

Perceptions and Attitudes Toward Patient Safety: Perspectives of Students in the Medical and Health Sciences at the University of Aden, Yemen

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Abstract

Background

Patient safety competencies remain insufficient among health sciences graduates, especially in conflict-affected areas. This study assessed perceptions and attitudes toward patient safety among undergraduate medical students at the University of Aden, Yemen.

Methods

A cross-sectional descriptive study was carried out in June 2023 using a validated self-administered questionnaire based on the WHO Multi-professional Patient Safety Curriculum Guide. The survey had five sections: Error and Patient Safety, Safety of the Healthcare System, Personal Influence, Personal Attitudes, and Workplace Safety. Data were analyzed using SPSS and summarized using descriptive statistics, while inter-college comparisons were conducted with one-way ANOVA.

Results

Among 1,233 participants, the majority were dentistry students (46.7%) and pharmacy students (29.0%). The general understanding of patient safety was inadequate, with just 32.0% acknowledging elements that affect safety and less than 24% familiar with mistake reporting protocols. A majority (58.2%) considered medical mistakes prevalent, while just 11.6% regarded their healthcare system as secure. Although 63.5% saw error reporting as advantageous, fewer than half believed they could reliably guarantee patient safety in practice. Perceptions of workplace safety were ambivalent, with just 58.8% anticipating managerial support for safety activities and merely 40% recognising incentives for error reporting. ANOVA indicated substantial differences among colleges ($p < 0.001$), with nursing students consistently exhibiting superior safety perceptions, and pharmacy students excelled compared to those in medicine and dentistry across several categories.

Conclusion

Positive attitudes coexist with major system and reporting gaps, requiring interprofessional, non-punitive, experiential patient safety education.

Introduction

Patient safety is an essential element of the quality of care and is progressively highlighted in global medical education [1]. Despite WHO's efforts, implementation of patient safety education in undergraduate curricula remains inconsistent and fragmented, with only about one-fifth of countries formally integrating such content and very few linking it to licensing standards [2, 3]. Delivering secure and efficient therapy necessitates not only clinical proficiency but also the development of favourable attitudes and behaviours towards patient safety among medical care providers and prospective practitioners [2]. In the past few years, the prevalence of hospital errors and serious incidents in hospital

settings has garnered considerable global attention, establishing patient safety education as a paramount goal within medical curricula [4]. The World Health Organization (WHO) has promoted the incorporation of patient safety concepts across all tiers of health professional education, highlighting the cultivation of a safety culture that encourages transparent communication, collaboration, and error reporting [5]. However, most existing educational models and evidence are derived mainly from high- and middle-income countries contexts, with minimal adaptation to low-resource or culturally distinct settings [6]. Students studying medical disciplines, especially those in medicine and allied sciences, constitute the future workforce that will influence healthcare practices [7]. Their knowledge, attitudes, and opinions about patient safety are crucial markers of the effectiveness of educational programs in equipping them to adhere to safety requirements in actual clinical environments [8]. Concurrently, faculty members are crucial in exemplifying patient safety behaviours and attitudes, offering mentorship, and imparting patient safety education [9]. Consequently, comprehending the similarities and disparities between students' understanding of patient safety is crucial for recognising deficiencies in knowledge, attitudes, and behaviours, as well as enhancing teaching strategies [8, 10]. Prior research has revealed discrepancies in patient safety perceptions across students, shaped by variables like educational background, clinical experience, and exposure to patient safety training [8, 10, 11]. Students often feel less confident than faculty in managing patient safety scenarios because their practical experience is insufficient [12], although some reports more positive attitudes due to recent engagement with modern patient safety curricula [13].

These concerns are magnified in fragile and conflict-affected settings (FCAS) like Yemen, where health systems face ongoing fragmentation, infrastructure breakdown, workforce shortages, and limited regulatory oversight. Quality of care in such environments is severely challenged by disrupted routines, unpredictable resources, and increased healthcare demands [14, 15]. O'Brien et al. found that while infection prevention and control remain the most common intervention, there is an urgent need to strengthen patient safety training, risk management, error reporting, and safety culture efforts [14]. Comparable initiatives have emerged in other LMIC and FCAS contexts, such as Saudi Arabia and Ethiopia, where universities have adopted components of the WHO Global Patient Safety Action Plan (2021–2030) to strengthen undergraduate education. This study aligns with these efforts by providing evidence to guide curriculum adaptation within Yemen's unique post-conflict academic environment.

Despite recognizing these challenges, there is a paucity of research in such settings, particularly those directly comparing composite scores of patient safety perceptions across various domains such as error prevention, safety culture, personal influence on safety, and safety practices. Therefore, this study seeks to evaluate undergraduate students' understanding and attitudes about patient safety across several healthcare fields at the University of Aden, Yemen, to inform curriculum development and faculty training initiatives essential for cultivating a constructive patient safety culture in academic and clinical settings.

Methods

Study Design and Study Population

This was a descriptive cross-sectional study that was carried out in June 2023 at the Faculty of Medicine and Health Sciences, Faculty of Dentistry, Faculty of Pharmacy, and Faculty of Nursing, University of Aden, Yemen. The target group comprised undergraduate students from the first to final year of study in medical, dentistry, pharmacy, and nursing disciplines. The University of Aden is one of Yemen's oldest and largest public universities, established in 1970, serving over 24,000 students across 17 faculties, of which there are four faculties for health and medical sciences. It functions as a major reference institution for southern governorates, providing education, clinical training, and specialist referral services to surrounding governmental and private healthcare institutions [16]

Sample Size Determination

All registered undergraduate students in the Faculties of Medicine and Health Sciences, Dentistry, Pharmacy, and Nursing who were present during the study period and consented to participate were considered eligible and were enrolled using a probability proportionate to size approach (PPS). A total of 1,233 students completed the questionnaire out of 1,460 eligible students, yielding an overall response rate of 84.4% (Medicine = 168 [78.5%], Dentistry = 576 [86.0%], Pharmacy = 358 [83.5%], Nursing = 131 [89.1%]). Although no formal sample size calculation was required for this census-style survey, a post-hoc power analysis ($\alpha = 0.05$, effect size = 0.25) confirmed > 0.90 power to detect inter-disciplinary differences. Potential response bias from non-participants was acknowledged as a study limitation.

Data Collection Instrument

Data were gathered with an organised, personally administered survey created in accordance with the World Health Organisation (WHO) Multi-professional Patient Safety Curriculum Guide [5]

The questionnaire underwent content validation by five experts in medical education and patient safety to assess clarity, relevance, and cultural appropriateness. Reliability was tested in a pilot of 20 students, yielding a Cronbach's $\alpha = 0.87$, indicating good internal consistency. Data were collected face-to-face by trained research assistants in classrooms after obtaining verbal consent, minimizing non-response, and ensuring data completeness

The survey included the following domains:

1. Error and Patient Safety: Comprehension of human error classifications, contributing elements, and error reporting systems.
2. Safety of the Healthcare System: Perceptions about systemic safety protocols and the incidence of mistakes.
3. Personal Impact on Safety: Assurance in the capacity to avert, disclose, and address problems.

4. Personal Attitudes Towards Patient Safety: Openness to learning from mistakes and fostering transparency.
5. Workplace Safety: Perceptions about the assistance provided by coworkers, supervisors, and institutional policies concerning patient safety.

Each question was evaluated using a 5-point Likert scale (Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree). We computed the proportion of respondents that chose "Agree" or "Strongly Agree." The questionnaire was subjected to expert validation and piloted with 20 students to ascertain clarity and relevance. Modifications were implemented in accordance with comments from the pilot research.

Statistical Analysis

Data input and statistical evaluation were conducted utilising SPSS version 25.0. Descriptive statistics were employed to encapsulate the characteristics of the subjects. Continuous data were expressed as frequencies and percentages, whilst categorical variables were summarised using frequencies and percentages. The Shapiro-Wilk test indicated normality for various variables, prompting the use of parametric techniques for analysis. The One-Way ANOVA test was employed to ascertain if statistically significant differences exist among the means of more than one variable. A p-value of less than 0.05 was deemed statistically significant for all analyses.

Results

Demographic Characteristics

Dental students constituted 46.7% of the participants, followed by pharmacy (29.0%), human medicine (13.6%), and nursing (10.6%). The sex break down was about equal, with a male majority (53.7%). Most students were in their second to fifth academic years, with fewer in the first and sixth years. The overall response rate was 84.4%, ranging from 78.5% among medical students to 89.1% among nursing students. More details in Table 1

Table 1
Student Demographics (n = 1233)

Category	Frequency	%
College		
Medicine	168	13.6
Dentistry	576	46.7
Pharmacy	358	29.0
Nursing	131	10.6
Sex		
Male	662	53.7
Female	571	46.3
Year of Study		
1st year	217	17.6
2nd year	260	21.1
3rd year	220	17.8
4th year	226	18.3
5th year	266	21.5
6th year	44	3.6

Domain-Specific Results

Error and Patient Safety

Table 2 indicates that only 32.0% of students (394 out of 1,233) showed comprehension in this domain. Awareness of various forms of human mistake (24.0%, 296 students), methods for reporting an error (23.2%, 286 students), and avenues for voicing concerns about errors (23.0%, 284 students) was comparably limited. Disturbingly, the involvement of healthcare organisations in error reporting and the elements contributing to human mistake were the least acknowledged, at 19.6% (242 students) and 17.6% (217 students), respectively.

Table 2
Awareness About Error and Patient Safety (n = 1233)

Awareness About	%
Factors influencing patient safety	32.0
Different types of human error	24.0
How to report an error	23.2
Ways of speaking up about error	23.0
Role of healthcare organizations in error reporting	19.6
Factors contributing to human error	17.6

Safety of the Healthcare System

Table 3 shows that 58.2% (717 students) agreed that medical errors are prevalent, while 56.4% (695 students) concurred that most healthcare workers commit errors. Only 42.0% (518 students) believed that healthcare personnel receive training in patient safety. Confidence in practical safety outcomes was notably low, with only 30.6% (377 students) believing that the administration of incorrect medications is very unusual, and merely 11.6% (143 students) considering their country's healthcare system to be safe for patients.

Table 3
Safety of the Healthcare System (n = 1233)

Statement	%
Medical error is very common	58.2
Most healthcare workers make errors	56.4
Healthcare staff receive training in patient safety	42.0
It is very unusual for patients to be given wrong drugs	30.6
There is a safe system for patients in my country	11.6

Personal Impact on Safety

Table 4 indicates that 63.5% (783 students) concurred that completing reporting forms enhances patient safety, reflecting a proactive stance on error reporting. Furthermore, 59.4% (732 students) reported feeling comfortable discussing their own errors, while 57.5% (709 students) indicated confidence in addressing errors made by others. However, a smaller proportion of students (46.5%, 574 students) reported feeling consistently capable of ensuring patient safety in practice, while only 43.2% (533 students) indicated that they found it easy to disclose their own errors. It is noteworthy that approximately 24.1% (297 students) tended to attribute blame to others rather than address underlying issues, suggesting persistent punitive attitudes.

Table 4
Personal Influence Over Safety (n = 1233)

Statement	%
Filling in reporting forms helps improve patient safety	63.5
I am able to talk about my own errors	59.4
I know how to talk to people who have made an error	57.5
I am always able to ensure patient safety is not compromised	46.5
Telling others about an error I made would be easy	43.2
I am confident about speaking to someone showing lack of concern	40.2
It is easier to blame someone than focus on causes	24.1

Personal Attitudes towards Patient Safety

Table 5 demonstrates a significant consensus on the value of learning from errors. Eighty-seven percent of the 1,073 students surveyed believed that learning from mistakes can prevent incidents, while 85.6% of the 1,056 students acknowledged that recognising and addressing errors is central to their future roles.

Table 5
Personal Attitudes to Patient Safety (n = 1233)

Statement	%
If I keep learning from my mistakes, I can prevent incidents.	87.0
Acknowledging and dealing with my errors will be an important part of my job.	85.6
I can contribute to patient safety.	85.1
It is important for me to learn how best to acknowledge and deal with my errors by the end of medical school.	83.3

Safety at the Workplace

Table 6 outlines that 58.8% (725 students) expected healthcare leaders to prioritise patient safety, while 50.7% (625 students) believed nurses are committed to safety; however, concerns persisted. A mere 46.4% (572 students) indicated that they would find it acceptable to disclose mistakes in their future workplaces. Additionally, 45.8% (565 students) indicated that managers prioritise performance targets over patient safety. Only 41.5% of students (512) expressed trust in management's fairness regarding error admissions, while merely 40.4% (498 students) felt that managers promote error reporting. The fear of criticism persisted as a notable concern, with only approximately 21% of students feeling secure from criticism by doctors (20.5%) or nurses (21.0%) when disclosing mistakes.

Table 6
Safety at the Workplace (n = 1233)

Statement	%
Managers in the healthcare system will expect us to focus on patient safety.	58.8
The doctors will be committed to identifying and addressing patient safety risks.	53.0
The nurses will be committed to identifying and addressing patient safety risks.	50.7
Being open and honest about the mistakes I make will be acceptable at my place of work.	46.4
Managers in the healthcare system will be more interested in meeting performance targets than in patient safety.	45.8
Admitting an error, I had made would lead to just and fair treatment by management.	41.5
Managers in the healthcare system will make it easy to report errors.	40.4
The nurses will not criticise me for making mistakes.	21.0
The doctors will not criticize me for making mistakes.	20.5

The one-way ANOVA analysis revealed statistically significant differences among the four college groups (Human Medicine, Dental, Pharmacy, Nursing) across all five variables examined. Nursing students consistently demonstrated the highest average scores across all areas, including perceived error reporting, safety of the health systems, personal effect on safety, personal attitudes towards patient safety, and workplace safety perception. Post hoc Bonferroni comparisons indicated that the differences were particularly pronounced between the Nursing group and the others, with Pharmacy students also demonstrating superior performance compared to Human Medicine and Dental students across various domains. More details are found in Table 7

Table 7
Comparison Between Domains Across Colleges (n = 1233)

Variable	College	n	Mean ± SD	F (df = 3,1229)	p-value	Significant Post Hoc Comparisons (Bonferroni)
Error PS	Human Medicine	168	2.62 ± 0.73	5.40	0.001	Nursing > All (p < 0.01)
	Dental	576	2.62 ± 0.66			
	Pharmacy	358	2.65 ± 0.91			
	Nursing	131	2.91 ± 0.79			
SHS	Human Medicine	168	2.95 ± 0.52	14.83	< 0.001	Pharmacy, Nursing > Dental, Medicine
	Dental	576	2.92 ± 0.57			
	Pharmacy	358	3.10 ± 0.52			
	Nursing	131	3.20 ± 0.56			
Personal Influence	Human Medicine	168	3.05 ± 0.58	12.57	< 0.001	Nursing, Pharmacy > Dental > Medicine
	Dental	576	3.20 ± 0.78			
	Pharmacy	358	3.38 ± 0.70			
	Nursing	131	3.46 ± 0.77			
Personal Attitude PS	Human Medicine	168	4.14 ± 0.82	13.09	< 0.001	Pharmacy, Nursing > Dental, Medicine
	Dental	576	4.14 ± 0.80			
	Pharmacy	358	4.41 ± 0.58			
	Nursing	131	4.37 ± 0.68			
* Safety of the Healthcare System						

Variable	College	n	Mean $\pm$ SD	F (df = 3,1229)	p-value	Significant Post Hoc Comparisons (Bonferroni)
Safety WP	Human Medicine	168	2.94 $\pm$ 0.52	13.90	< 0.001	Nursing > Pharmacy > Dental > Medicine
	Dental	576	3.09 $\pm$ 0.66			
	Pharmacy	358	3.23 $\pm$ 0.64			
	Nursing	131	3.34 $\pm$ 0.59			
* Safety of the Healthcare System						

Discussion

This investigation evaluated the views on patient safety among 1,233 students across four key healthcare disciplines: dentistry, pharmacy, human medicine, and nursing. The study revealed moderate overall awareness and positive attitudes toward patient safety, directly addressing the primary research objectives. Nursing and pharmacy students showed the highest perceptions, suggesting stronger experiential learning and curricular emphasis on patient-centered care.

Students demonstrated a fair understanding of human error and safety principles but limited knowledge of error-reporting systems [17]. and systemic approaches to report organizational errors [18, 19]. This limited systems awareness suggests that Yemeni curricula, like those in other low-resource settings, remain oriented toward individual error prevention rather than organizational learning. In comparison with findings from studies in Saudi Arabia [20, 21], Malaysia [22], and Ethiopia [23, 24]. the trend of strong personal attitudes but weaker systemic competence appears consistent across LMICs, reinforcing that education reforms alone are insufficient without institutional support for safety culture.

Despite the majority of students recognizing their role in safety, still 24.1% preferred to attribute blame to others instead of investigating underlying causes, indicating a continued culture of blame due fear of criticism and repercussions, which amplify underreporting and defensive behaviours [25, 26]. This underscores the need for promoting psychological safety and establishing non-punitive learning environments that encourage open discussion of errors and collective learning

The study also revealed that nursing and pharmacy students consistently achieved higher scores than their medical and dental counterparts, reflecting their early patients' interactions, practice-focused and patients-centred curricular with stronger emphasis on teamwork and communication [26, 27, 28, 29]. In contrast, medical and dentistry students' curricula focus more on clinical skills [30]. The findings of this study have important implications for patient safety education and policy in Yemen and other fragile

settings. They reveal that Yemen's emerging health workforce demonstrates the willingness, but not yet the structural capacity, to practice safely, which is a gap that demands coordinated reform across both educational and governance systems. In contexts marked by limited systems-based competence and weak institutional support, even experienced professionals struggle to uphold safety standards when coordination, communication, and accountability mechanisms are lacking [31]. This highlights that systemic fragility, rather than knowledge deficits alone, is a key determinant of safety performance.

Despite these challenges within the Yemeni context, education-driven interventions remain feasible. Establishing a uniform, multidisciplinary, and competency-based patient safety curriculum, aligned with the WHO Global Patient Safety Action Plan 2021–2030 and Patient safety curriculum guide [5], can help institutionalize systems-based thinking, strengthen understanding of organizational responsibilities, and improve awareness of error-reporting processes. Furthermore, patient safety education in Yemen must extend beyond theoretical instruction to foster resilience, adaptability, and ethical accountability among future health professionals capable of working effectively in fragile contexts. Integrating interprofessional and simulation-based learning, including e-simulation, would provide a scalable solution that enable students to translate theory into practice, while promoting psychologically safe, non-punitive learning environments that encourage open error reporting, reflection, and constructive feedback. [5, 32]. Finally, the Ministry of Public Health and Population, in collaboration with Yemeni universities, should develop a phased national framework for patient safety education, beginning with faculty development, curriculum standardization, and pilot simulation programs. Implemented gradually, such measures could lay the foundation for a sustainable culture of safety, improving healthcare quality and strengthening system resilience even within Yemen's challenging environment. Future research should employ longitudinal designs to evaluate changes in perceptions and competencies over time, particularly following targeted educational interventions.

This study contributes novel evidence from a fragile and conflict-affected context, demonstrating that while the emerging Yemeni health workforce shows readiness to engage with patient safety principles, systemic fragility rather than knowledge deficits alone remains the main determinant of performance. For policy and practice, embedding interprofessional, simulation-based modules and fostering non-punitive error-reporting systems are critical to achieving the WHO Global Patient Safety Action Plan targets.

Limitations

The findings of this study must be assessed in light of specific limitations. The cross-sectional design captures perceptions at a specific moment, restricting the understanding of temporal changes or effects following interventions. Self-reported data can be subject to social desirability bias, which may lead to an exaggeration of positive attitudes or awareness levels. The increased representation of dental and pharmacy students may influence the generalisability to other healthcare disciplines. The study was conducted in a single country, which may limit the generalisability of the findings to other regions with differing healthcare and educational systems. Moreover, as the study was undertaken at a single

university, generalization should be approached cautiously; however, it is important to recognize the University of Aden's role as a major academic institution serving several governorates in southern Yemen, which provides the findings with meaningful regional relevance. Conducting such research in a conflict-affected and resource-limited environment also posed logistical challenges, highlighting both the difficulty and the importance of generating evidence on patient safety in fragile settings. Despite these constraints, the large sample size and inclusion of multiple disciplines represent key strengths that enhance the credibility and contextual value of the results. Additionally, the study provides important baseline evidence for curricular and policy reform.

Conclusion

The findings reveal that although healthcare students often exhibit favourable attitudes towards patient safety and recognise their individual responsibilities, significant deficiencies remain in their comprehension of systemic safety protocols, error reporting procedures, and the mitigation of blame culture. Nursing and pharmacy students regularly exhibited superior patient safety abilities, likely attributable to their curricula's emphasis on patient-centered and systems-oriented training. To close the knowledge-practice gap, it is imperative to implement focused educational interventions that include patient safety into all healthcare curricula, especially for medical and dental students. Interprofessional, experiential education that promotes collaboration, systems thinking, and non-punitive reporting settings should be prioritised.

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the Declaration of Helsinki. Ethical approval was obtained from the Research Ethics Committee of the Faculty of Medicine and Health Sciences, University of Aden. Written informed consent was obtained from all participants before their inclusion in the study. Participation was voluntary, and the confidentiality and anonymity of participants were strictly maintained throughout the study.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

HB contributed to conceptualization, methodology, project administration, supervision, and writing—review and editing. F M S M contributed to data curation, formal analysis, and writing—original draft, review, and editing. AB contributed to investigation, data curation, and writing—original draft, review, and editing. K A S contributed to methodology, formal analysis, and visualization. A A T contributed to writing—original draft preparation and writing—review and editing. All authors read and approved the final manuscript.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the first or corresponding author on reasonable request.

References

1. World Health Organization. Global patient safety action plan 2021–2030: towards eliminating avoidable harm in health care. Geneva: World Health Organization; 2021.
2. World Health Organization. Global patient safety report 2024. Geneva: World Health Organization. 2024. Available from: <https://www.who.int/publications/i/item/9789240095458>
3. Mistri IU, Badge A, Shahu S. Enhancing patient safety culture in hospitals. *Cureus*. 2023;15(12):e51159. 10.7759/cureus.51159. . PMID: 38283419; PMCID: PMC10811440.
4. Rodziewicz TL, Houseman B, Vaqar S et al. medical error reduction and prevention. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. [Updated 2024 Feb 12]. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK499956/>
5. World Health Organization, WHO Patient Safety. Patient safety curriculum guide: multi-professional edition. Geneva: World Health Organization. 2011. Available from: <https://iris.who.int/handle/10665/44641>
6. Aldardeir N, Abdullah QK, Jones L. Patient safety education in undergraduate medical education through a global lens: a scoping review. *BMC Med Educ*. 2025;25(1):544. 10.1186/s12909-025-07159-x. . PMID: 40241068; PMCID: PMC12001576.
7. Mickan S, Golenko X, Buys N. Exploring future health workforce educational needs: a qualitative investigation. *J Multidiscip Healthc*. 2019;12:527–32.
8. Nabilou B, Feizi A, Seyedin H. Patient safety in medical education: students' perceptions, knowledge and attitudes. *PLoS ONE*. 2015;10(8):e0135610.

9. Wetzel AP, Dow AW, Mazmanian PE. Patient safety attitudes and behaviors of graduating medical students. *Eval Health Prof.* 2012;35(2):221–38.
10. Sepp J. Advancing patient safety competencies in nursing education: an examination of student attitudes. *Agron Res.* 2024;22:1.
11. Kirkman MA, Sevdalis N, Arora S, Baker P, Vincent C, Ahmed M. The outcomes of recent patient safety education interventions for trainee physicians and medical students: a systematic review. *BMJ Open.* 2015;5(5):e007705.
12. Lukewich J, Edge DS, Tranmer J, Raymond J, Miron J, Van Den Ginsburg L. Undergraduate baccalaureate nursing students' self-reported confidence in learning about patient safety in the classroom and clinical settings: an annual cross-sectional study (2010–2013). *Int J Nurs Stud.* 2015;52(5):930–8.
13. Oates K, Wilson I, Hu W, Walker B, Nagle A, Wiley J. Changing medical student attitudes to patient safety: a multicentre study. *BMC Med Educ.* 2018;18:1–7.
14. O'Brien N, Shaw A, Flott K, Leatherman S, Durkin M. Safety in fragile, conflict-affected, and vulnerable settings: evidence scanning approach for identifying patient safety interventions. *J Glob Health.* 2022;12:04018.
15. Shaw A, O'Brien N, Flott K, Leatherman S, Neves AL, Durkin M. The urgent need to identify and evaluate patient safety interventions in fragile, conflict-affected and vulnerable settings. *J Glob Health.* 2021;11:03082.
16. <https://adc.aden-univ.net/statistics.htm>
17. Ayub F, Afzal N, Ali W, Asif F, ul Hassan SS, Haque G, et al. Exploring medical and nursing students' perceptions about a patient safety course: a qualitative study. *BMC Med Educ.* 2024;24(1):452.
18. Palominos E, Levett-Jones T, Power T, Martinez-Maldonado R. Healthcare students' perceptions and experiences of making errors in simulation: an integrative review. *Nurse Educ Today.* 2019;77:32–9.
19. Lee NJ, Jang H, Park SY. Patient safety education and baccalaureate nursing students' patient safety competency: a cross-sectional study. *Nurs Health Sci.* 2016;18(2):163–71.
20. Baig M, Gazzaz ZJ, Atta HM, Mostafa MM, Jameel T, Murad MA, et al. Patient safety attitudes among Saudi medical students and interns: insights for improving medical education. *Adv Med Educ Pract.* 2024;15:1349–60. 10.2147/AMEP.S503055. PMID: 39759474; PMCID: PMC11699847.
21. Colet PC, Cruz JP, Cruz CP, Al-Otaibi J, Qubeilat H, Alquwez N. Patient safety competence of nursing students in Saudi Arabia: a self-reported survey. *Int J Health Sci (Qassim).* 2015;9(4):418–26. PMID: 26715921; PMCID: PMC4682596.
22. Samsiah A, Othman N, Jamshed S, Hassali MA. Perceptions and attitudes towards medication error reporting in primary care clinics: a qualitative study in Malaysia. *PLoS ONE.* 2016;11(12):e0166114. 10.1371/journal.pone.0166114. . PMID: 27906960; PMCID: PMC5132213.
23. Eshetie Y, Yimer A, Ayalew E, Wubneh Z. Prevalence and its associated factors of medical error reporting among healthcare professionals in Ethiopia: a systematic review and meta-analysis. *PLoS ONE.* 2025;20(5):e0325114. 10.1371/journal.pone.0325114.

24. Toitole KK, Gebremariam TH, Teshome AG. Factors associated with self-reported medical errors among undergraduate health science students in southern Ethiopia. *Front Med*. 2024;11:1354270. 10.3389/fmed.2024.1354270.
25. Al Dweik R, Stacey D, Kohen D, Yaya S. Factors affecting patient reporting of adverse drug reactions: a systematic review. *Br J Clin Pharmacol*. 2017;83(4):875–83.
26. Ghaffari R, Nourizadeh R, Hajizadeh K, Vaezi M. Barriers to reporting medical errors from the perspective of obstetric residents: a qualitative study. *J Educ Health Promot*. 2024;13(1):314.
27. Dimitriadou M, Merkouris A, Charalambous A, Lemonidou C, Papastavrou E. The knowledge about patient safety among undergraduate nurse students in Cyprus and Greece: a comparative study. *BMC Nurs*. 2021;20(1):110.
28. Bakrin FSO, Azizi BH, Yusuf N, Tajuddin Y, Sinniah J, Balakrishnan S, et al. Perceptions of patient safety competency among graduating pharmacy, nursing, physiotherapy and medical imaging students: a cross-sectional study in Malaysia. *Pharm Educ*. 2022;22(1):312–22.
29. Ni J, Liu Q, Li X, Chen M. Outcomes of interprofessional education for pharmacy students: a systematic review. *BMC Med Educ*. 2024;24(1):1334.
30. Demir AK, Ulusoy H. Perceptions of patient safety culture of dentistry students and dentists in a faculty of dentistry. *Int J Health Manag Tour*. 2023;8(1):1–16.
31. El-Khani U, Ashrafian H, Rasheed S, Veen H, Darwish A, Nott D, et al. The patient safety practices of emergency medical teams in disaster zones: a systematic analysis. *BMJ Glob Health*. 2019;4:e001889. 10.1136/bmjgh-2019-001889.
32. Bahattab AAS, Zain O, Linty M et al. Development and evaluation of scenario-based e-simulation for humanitarian health training: a mixed-methods action research study. *BMJ Open*. 2024;14: e079681. doi: 10.1136/bmjopen-2023-079681. Available from: <https://bmjopen.bmj.com/content/14/8/e079681>