



Original Article

Assessment of Patient Safety Culture From the Perspective of Healthcare Staff in Selected Hospitals of Isfahan University of Medical Sciences: A Multicenter Cross-Sectional Study

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Abstract

Introduction: Ensuring that individuals receive healthcare free from preventable harm is considered one of the most fundamental human rights, and patient safety is a key indicator of healthcare quality. The present study aimed to evaluate the status of patient safety culture among healthcare staff working in selected hospitals affiliated with Isfahan University of Medical Sciences.

Methods: This multicenter cross-sectional descriptive-analytical study was conducted among 385 healthcare professionals working in Al-Zahra, Ayatollah Kashani, Amin, and Issa Ibn Maryam Hospitals between 2024 and 2025. Participants were selected using stratified random sampling. Data were collected using a demographic information questionnaire and the validated Hospital Survey on Patient Safety Culture (HSOPSC). Descriptive and inferential statistics, including the chi-square test, Mann-Whitney U test, Kruskal-Wallis test, and multivariable linear regression analysis, were used for data analysis with SPSS 22.

Results: The mean overall patient safety culture score was $40.15 \pm 13.26\%$, indicating a weak patient safety culture according to the AHRQ classification. Teamwork within units (58.9%) and organizational learning and continuous improvement (56.8%) had the highest scores, whereas non-punitive responses to errors (15.4%) and staffing adequacy (20.4%) had the lowest scores. Females had significantly higher patient safety culture scores than males ($P=0.016$), whereas no significant differences were observed across hospitals, age groups, or years of professional experience. Although the overall multivariable regression model did not reach statistical significance ($P=0.052$), female gender remained substantially associated with higher patient safety culture scores after adjustment for other covariates ($P=0.002$).

Conclusion: Patient safety culture in the studied hospitals was below the desirable level, with non-punitive responses to errors and staffing adequacy identified as the weakest dimensions, highlighting the need for targeted efforts to strengthen patient safety culture, particularly in areas requiring improvement.

Keywords: Patient safety culture, Patient safety, Hospital, Healthcare staff, HSOPSC



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Introduction

Patient safety is a fundamental dimension of healthcare quality and aims to minimize preventable harm

associated with the delivery of healthcare services, thereby safeguarding one of the most basic rights of patients (1). In addition, patient safety culture is, in essence, a



universal value within health systems, reflecting the awareness, attitudes, and perspectives of healthcare personnel regarding patient safety during the provision of care (2). In the contemporary global landscape, medical errors represent one of the most pressing challenges facing health systems worldwide, affecting all countries without exception (3). At the international level, numerous studies have assessed patient safety culture. According to evidence from a Swedish investigation, patient safety culture is particularly strengthened by effective intra-unit teamwork and non-punitive responses to errors. Conversely, managerial support for patient safety and staffing levels were identified as the least favorable dimensions. Notably, managers reported the highest safety culture scores, while physicians mentioned the lowest scores (4). Accordingly, significant challenges in patient safety culture persist even in highly developed countries, underscoring the need for sustained interventions. The World Health Organization estimates that approximately one in every ten patients in developed countries experiences harm while receiving healthcare services. In developing countries, healthcare-associated risks are estimated to be 20 times higher than those in developed nations, costing some countries between 6 and 21 billion US dollars annually (5). According to reports from the Organization for Economic Co-operation and Development, nearly 10% of hospital spending is devoted to addressing complications resulting from medical errors (3). No precise and comprehensive statistics are publicly available on the incidence of medical errors in Iran; however, the Ministry of Health and Medical Education has acknowledged that substantial financial resources are annually expended on the care of patients affected by such errors, a claim further corroborated by the rising volume of public complaints against the health system (6). In a systematic review of 35 studies involving nurses employed in Iranian hospitals, Hajizadeh et al found that a stronger perception of patient safety culture was associated with lower rates of adverse events, fewer medication errors, and reduced occupational stress. They concluded that enhancing patient safety culture not only improves patient outcomes but also yields significant positive consequences for nursing staff themselves (7). Evaluating patient safety culture within healthcare organizations is a key step toward enhancing patient safety and minimizing adverse events, as it helps identify organizational weaknesses while providing managers with valuable insights into staff perceptions (8). Moreover, assessing the existing safety culture is considered the initial and most fundamental step in developing a strong safety culture within healthcare organizations, as effective improvement strategies cannot be planned or implemented without a comprehensive understanding of the current situation (9). Over the past two decades, the recurrent occurrence of medical errors has led to a global consensus that patient safety has not reached an acceptable level and requires continuous enhancement (10). Given that human errors by healthcare personnel are inevitable, contemporary

attention has increasingly shifted toward improving systems for hazard prevention rather than attributing blame to individuals (11). Among the major advances in patient safety in recent years, the transition from an individual-focused model to a systems-oriented approach has been particularly significant.

Owing to its strong psychometric properties and broad international acceptance, the Hospital Survey on Patient Safety Culture (HSOPSC) is regarded as a standard instrument for evaluating patient safety culture. It is noteworthy that the survey has been adapted into more than 20 languages and implemented across healthcare organizations in over 45 countries (4). Research conducted in Iranian hospitals has consistently explored different aspects of patient safety culture. For example, Mostafaei et al surveyed 600 clinical and paraclinical employees working in selected hospitals affiliated with Tehran University of Medical Sciences and concluded that teamwork within hospital units and the frequency of event reporting were the strongest dimensions, each receiving a positive score of 62%. Conversely, overall perceptions of patient safety (56%) and non-punitive responses to errors (58%) represented the weakest dimensions. The study further found that 42% of respondents had not reported any adverse events within the preceding year (12). Consistent with previous evidence, Salarvand et al (2015) demonstrated that non-punitive responses to errors remained among the least favorable dimensions of patient safety culture (13). Likewise, Aires-Moreno et al indicated that education, teamwork, and organizational structural changes were the most successful approaches to enhancing patient safety culture, with the greatest impact observed when such strategies were sustained for more than one year and focused on improving the quality of communication (14). Similarly, Davis et al reported that implementing a “Just Culture” approach resulted in greater staff participation in surveys and a significant increase in error-reporting rates (15).

Additionally, a national review conducted in Iran revealed that the rate of medical errors was approximately 53%, of which 22–44% led to patient mortality, with the majority attributable to medication errors, preventive failures, therapeutic mismanagement, and administrative deficiencies. Moreover, nurses’ overall perception of patient safety was low in the majority of Iranian surveys, and most nurses did not regard patient safety as satisfactory in their own work settings (16). A study conducted in three hospitals affiliated with Tehran University of Medical Sciences investigated ten domains of patient safety culture and indicated that all evaluated domains fell below the desired standard, emphasizing the necessity for comprehensive and systematic improvement initiatives. In response to the rising prevalence of medical errors and growing public awareness, patient safety has been established as a strategic priority by the Iranian Ministry of Health (17).

Previous studies performed in Isfahan have mainly been limited to single-center designs or have predominantly

focused on nursing staff; therefore, the available evidence regarding patient safety culture across different healthcare professional groups remains limited (18, 19). As a result, studies that simultaneously capture the perspectives of various healthcare workers across multiple hospitals are still scarce. Furthermore, although international evidence provides useful reference points, differences in healthcare systems and organizational structures limit the direct applicability of these findings to the Iranian context.

Patient safety culture is a dynamic concept that evolves in response to policy changes, workforce characteristics, and organizational interventions (20). Hence, periodic assessments are valuable not only for monitoring changes over time but also for identifying areas that require attention and improvement. In addition, given the large population of Isfahan and the concentration of major teaching hospitals in the city, multicenter studies involving different healthcare professional groups appear necessary. Considering the existing evidence gap and the need for context-specific interventions, this study aims to assess the current status of patient safety culture in selected hospitals affiliated with Isfahan University of Medical Sciences during 2024–2025. The findings are expected to provide evidence to support the design, prioritization, and implementation of future patient safety improvement initiatives.

Methods

Study Design and Setting

This research adopted a multicenter, cross-sectional, descriptive-analytical design to assess the current status of patient safety culture from the viewpoints of healthcare professionals employed in selected hospitals affiliated with Isfahan University of Medical Sciences throughout 2024–2025. The study was conducted in four selected teaching hospitals, including Al-Zahra, Ayatollah Kashani, Amin, and Issa Ibn Maryam, affiliated with Isfahan University of Medical Sciences. These centers were selected based on their high volume of specialized and subspecialized services, the diversity of their clinical and paraclinical units, and their central role in the provision of healthcare services.

Study Population, Inclusion and Exclusion Criteria

The study population encompassed all clinical and paraclinical personnel working in the selected hospitals. The occupational groups included in this study were nursing (nursing, operating room, and anesthesiology), medicine, laboratory sciences, and radiology. Additionally, inclusion criteria consisted of a minimum of six months of employment at the respective hospital, an active employment status (formal, contractual, fixed-term, or agency-based), and informed willingness to participate in the study. However, participants who returned incomplete questionnaires or withdrew from the study at any point were excluded from the final analysis.

Sample Size and Sampling Method

Sample size was calculated using the formula for estimating a mean in descriptive studies:

A confidence level of 95% ($Z=1.96$), an estimated standard deviation ($S=18.12$), and a precision of estimation ($d=1.8$) were applied, and the initial calculated sample size was 384 participants. Finally, a total of 423 questionnaires were distributed to account for an estimated 10% attrition rate. Following data cleaning, removal of incomplete questionnaires, and quality control procedures, data from 385 participants were included in the final analysis.

Sampling was conducted using a non-proportional (disproportionate) stratified random method. Each of the four occupational groups (nursing, medicine, laboratory sciences, and radiology) within each of the four participating hospitals constituted an independent stratum, yielding a total of 16 strata. Further, a disproportionate, rather than a strictly proportional, allocation was used because a proportional design would have produced very small cell sizes for the numerically smaller occupational groups (radiology, laboratory sciences, and medicine) relative to nursing, which could compromise the stability of within-stratum estimates. Additionally, a complete list of eligible personnel was compiled within each stratum, and each individual was assigned a unique identifier; participants were then selected from this list using a random number table until the target number of respondents for that stratum was reached.

Data Collection Instrument

Data were collected using version 1.0 of the Survey on Patient Safety Culture (SOPS) Hospital Survey, commonly referred to as the HSOPSC, originally developed and released by the Agency for Healthcare Research and Quality (AHRQ) in 2004. This version, comprising 42 items across 12 dimensions, was used in preference to the restructured SOPS Hospital Survey 2.0 (released by AHRQ in 2019), which employs a different item set, item wording, and composite structure. Version 1.0, which is widely utilized internationally, was the version for which a validated Persian-language translation was available.

The questionnaire comprised two sections. The first section captured demographic and occupational characteristics, including age, gender, occupational group, work experience, unit of assignment, and organizational variables. Further, the second section consisted of 42 items organized across 12 dimensions of patient safety culture, including (1) teamwork within units, (2) staffing adequacy, (3) organizational learning and continuous improvement, (4) non-punitive response to errors, (5) overall perceptions of patient safety, (6) supervisor/manager expectations and actions promoting patient safety. The other dimensions were (7) feedback and communication about errors, (8) openness of communication, (9) frequency of event reporting, (10) hospital management support for patient safety, (11) teamwork across units, and (12) handoffs and transitions.

Two outcome variables were independently assessed as well: “overall patient safety grade” and “number of events reported in the past 12 months.” Responses were recorded on a five-point Likert-type scale, and items with negative polarity were reverse-scored in accordance with the standardized instrument protocol.

Validity, Reliability, and Scoring

The Persian version of the HSOPSC has been previously psychometrically evaluated in Iran. In the Persian validation study, a Cronbach’s alpha coefficient of 0.82 was reported for the total instrument, and construct validity was confirmed through confirmatory factor analysis (21). For the present study sample, the internal consistency of the total 42-item scale was also assessed using Cronbach’s alpha coefficient together with corrected item-total correlation analysis (refer to the Results Section).

Scoring was conducted in accordance with the AHRQ analytical guidelines, based on the percent positive response method. For positively worded items, responses of “agree/strongly agree” and “most of the time/always” were classified as positive. Moreover, reverse scoring was first applied for negatively worded items, followed by extracting positive responses. According to the instrument’s guidelines, dimensions with scores of $\geq 75\%$, 50–74%, and below 50% were categorized as strengths, areas requiring improvement, and weaknesses in patient safety culture, respectively.

The composite patient safety culture score was calculated as the mean percentage of positive responses across the twelve dimensions. It should be noted that the two outcome variables were not included in the composite score.

Data Management and Statistical Analysis

Statistical analyses were conducted using SPSS software (version 22). Continuous variables were summarized as means $\pm$ standard deviations (SD), whereas categorical variables were presented as frequencies and percentages. The normality of data distribution was also assessed using the Kolmogorov–Smirnov and Shapiro–Wilk tests. Given that the overall patient safety culture score was not normally distributed (Shapiro–Wilk = 0.985, $P = 0.001$), non-parametric statistical methods were applied for inferential analyses involving this variable.

The internal consistency of the total 42-item instrument was evaluated using Likewise, Cronbach’s alpha coefficient, along with corrected item-total correlations. Differences in the total patient safety culture score between the two gender groups were also determined using the Mann–Whitney U test. Additionally, differences among three or more independent groups (age group, hospital, occupational group, and years of experience) were assessed using the Kruskal–Wallis H test. Similarly, the relationship between hospital of employment and the overall patient safety grade was evaluated using the Kruskal–Wallis H test. In addition, the relationship between hospital of employment and the frequency of

reported adverse events was analyzed by applying the chi-square test. Interrelationships among the twelve patient safety culture dimensions, as well as between each dimension and the total composite score, were also examined using Spearman’s rank correlation coefficient, consistent with the non-normal distribution of these variables.

Further, multivariable linear regression analyses were performed to identify factors independently associated with patient safety culture, with the total composite safety culture score and the three lowest-scoring individual dimensions (non-punitive response to error, staffing adequacy, and communication openness) entered as dependent variables in separate models. In each model, age and years of experience were entered as ordinal category codes. Moreover, occupational group and hospital of employment were entered as sets of dummy-coded indicator variables (nursing and Al-Zahra Hospital serving as the reference categories, respectively), and gender was entered as a binary predictor. Then, model assumptions were assessed using variance inflation factors (multicollinearity), the Durbin–Watson statistic (independence of residuals), and Cook’s distance (influential cases). Statistical significance was defined as a $P < 0.05$.

Results

Sample Characteristics

Of the 423 questionnaires distributed, 385 were completed and included in the final analysis, corresponding to a completion rate of 91.0%. Based on the results, Al-Zahra Hospital accounted for the largest share of participants (42.6%), followed by Amin Hospital (24.7%), Ayatollah Kashani Hospital (22.9%), and Issa Ibn Maryam Hospital, which contributed the smallest proportion (9.9%). With respect to the occupational group, the majority of respondents were nurses (68.1%), followed by laboratory sciences personnel (13.2%), radiology staff (10.4%), and physicians (8.3%), respectively. Regarding age distribution, the 30–40-year age group represented the largest proportion of participants (50.4%), while 30.1% were younger than 30 years, 19.0% were between 40 and 50 years, and only 0.5% ($n = 2$) were older than 50 years. With respect to gender, 79 participants (20.5%) were male and 306 (79.5%) were female; a distribution consistent with, and expected given, the predominance of nursing personnel (68.1%), itself a female-majority occupational group, within the overall study sample. Concerning professional experience, 43.9% ($n = 165$), 36.4% ($n = 137$), and 19.7% ($n = 74$) of respondents reported less than 10 years, 10–20 years, and 20–30 years of work experience, respectively; nine participants (2.3%) did not provide information regarding years of experience and were therefore excluded, on a listwise basis, from all subsequent analyses that included experience as a variable (Table 1).

Internal Consistency of the Instrument

The internal consistency of the 42-item Persian version

of the HSOPSC questionnaire was evaluated for the present study sample (N=385) using Cronbach's alpha coefficient. The overall scale demonstrated acceptable internal consistency, with an alpha coefficient of 0.727. Furthermore, item-level analysis showed that corrected item-total correlations ranged from -0.046 to 0.412 across the 42 items, and the deletion of any single item would not have raised the overall alpha above 0.731, indicating that the reliability of the instrument was not meaningfully compromised by any individual item. This value is broadly consistent with, albeit somewhat lower than, the alpha of 0.82 reported for the Persian version of the HSOPSC in its original psychometric validation study, supporting the acceptability of the instrument for the present study population.

Patient Safety Culture Dimension Scores

The overall composite score of patient safety culture, calculated as the mean percentage of positive responses across the twelve dimensions, was 40.15% (SD=13.26). According to the interpretive framework of the AHRQ, this composite value fell below the 50% threshold, placing the overall patient safety culture of the study

population within the “weakness” category. Based on the results (Table 2), none of the twelve dimensions reached the “strength” threshold ($\geq 75\%$ positive responses). Teamwork within units (mean=58.90%, SD=26.03) and organizational learning and continuous improvement (mean=56.80%, SD=31.01) were classified as “areas requiring improvement” (50–74% positive responses). The remaining ten dimensions were categorized as weaknesses ($< 50\%$ positive responses). These included management support for patient safety (mean=49.78%, SD=33.17), teamwork across units (mean=46.10%, SD=30.58), overall perceptions of patient safety (mean=43.31%, SD=25.88), handoffs and transitions (mean=42.21%, SD=33.62), and feedback and communication about errors (mean=40.87%, SD=31.24). The other dimensions were supervisor/manager expectations and actions promoting patient safety (mean=39.16%, SD=26.96), frequency of event reporting (mean=35.76%, SD=30.90), communication openness (mean=33.07%, SD=27.27), staffing adequacy (mean=20.39%, SD=21.50), and non-punitive response to errors, which obtained the lowest score among all twelve dimensions (mean=15.41%, SD=22.29).

Comparison of Total Patient Safety Culture Score Across Demographic and Occupational Subgroups

Considering that the total patient safety culture score did not follow a normal distribution across the overall sample (Kolmogorov–Smirnov and Shapiro–Wilk tests, both $P < 0.05$, as reported in the Methods section), the Mann–Whitney U and Kruskal–Wallis H tests were used to compare total scores across demographic and

Table 1. Demographic, Occupational, and Outcome Characteristics of Participants (N=385)

Variable	Category	n	%
Hospital	Al-Zahra	164	42.6
	Amin	95	24.7
	Ayatollah Kashani	88	22.9
	Issa Ibn Maryam	38	9.9
Occupational group	Nursing	262	68.1
	Laboratory sciences	51	13.2
	Radiology	40	10.4
	Medicine	32	8.3
Gender	Male	79	20.5
	Female	306	79.5
Age group	<30 years	116	30.1
	30–40 years	194	50.4
	40–50 years	73	19.0
	>50 years	2	0.5
Work experience ^a	<10 years	165	43.9
	10–20 years	137	36.4
	20–30 years	74	19.7
Overall patient safety grade	Excellent	36	9.4
	Very good	110	28.6
	Acceptable	171	44.4
	Poor	62	16.1
	Failing	6	1.6
Adverse events reported (past 12 months)	0	227	59.0
	1–5	153	39.7
	5–10	5	1.3

Note. ^aValid percentages shown; n=376 valid responses (9 participants, 2.3%)

Table 2. Patient Safety Culture Dimension Scores and AHRQ Classification (N=385)

Dimension	Mean (%)	SD	Median	Classification
Teamwork within units	58.90	26.03	50.00	Area requiring improvement
Organizational learning and continuous improvement	56.80	31.01	66.67	Area requiring improvement
Management support for patient safety	49.78	33.17	66.67	Weakness
Teamwork across units	46.10	30.58	50.00	Weakness
Overall perceptions of patient safety	43.31	25.88	50.00	Weakness
Handoffs and transitions	42.21	33.62	50.00	Weakness
Feedback and communication about errors	40.87	31.24	33.33	Weakness
Supervisor/manager expectations and actions promoting patient safety	39.16	26.96	50.00	Weakness
Frequency of event reporting	35.76	30.90	33.33	Weakness
Communication openness	33.07	27.27	33.33	Weakness
Staffing adequacy	20.39	21.50	25.00	Weakness
Non-punitive response to errors	15.41	22.29	0.00	Weakness
Total safety culture score	40.15	13.26	40.28	Weakness

Note. SD: Standard deviation; AHRQ: The Agency for Healthcare Research and Quality

occupational subgroups.

Total safety culture scores significantly differed by gender. Male participants ($n=79$) obtained a mean rank of 166.00 (mean = 36.72, SD = 13.03, median = 39.58), whereas female participants ($n=306$) obtained a mean rank of 199.97 (mean = 41.03, SD = 13.19, median = 40.97); in other words, female participants reported remarkably higher total safety culture scores than male participants [Mann–Whitney $U=9954.00$, $Z=-2.419$, $P=0.016$, $r \approx$

Table 3. Comparison of Total Patient Safety Culture Score Across Demographic and Occupational Subgroups

Grouping Variable	Subgroup	n	Mean Rank	Test Statistic	df	P-Value
Gender	Male	79	166.00	$U=9954.00$, $Z=-2.419$, $r=0.12$	-	0.016
	Female	306	199.97			
Age group [†]	<30 years	116	189.55	$H=0.841$	3	0.840
	30–40 years	194	193.73			
	40–50 years	73	194.73			
	>50 years	2	259.00			
Hospital	Al-Zahra	164	191.61	$H=3.054$	3	0.383
	Amin	95	199.99			
	Ayatollah Kashani	88	179.17			
	Issa Ibn Maryam	38	213.53			
Occupational group	Nursing	262	183.59	$H=7.420$	3	0.060
	Radiology	40	214.68			
	Laboratory sciences	51	224.27			
	Medicine	32	193.08			
Work experience	<10 years	165	189.11	$H=0.105$	2	0.949
	10–20 years	137	186.32			
	20–30 years	74	191.17			

Note. df: Degree of freedom; Mann–Whitney U test was used for the two-level comparison (gender); Kruskal–Wallis H test was employed for all comparisons involving three or more groups. [†]The >50-years subgroup ($n=2$) is too small to yield a stable estimate, and this stratum's contribution to the age-group comparison should be interpreted with caution

0.12 (small effect size)]. Moreover, subgroup normality checks indicated that the male subgroup approximated a normal distribution (Shapiro–Wilk $P=0.124$), whereas the female subgroup significantly deviated from normality (Shapiro–Wilk $P=0.002$), consistent with the non-normal distribution of the overall sample, further supporting the use of a non-parametric test for this comparison. This finding corroborates a simple linear regression, which confirmed a statistically significant unadjusted association between gender and the total safety culture score, such that being female was associated with a higher predicted score ($B=4.314$, $SE=1.660$, $\beta=0.132$, $t=2.598$, $P=0.010$, 95% CI: 1.049–7.578), with gender alone accounting for 1.7% of the variance in the total score [$R^2=0.017$, adjusted $R^2=0.015$, $F(1, 383)=6.749$, $P=0.010$].

No statistically significant differences in total safety culture score were observed across age groups ($H=0.841$, $df=3$, $P=0.840$), hospital of employment ($H=3.054$, $df=3$, $P=0.383$), or years of professional experience ($H=0.105$, $df=2$, $P=0.949$). A comparison across occupational groups approached, but did not reach, conventional statistical significance ($H=7.420$, $df=3$, $P=0.060$); descriptively, laboratory sciences personnel (mean rank = 224.27) and radiology staff (mean rank = 214.68) obtained the highest mean ranks, whereas nursing personnel obtained the lowest ranks (mean rank = 183.59), with physicians occupying an intermediate position (mean rank = 193.08). Based on the results (Table 3), effect sizes (epsilon-squared) for these four non-significant-to-borderline comparisons were negligible to very small, ranging from approximately 0.00 (age, hospital, and work experience) to 0.012 (the occupational group). The age-group comparison should be interpreted with particular caution, as the oldest subgroup (>50 years) comprised only two participants.

Correlations Among Patient Safety Culture Dimensions

Spearman's rank correlation analysis was performed to examine the interrelationships among the twelve patient safety culture dimensions and the interrelationships

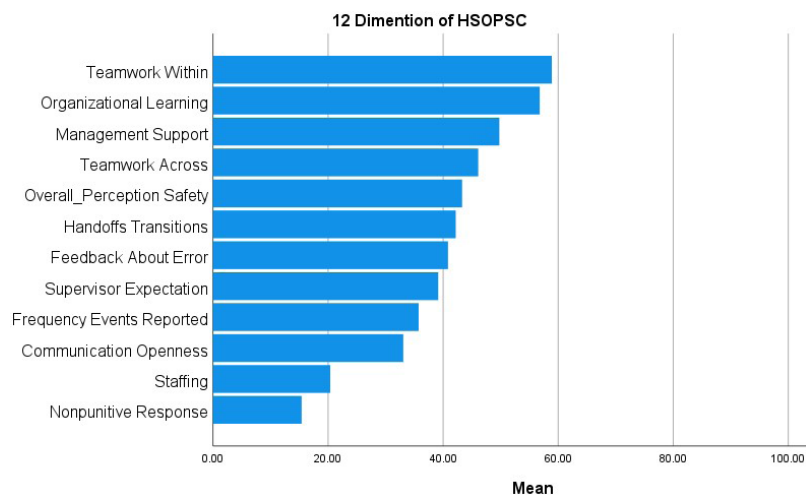


Figure 1. Distribution of Positive Response Percentages Across the Twelve Patient Safety Culture Dimensions

Note. HSOPSC: Hospital Survey on Patient Safety Culture

between each dimension and the total composite score (Table 4). All twelve dimensions were significantly and positively correlated with the total composite score (all $P<0.001$), with coefficients ranging from $r_s=0.285$ (staffing adequacy) to $r_s=0.578$ (teamwork across units); given that the total score is calculated as the arithmetic mean of the twelve dimension scores, these dimension-total correlations are subject to part-whole overlap and are expected to be inflated relative to correlations between fully independent measures, so the inter-dimension correlations below are of greater analytic interest. Among the inter-dimension correlations, the strongest association was observed between teamwork across units and management support for patient safety ($r_s=0.380$, $P<0.001$), followed by handoffs and transitions and

teamwork across units ($r_s=0.341$, $P<0.001$), and feedback and communication about errors and communication openness ($r_s=0.280$, $P<0.001$). In contrast, several dimension pairs demonstrated weak or non-significant associations; for example, staffing adequacy was not significantly correlated with non-punitive response to errors ($r_s=0.027$, $P=0.594$), overall perceptions of patient safety ($r_s=-0.012$, $P=0.814$), or feedback and communication about errors ($r_s=0.042$, $P=0.416$). In addition, the frequency of event reporting was not substantially correlated with handoffs and transitions ($r_s=-0.007$, $P=0.887$) or non-punitive response to errors ($r_s=0.024$, $P=0.643$).

Table 4. Spearman Correlation Matrix Among the Twelve Patient Safety Culture Dimensions and the Total Score (N=385)

Dimension	1	2	3	4	5	6	7	8	9	10	11	12
1. Teamwork within units	-											
2. Staffing adequacy	0.175**	-										
3. Organizational learning	0.251**	0.062	-									
4. Non-punitive response to errors	0.078	0.027	0.112*	-								
5. Overall perceptions of patient safety	0.097	-0.012	0.241**	0.201**	-							
6. Supervisor/manager expectations	0.160**	0.052	0.135**	0.092	0.040	-						
7. Feedback and communication about errors	0.189**	0.042	0.135**	0.123*	0.205**	0.182**	-					
8. Communication openness	0.141**	0.132**	0.131*	0.088	0.194**	0.153**	0.280**	-				
9. Frequency of event reporting	0.095	0.071	0.119*	0.024	0.026	0.078	0.166**	0.209**	-			
10. Management support	0.191**	0.098	0.165**	0.066	0.179**	0.200**	0.131*	0.152**	0.152**	-		
11. Teamwork across units	0.138**	0.158**	0.091	0.108*	0.181**	0.173**	0.179**	0.195**	0.041	0.380**	-	
12. Handoffs and transitions	0.097	0.024	0.112*	0.075	0.152**	0.140**	-0.003	0.133**	-0.007	0.246**	0.341**	-
13. Total safety culture score [§]	0.445**	0.285**	0.461**	0.317**	0.407**	0.405**	0.480**	0.478**	0.355**	0.578**	0.574**	0.433**

Note. Spearman's rank correlation coefficients are reported given the non-normal distribution of dimension scores; * $P<0.05$ and ** $P<0.01$ (two-tailed). [§]Row 13 correlations are part-whole (dimension-to-composite) coefficients and are expected to be inflated relative to the inter-dimension correlations in rows 1–12.

Table 5. Multivariable Linear Regression Analysis of Factors Associated With Total Safety Culture Score and Its Three Lowest-Scoring Dimensions (n=376)

Predictor	Total Safety Score B (SE)	Communication Openness B (SE)	Staffing Adequacy B (SE)	Non-Punitive Response B (SE)
Constant	28.926 (4.009)***	13.978 (8.283)	16.248 (6.495)*	8.786 (6.831)
Age (per category)	0.779 (1.017)	-0.694 (2.100)	2.199 (1.647)	1.502 (1.732)
Gender (female vs. male)	5.327 (1.701)**	8.401 (3.515)*	2.669 (2.756)	0.851 (2.899)
Years of experience (per category)	-0.323 (0.966)	1.594 (1.997)	-2.293 (1.566)	0.754 (1.647)
Radiology (vs. nursing)	3.148 (2.309)	7.814 (4.771)	-0.282 (3.741)	2.196 (3.934)
Laboratory sciences (vs. nursing)	4.081 (2.109) [†]	2.432 (4.359)	4.380 (3.418)	1.877 (3.595)
Medicine (vs. nursing)	1.492 (2.584)	0.908 (5.339)	-6.427 (4.186)	-1.219 (4.403)
Amin (vs. Al-Zahra)	0.637 (1.727)	4.248 (3.568)	0.836 (2.798)	-0.751 (2.943)
Ayatollah Kashani (vs. Al-Zahra)	-2.250 (1.787)	-0.017 (3.693)	-2.275 (2.895)	1.548 (3.045)
Issa Ibn Maryam (vs. Al-Zahra)	2.100 (2.426)	1.380 (5.013)	-3.413 (3.931)	3.198 (4.134)
R ²	0.044	0.028	0.030	0.009
Adjusted R ²	0.021	0.004	0.006	-0.016
F (df1, df2)	1.889 (9, 366)	1.151 (9, 366)	1.271 (9, 366)	0.351 (9, 366)
P (model)	0.052	0.326	0.251	0.957

Note. df: Degree of freedom; *n=376 for all models (9 participants with missing job-experience data were excluded listwise). Gender was coded 1= male, 2= female (reference category: male); a positive gender coefficient therefore indicates a higher predicted score for female relative to male participants. Other reference categories: occupational group (nursing), hospital (Al-Zahra). [†] $P=0.054$ (did not reach the 0.05 threshold); * $P<0.05$; ** $P<0.01$; *** $P<0.001$. Variance inflation factors ranged from 1.031 to 1.211 across all models; Durbin-Watson statistics ranged from 1.434 to 1.979; Cook's distance did not exceed 0.06 in any model.

Multivariable Regression Analysis of Factors Associated With Patient Safety Culture

To identify factors independently associated with patient safety culture, multivariable linear regression analyses were performed with the total composite safety culture score and the three lowest-scoring individual dimensions (non-punitive response to error, staffing adequacy, and communication openness) entered as dependent variables. In each model, age, gender, years of professional experience, occupational group, and hospital of employment were simultaneously entered as independent variables ($n=376$; nine participants with missing experience data were excluded listwise). Further, age and years of experience were entered as ordinal category codes (age: 1 = < 30 years, 2 = 30–40 years, 3 = 40–50 years, 4 = > 50 years; experience: 1 = < 10 years, 2 = 10–20 years, 3 = 20–30 years), so that each coefficient reflected the estimated change in the outcome per one-category increase rather than per additional year. Additionally, occupational group and hospital of employment were entered as sets of dummy-coded indicator variables, with nursing and Al-Zahra Hospital serving as the reference categories, respectively. Furthermore, gender was coded 1 = male, 2 = female, so that a positive coefficient indicated a higher predicted score for female relative to male participants (Table 5).

For the total safety culture score, the overall model approached, but did not reach, conventional statistical significance [$R^2=0.044$, adjusted $R^2=0.021$, $F(9,366)=1.889$, $P=0.052$]. Although the overall multivariable model did not reach statistical significance, female gender was associated with a higher total safety culture score after adjustment for age, professional experience, occupational group, and hospital of employment ($B=5.327$, $SE=1.701$, $\beta=0.162$, $t=3.131$, $P=0.002$, 95% CI: 1.982–8.672). This adjusted estimate was similar in magnitude to, and slightly larger than, the unadjusted association reported above ($B=4.314$), representing that the association between gender and total safety culture score was not attenuated after accounting for age, experience, occupational group, and hospital of employment. Working in the laboratory sciences occupational group showed a non-significant trend toward a higher total score relative to nursing ($B=4.081$, $SE=2.109$, $\beta=0.102$, $t=1.935$, $P=0.054$). No other predictor, including age ($P=0.444$), years of experience ($P=0.738$), the radiology ($P=0.174$) or medicine ($P=0.564$) occupational groups, or hospital of employment (all $P>0.20$), reached statistical significance.

Concerning communication openness, the overall model was not statistically significant [$R^2=0.028$, adjusted $R^2=0.004$, $F(9,366)=1.151$, $P=0.326$]. Gender remained a significant independent predictor; female participants scored, on average, 8.40 points higher than male participants ($B=8.401$, $SE=3.515$, $\beta=0.125$, $t=2.390$, $P=0.017$, 95% CI: 1.489–15.314). No other predictor reached statistical significance (all $P>0.09$).

Regarding staffing adequacy, the overall model was not

statistically significant [$R^2=0.030$, adjusted $R^2=0.006$, $F(9,366)=1.271$, $P=0.251$], and none of the nine independent variables was significantly associated with staffing scores (all $P>0.12$), including gender ($B=2.669$, $SE=2.756$, $P=0.333$).

In terms of non-punitive responses to errors, the overall model was not statistically significant ($R^2=0.009$, adjusted $R^2=-0.016$, $F(9,366)=0.351$, $P=0.957$), and none of the independent variables was substantially associated with scores on this dimension (all $P>0.38$), including gender ($B=0.851$, $SE=2.899$, $P=0.769$).

Across all four multivariable models, variance inflation factors ranged from 1.031 to 1.211, implying no evidence of problematic multicollinearity among the independent variables. Durbin–Watson statistics ranged from 1.434 to 1.979, and Cook’s distance values did not exceed 0.06 in any model, showing that no unduly influential cases affected the stability of the regression estimates.

Outcome Variables: Overall Safety Grade and Frequency of Event Reporting

Regarding the outcome variable of overall patient safety grade, “acceptable” was the most frequently selected category (44.4%), followed by “very good” (28.6%), “poor” (16.1%), “excellent” (9.4%), and “failing” (1.6%), with a median self-rated grade corresponding to “acceptable” (Table 1). With respect to the frequency of adverse event reporting, more than half of the participants (59.0%) reported that they had not submitted any adverse event report during the preceding 12 months. However, 39.7% mentioned having submitted between one and five reports, and 1.3% reported having submitted between five and ten reports (Table 1). No statistically significant differences were observed among the four hospitals with respect to the overall patient safety grade (Kruskal–Wallis $H=1.169$, $P=0.760$) or the number of adverse events reported ($\chi^2=3.280$, $P=0.773$).

Discussion

Patient safety culture is a fundamental component of healthcare quality and is widely recognized as an important indicator of health system performance. The present study assessed patient safety culture among healthcare professionals working in selected teaching hospitals affiliated with Isfahan University of Medical Sciences. The overall patient safety culture score was 40.2%, which was categorized as a “weakness”, according to the AHRQ interpretive framework. This finding indicated that, despite increasing attention to patient safety in healthcare systems, substantial challenges remain in establishing a strong safety culture within the participating hospitals. Similar findings were reported in previous studies conducted in Iran, where patient safety culture scores generally remained below the desirable level (22, 23). These findings suggest that improving patient safety culture requires sustained organizational commitment, effective managerial strategies, continuous education, and system-level interventions rather than

isolated corrective actions.

Moreover, considerable variation was found across the twelve dimensions of patient safety culture. In our study, teamwork within units and organizational learning and continuous improvement received the highest scores, whereas non-punitive response to error and staffing adequacy were identified as the weakest dimensions. The relatively higher score of teamwork within units may be explained by the close daily interactions and interprofessional collaboration required in clinical environments. Effective teamwork among healthcare providers has been recognized as an essential component of patient safety, as it facilitates communication, coordination, and mutual support during patient care processes. In line with the present findings, some previous studies in Iran reported teamwork within units as one of the strongest dimensions of patient safety culture (24, 25). Likewise, similar observations have been reported in healthcare settings outside Iran, including Saudi Arabian hospitals (26), suggesting that cooperation within clinical units is often more established than broader organizational mechanisms supporting safety improvement.

The relatively favorable score observed for organizational learning and continuous improvement represents that healthcare professionals perceive some degree of effort toward learning from previous experiences and improving care processes. Although this dimension did not reach the AHRQ threshold for a safety culture strength, its comparatively higher score may indicate that learning mechanisms are more developed than other components of patient safety culture. Similarly, previous research has emphasized the importance of organizational learning as a key element in improving healthcare safety performance (27). Furthermore, the positive correlations observed between several dimensions in the present study, particularly between teamwork across units and management support for patient safety, highlight the potential influence of leadership and organizational support in strengthening collaborative safety practices. This finding conforms to evidence demonstrating that supportive leadership, effective communication, and teamwork are among the main determinants of a positive patient safety culture (28).

In contrast, non-punitive responses to errors received the lowest score among all twelve dimensions. This finding is important because a blame-oriented approach toward errors may represent a major barrier to transparent reporting and organizational learning. Healthcare professionals who perceive that reporting errors may result in criticism, punishment, or negative professional consequences may be less willing to disclose adverse events or near misses, probably reducing opportunities to identify system weaknesses and prevent recurrence of similar events. Several studies conducted in Iran have consistently identified non-punitive responses to errors as one of the weakest dimensions of patient safety culture (18, 19, 29, 30). Similar findings reported in hospitals in Isfahan, including intensive care and neonatal intensive

care settings, revealed that concerns regarding blame and punitive responses remain a persistent challenge across different clinical environments (18, 19). These findings emphasize the importance of developing a just culture in which errors are viewed as opportunities for system improvement rather than individual blame.

The low score of non-punitive responses to errors was accompanied by a low frequency of adverse event reporting, as 59% of participants reported that they had not submitted any adverse event report during the previous 12 months. Although this finding may partly reflect a genuinely low occurrence of reportable events, the coexistence of low reporting frequency and weak non-punitive response scores may suggest the presence of organizational barriers to reporting. Based on previous evidence, healthcare organizations with established Just Culture approaches frequently achieve higher reporting rates because staff perceive reporting as a mechanism for learning and improvement rather than punishment (31, 32). Similarly, El-Jardali et al found that approximately 60% of healthcare professionals in Lebanese hospitals reported no adverse events during the previous year (33). They concluded that inadequate systems for incident investigation, feedback, and root-cause analysis may further limit staff awareness of safety events and reduce opportunities for organizational learning (34).

Staffing adequacy was another dimension with a relatively low score in the present study. This finding may reflect concerns regarding workload, workforce limitations, and the ability of healthcare professionals to maintain safe practices under demanding working conditions. Previous studies have identified inadequate staffing and excessive workload as important factors associated with patient safety challenges (35). However, improving staffing levels alone may not be sufficient to enhance patient safety culture. According to evidence, sustainable improvement requires a combination of adequate resources, supportive leadership, effective communication, and strengthened teamwork (36). Therefore, staffing interventions should be implemented alongside broader organizational strategies.

An important contribution of our study was the evaluation of factors related to patient safety culture using multivariable regression analysis. Although the overall multivariable model approached statistical significance ($P=0.052$), female gender was associated with a higher adjusted patient safety culture score, whereas no statistically significant adjusted associations were found for age, work experience, occupational group, or hospital of employment. Furthermore, no statistically significant differences were observed among the four participating hospitals in terms of overall patient safety culture score, overall patient safety grade, or frequency of adverse event reporting. Similar findings were reported in previous Iranian studies, where no differences were consistently observed between healthcare institutions (37). Given that the participating hospitals operate within the same university healthcare system and follow similar managerial

policies and organizational regulations, the absence of significant differences may reflect shared system-level characteristics influencing patient safety culture (38).

Likewise, the absence of significant differences between hospitals suggests that improvement strategies should involve coordinated approaches at the university and health system levels rather than being limited to individual institutions. Strengthening leadership commitment, improving communication pathways, promoting non-punitive reporting systems, and providing continuous education may contribute to sustainable improvements in patient safety culture. Previous studies indicated that organizational culture change is a gradual process requiring long-term commitment, continuous monitoring, and repeated interventions rather than short-term initiatives (39-41).

Overall, our study provided an updated multicenter assessment of patient safety culture among different healthcare professional groups in teaching hospitals affiliated with Isfahan University of Medical Sciences. The results revealed that while teamwork and organizational learning represent relatively stronger aspects of safety culture, significant opportunities remain for improvement, particularly in establishing a non-punitive reporting environment, addressing staffing concerns, and strengthening organizational support for patient safety.

Strengths of the Study

This study had several strengths. First, it employed a multicenter design involving four teaching hospitals affiliated with Isfahan University of Medical Sciences, allowing for a broader assessment of patient safety culture. In addition, the inclusion of different healthcare professional groups (i.e., physicians, nurses, laboratory scientists, and radiology staff) provided a more comprehensive evaluation of patient safety culture from diverse professional perspectives. Moreover, the use of stratified random sampling and the validated Persian version of the HSOPSC enhanced the methodological rigor of the study. Finally, the application of inferential statistical analyses together with multivariable regression models enabled the identification of factors associated with patient safety culture beyond simple descriptive findings, thereby strengthening the interpretation of the results.

Limitations of the Study

The present study had several limitations that should be acknowledged. First, the use of the self-reported HSOPSC questionnaire may have introduced response bias, as some healthcare staff might have been reluctant to provide candid responses due to concerns about occupational consequences or the prevailing organizational culture. Moreover, the cross-sectional design of the study precluded the assessment of changes in patient safety culture over time and did not allow for the establishment of causal relationships between variables. Additionally, since the study was exclusively conducted

in selected hospitals affiliated with Isfahan University of Medical Sciences, caution should be exercised when generalizing the findings to other healthcare institutions or geographical regions. Furthermore, despite the use of stratified random sampling, the limited timeframe of the study constrained the possibility of expanding the sample size and broadening the coverage of healthcare centers. Ultimately, certain confounding factors, such as prior patient safety training and differences in working conditions across occupational groups, were not fully controlled and may have influenced the study results.

Conclusion

The findings of this multicenter study revealed that patient safety culture among healthcare professionals working in selected teaching hospitals affiliated with Isfahan University of Medical Sciences remains below the desired level. While teamwork within units and organizational learning and continuous improvement represented relatively stronger aspects of patient safety culture, substantial gaps were observed, particularly in non-punitive response to errors, staffing adequacy, and frequency of event reporting.

In addition, the low level of reported adverse events and the weak perception of a non-punitive response to errors may indicate ongoing challenges in establishing an open and learning-oriented reporting environment. However, given the cross-sectional design of the study, these findings should be interpreted as indicators of existing areas requiring attention rather than causal relationships.

Likewise, the absence of significant differences among participating hospitals suggests that the identified challenges may reflect broader organizational and system-level factors rather than issues specific to individual institutions. Therefore, continuous assessment of patient safety culture, along with sustained organizational commitment, supportive leadership, effective communication, and promotion of learning from errors, may help guide future improvement strategies.

Overall, this study provided a multicenter baseline assessment of patient safety culture across diverse healthcare professional groups and can serve as a reference point for future evaluations aimed at monitoring changes over time and prioritizing context-specific patient safety improvement efforts.

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Artificial Intelligence Use Disclosure

ChatGPT (OpenAI; GPT-5.4) was used to assist with language refinement. Then, all AI-generated content was critically reviewed and edited by the authors.

Authors' Contribution

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Competing Interests

The authors declare that they have no competing interests.

Consent for Publication

Not applicable.

Ethical Approval

This study was approved by the Ethics Committee of Isfahan University of Medical Sciences (IR.MUI.NUREMA.REC.1403.145). Written informed consent was also obtained from all participants.

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