001)<br>0.301–0.637 | 0.453 (<0.001)<br>0.316–0.648 | 10.276 (<0.001)<br>6.532–16.164 | 9.774 (<0.001)<br>6.174–15.473 |
| 4 | 0.635 (<0.001)<br>0.495–0.814 | 0.781 (0.250)<br>0.512–1.190 | 0.633 (0.014)<br>0.428–0.937 | 0.628 (0.001)<br>0.473–0.833 | 0.550 (<0.001)<br>0.415–0.728 | 0.696 (0.007)<br>0.536-0.904 | 0.546 (<0.001)<br>0.421–0.707 | 7.131 (<0.001)<br>4.923–10.330 | 6.924 (<0.001)<br>4.760–10.073 |
| 5 | 0.770 (0.074)<br>0.579–1.026 | 1.164 (0.553)<br>0.705–1.925 | 0.995 (0.982)<br>0.634–1.562 | 0.644 (0.010)<br>0.460–0.900 | 0.699 (0.031)<br>0.505–0.967 | 0.744 (0.063)<br>0.545–1.017 | 0.579 (<0.001)<br>0.429–0.781 | 6.191 (<0.001)<br>4.245–9.030 | 6.711 (<0.001)<br>4.511–9.984 |
| 6 | 0.685 (0.004)<br>0.530–0.885 | 1.057 (0.810)<br>0.670–1.668 | 1.068 (0.756)<br>0.705–1.620 | 0.571 (<0.001)<br>0.422–0.772 | 0.704 (0.018)<br>0.528–0.941 | 0.653 (0.003)<br>0.494–0.862 | 0.503 (<0.001)<br>0.382–0.664 | 7.475 (<0.001)<br>5.082–10.996 | 3.828 (<0.001)<br>2.790–5.253 |
| 7 | 1.363 (0.003)<br>1.107–1.677 | 2.111 (0.002)<br>1.327–3.358 | 1.301 (0.168)<br>0.895–1.892 | 1.457 (0.004)<br>1.130-1.879 | 1.278 (0.047)<br>1.004–1.628 | 1.227 (0.073)<br>0.981–1.534 | 1.679 (<0.001)<br>1.339–2.106 | 0.576 (<0.001)<br>0.469-0.707 | 0.614 (<0.001)<br>0.495-0.761 |
| 8 | 0.686 (0.002)<br>0.544–0.866 | 1.010 (0.960)<br>0.691–1.476 | 0.948 (0.765)<br>0.665–1.349 | 0.595 (<0.001)<br>0.454–0.780 | 0.669 (0.002)<br>0.516–0.868 | 0.637 (<0.001)<br>0.496–0.819 | 0.484 (<0.001)<br>0.375–0.624 | 6.399 (<0.001)<br>4.571–8.959 | 5.079 (<0.001)<br>3.690–6.991 |
| 9 | 0.556 (<0.001)<br>0.420–0.736 | 0.623 (0.047)<br>0.390–0.995 | 0.477 (0.001)<br>0.304–0.748 | 0.419 (<0.001)<br>0.298–0.587 | 0.357 (<0.001)<br>0.253–0.504 | 0.493 (<0.001)<br>0.363–0.669 | 0.499 (<0.001)<br>0.372–0.668 | 5.398 (<0.001)<br>3.801–7.667 | 6.283 (<0.001)<br>4.309–9.162 |

Adjusted for nursing unit type, age, gender, experience, qualification, nationality, position, shift duration and job status.

*Not including the subscale stress recognition.

OR, odds ratio; CI, confidence interval.

1: Overall Safety attitudes; 2: Teamwork Climate; 3: Safety Climate; 4: Job Satisfaction; 5: Unit Management; 6: Hospital Management; 7: Stress Recognition; 8: Working Condition; 9: Safety Behaviours.

such as pressure injuries. Thus, further research is required to estimate the actual cost of nursing-sensitive adverse events in Saudi Arabian hospitals. Health services, hospital managers and nurses should aim to prevent avoidable adverse events and create a culture that improves patient safety. This can be achieved by improving safety culture in nursing units by encouraging teamwork and working conditions. Furthermore, clinical leadership across all nursing levels should focus on understanding the cause of adverse events, expanding nurses' knowledge and resources, and implementing systems to monitor and reduce adverse events (Kakemam et al., 2019).

Nurses' positive attitudes towards safety are associated with a reduction in adverse events (Alanazi et al., 2022). In this study, we focused on the adverse events that are considered nursing-sensitive patient outcomes (Sim et al., 2018). We calculated overall SAQ scores, finding that a higher total SAQ score is associated with a lower frequency of adverse events except for patient falls, which are not statistically significant. The highest negative associations are between safety climate, safety behaviour, and UTIs. For each one-point increase in the mean subscale scores for safety climate and behaviour, the odds of UTIs decreased by 64%. However, we find that a strong teamwork climate (attitudes towards working as a team), safety climate (attitudes towards organisational commitment to safety), job satisfaction (attitudes towards work experience), and safety behaviour (attitudes towards collaboration with nurses, physicians and pharmacists) are significantly associated with a decrease in all adverse events including patient falls, which aligns with the findings presented in previous studies (Han et al., 2020; Kakemam et al., 2021; Lee et al., 2018).

Of the seven adverse events we examined, patient falls with or without injury were not associated with most SAQ subscales in our study. This is consistent with previous studies, which have revealed mixed associations. Some researchers have found no significant statistical association between attitudes towards safety and patient falls (Ausserhofer et al., 2013; Hessels et al., 2019; Taylor et al., 2012; Wang et al., 2014), whereas other scholars have found a positive relationship in some safety attitude subscale scores (Brown and Wolosin, 2013; Kakemam et al., 2021). Our study includes two outcomes for patient falls: with and without injury; however, the associations were inconsistent. Falls without injury had stronger associations with attitudes towards safety than falls with injury. This is an important finding when we consider that 25% of falls may be unreported (Toyabe, 2015), particularly if there is no injury, as falls with injury cannot be hidden. Failure to report falls is a phenomenon in many hospitals that has serious consequences for patient safety programmes. In our study, for each one-point increase in the mean scores for teamwork, safety climate, job satisfaction and safety behaviour, the odds of falls without injury declined by 56%, 45%, 37% and 52%, respectively. Only teamwork climate was negatively associated with both patient fall variables. However, the mixed associations may be due to the unit of analysis or the dichotomisation of ordinal variables in primary studies (Alanazi et al., 2022).

The inconsistency of the evidence in the association between attitudes regarding safety and adverse events may be related to the level of analysis. We performed the analysis at the individual level, and we noted consistent findings with those studies that followed similar analysis methods (Han et al., 2020; Kakemam et al., 2021; Wang et al., 2014). Studies analysed at the nursing unit level have revealed limited associations and some have offered no statistical significance (Ausserhofer et al., 2013; Hessels et al., 2019; Taylor et al., 2012). Ausserhofer et al. (2013) claimed that safety attitudes at the unit and hospital level are less related to adverse events; however, other studies have identified an association at the hospital level (Lee et al., 2018; Olds et al., 2017). Therefore, future research is needed on the nursing unit level to confirm whether the unit of analysis should be considered.

### Limitations

This cross-sectional study explored nurses' attitudes towards safety and the relationship to adverse events and quality of care, which means that causal inferences cannot be made. Both adverse events and attitudes regarding safety were self-reported and could have been subject to social desirability bias (Vincelette et al., 2019); however, the surveys used in this study have been previously validated and used in many international studies. Although the study was limited to five MOH hospitals in Saudi Arabia, the sample included nurses from different backgrounds. We had no formal roles or positions within the hospitals where the data was collected, thereby ensuring no bias or influence on the study's outcomes. Additionally, the outbreak of COVID-19 could have impacted the data collection process as well as the response rate.

## Conclusion

This study examined nurses' attitudes towards safety and their relationship to adverse events and quality of care in five MOH hospitals in Saudi Arabia. In general, nurses reported less-than-positive attitudes towards safety, which may be why their perceptions of the frequency of adverse events were high. A key finding from this study is that nurses with positive attitudes towards safety subscales reported lower rates of adverse events. Adverse events significantly affect patients and the healthcare system. To minimise adverse events and improve the quality and safety of care, attitudes regarding safety should be considered. Encouraging a culture of teamwork and collaboration between nurses and other professionals and supporting nurses to complete their care activities will result in positive patient outcomes. This study contributes to the growing body of evidence that emphasises the critical role of safety attitudes in healthcare, particularly in regions such as Saudi Arabia where existing research is limited. These findings underscore the need for targeted interventions to foster a positive safety culture, which could have a transformative impact on patient care. Given that we examined individual nurse's attitudes, future researchers who analyse the nursing unit and hospital level may contribute to the understanding of how individual attitudes towards safety improve a unit's safety culture. Furthermore, researchers should analyse outcomes from hospital-based administrative datasets to identify and explore any notable differences between nurse-reported rates of adverse events and data collected from administrative data sources.

### Key points for policy, practice and/or research

- Nurses' attitudes towards safety require organisational commitment and support from healthcare leadership to foster a culture of safety and to enhance patient outcomes.
- Organisations should consider the preventable adverse events and address factors that contribute to higher rates of adverse events, such as stressful working conditions.
- A strong commitment to safety and job satisfaction among nurses is associated with decreased adverse events and favourable quality of care.
- Collaboration with healthcare professionals is associated with better care quality and fewer adverse events.
- Previous studies have demonstrated mixed results on the association between attitudes regarding safety and patient falls. However, we find that a strong teamwork climate and safety behaviour consistently have a negative association with rates of patient falls, both with and without injury.
- Organisations in Saudi Arabia should ensure that incident reporting systems are secure and supportive, especially for international nurses, to promote transparency and enhance the overall safety culture.

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The authors wish to disclose that the manuscript is a partial report of results from a doctoral thesis project. Although other papers based on the project have been published, this manuscript is an original work and has not been published elsewhere.

## 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 datasets used and analysed during the current study are available from the corresponding author upon reasonable request.

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