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Attitudes of pharmacy students towards patient safety: a cross-sectional study from six developing countries

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Article title: Attitudes of pharmacy students towards patient safety: a cross-sectional study from six developing countries

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ABSTRACT

Objective: To evaluate the attitudes of undergraduate pharmacy students towards patient safety in six developing countries.

Design: A cross-sectional study.

Setting: Participants were enrolled from the participating universities in six countries.

Participants: Undergraduate pharmacy students from the participating universities in six developing countries (Jordan, Saudi Arabia, Kuwait, Qatar, India and Indonesia) were invited to participate in the study between October 2018 and September 2019.

Primary outcome: Attitudes towards patient safety was measured using 14-item questionnaire that contained five subscales: being quality-improvement focused, internalising errors regardless of harm, value of contextual learning, acceptability of questioning more senior healthcare professionals' behaviour, and attitude towards open disclosure. Multiple-linear regression analysis was used to identify predictors of positive attitudes towards patient safety.

Results: A total of 2,595 students participated in this study (1,044 from Jordan, 514 from Saudi Arabia, 134 from Kuwait, 61 from Qatar, 416 from India and 429 from Indonesia). Overall, the pharmacy students reported a positive attitude towards patient safety with a mean score of 37.4 (SD= 7.0) out of 56 (66.8%). The "being quality-improvement focused" subscale had the highest score, 75.6%. The subscale with the lowest score was "internalising errors regardless of harm", 49.2%. Female students had significantly better attitudes towards patient safety scores compared to male students (p=0.001). Being at a higher level of study and involvement in or witnessing harm to patients while practising were important predictors of negative attitudes towards patient safety (p<0.001).

Conclusion: Patient safety content should be covered comprehensively in pharmacy curricula and reinforced in each year of study. This should be more focused on students in their final year of study and who have started their training. This will ensure that the next generation of pharmacists are equipped with the requisite knowledge, core competencies and attitudes to ensure optimal patient safety when they practice.

Keywords: Attitude; Patient; Pharmacy; Safety; Students.

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Strengths and limitations of this study

- This study provides evidence for a better understanding of the attitudes of undergraduate pharmacy students towards patient safety in developing countries.

- This is the first large-scale study to investigate this association in the Middle East and to extend the generalisability of the current evidence from other countries.

- We were not able to estimate the response rate for our study, which might lead to nonresponse bias.

INTRODUCTION

Patient safety is one of the main concerns of healthcare systems during the provision of healthcare services and is increasingly being used as a measure of healthcare quality. The World Health Organization (WHO) has stressed the importance of reducing healthcare errors and establishing action plans to reduce patient harm and increase patient safety [1]. Medical errors are associated with high probability of patients harm and high mortality rate which raised the need for strategies that are evidence-based to enhance patient safety [2]. Research results revealed that around 10.0% of patients admitted to hospital within developed countries have a chance of being harmed, and up to 18.0% of hospital admissions experienced adverse events. Besides, there is a growing concern pertinent to the level of harm among patients in developing countries that could be attributed to the lack of accountability [3-5].

One of the best strategies to promote safer attitudes towards patient safety is education [6,7]. Patient safety education for undergraduate healthcare students has been considered a crucial element in minimising patient harm and developing a positive patient safety culture [8]. Several key international organisations have made recommendations to reshape healthcare professional education curricula to guarantee that they foster students' attitudes toward patient safety through enhancing their knowledge, skills and attitudes [9-14]. In recent years, pharmacy degree programmes have included content related to patient safety through curriculum guides [5], including the WHO's Patient Safety Curriculum Guide for Medical Schools [15] and their Multiprofessional Patient Safety Curriculum Guide [16-19]. Pharmacy students, in developing countries, gain some practical experience in healthcare settings at an earlier stage of their studies, either through experiential education placements or simulation-based programs [20]. However, unlike other healthcare professions, pharmacists' training is not well structured and does not mandate close monitoring of students during their training by preceptors. Although patient-centred care and patient safety might have been embedded through the curriculum, it has been mostly informal and theoretical [4,5,21].

In developing countries, there are cultural concerns, where pharmacy students are intimidated by other healthcare professionals particularly, physicians, when they are in the clinical practice setting which will hamper patient safety. The 'hierarchical difference in medical knowledge' will make young pharmacists' reluctance to question decisions made by physicians [5,22]. Therefore, improving patient safety in developing countries requires changing attitude particularly in shifting the blame culture in healthcare settings.

Improving patient safety requires preparing future healthcare professionals to re-enforce patient safety. Therefore, efforts to foster patient safety in developing countries must be augmented and 'education system during undergraduate studies, to provide knowledge, that is reflected into attitudes, which will be translated into practice' to make healthcare safer [22].

Despite the increasing effort to enhance patient safety through improving healthcare professional curricula, this improvement is considered challenging, and progress is very slow [5,12,13,23-28]. Developing positive attitudes among university students is important as it is positively related to their achievement [29]. The accomplishment of educational goals related to delivering safe and quality healthcare services requires students to have positive attitudes towards patient safety [29,30]. Since attitude can substantially impact an individual's behaviour and practice [31], it is crucial that pharmacy students' attitudes towards patient safety are understood and evaluated particularly in developing countries.

Previous studies have explored the attitudes and values of healthcare students towards patient safety in different countries, using different instruments [18,19,32-39]. The most widely-used validated tool is the patient safety/medical fallibility survey, which was originally developed by Madigosky et al. for use among medical students [32]. This tool was validated to assess the patient safety attitudes of pharmacy students by Walpola et al. [40]. However, there are a limited number of studies that have focused on attitudes of undergraduate pharmacy students towards patient safety, especially in developing countries. Therefore, the aim of this study was to evaluate the attitudes of undergraduate pharmacy students towards patient safety in six developing countries.

METHODS

Study design

A quantitative cross-sectional survey using a self-administered questionnaire was conducted to explore patient safety attitudes and values among pharmacy students in six developing countries (Jordan, Saudi Arabia, Kuwait, Qatar, India and Indonesia). To achieve the study aim, a self-administered questionnaire approach was adopted. This approach has the advantage of being easily administered to a large number of participants within a short time period, eliminating interviewer bias [41]. In addition, this technique can easily explain students' behaviour [42].

Sample size

Based on the original study conducted by Walpola et al. [40], a sample size of 200 students from each country was considered adequately representative. The original study estimated the appropriate sample size based on Boomsma's method of estimating a minimum sample size to conduct a confirmatory factor analysis based on the number of items to number of factors ratio of the model [43].

Sampling strategy

The study population included undergraduate pharmacy students across all professional years of study. A convenience sampling technique was used to recruit eligible participants as it was not feasible to determine a sampling frame in each of the six countries. This sampling technique is a type of non-probability sampling method,

in which participants from the target population who met the inclusion criteria of the study were easily accessible due to geographical proximity, availability at a given time, or were willing to take part in the study [44]. Student recruitment was conducted by researchers (AN, OA) in Jordan, (A. Alsharif) in Saudi Arabia, (ZA) in Kuwait, (A. Awaisu) in Qatar, (SH) in India and (AK) in Indonesia. The questionnaire was administered either as a hard-copy or electronically to eligible participants in a consistent manner to reduce the risk of assessment bias. All the undergraduate pharmacy students in the participating universities were approached and invited to take part in the study. For students who agreed to participate, the questionnaire was administered either as a hard copy or electronically after the study aim and objectives had been explained.

Survey instrument

A previously validated questionnaire [40] was used in this study to explore the attitudes of undergraduate pharmacy students towards patient safety. This questionnaire was originally developed and validated by Walpola and colleagues, who validated an adaptation of Madigosky et al's questionnaire (the Patient Safety/Medical Fallibility Curriculum Survey) [32], to evaluate attitudes and values of pharmacy students towards patient safety. Walpola et al.'s 14-item questionnaire comprised five subscales: (1) quality-improvement focused (four questions), (2) internalising errors regardless of harm (three questions), (3) value of contextual learning (three questions), (4) acceptability of questioning more senior healthcare professionals' behaviour (two questions), and (5) attitude towards open disclosure (two questions). The study questionnaire asked undergraduate pharmacy students about the degree of applicability of each item to them using a 5-point Likert scale. Response options ranged from 0 to 4, where 0 meant "strongly disagree" and 4 meant "strongly agree". Three items (items numbered 5, 6, and 7) were negatively worded and, thus, were reversely scored during the analysis, where 0 meant "strongly agree" and 4 meant "strongly disagree". The total possible score for the questionnaire ranged between 0 and 56 and could be interpreted based on the mid-point of the highest possible score of the scale (equal to 28): the higher the score, the better the attitude towards patient safety. Besides, the following data were collected: participant's gender, year of study, prior practical experience in healthcare settings- if applicable, and involvement in an incident that resulted in harm or potential harm as a result of receiving healthcare.

The use of a pre-existing questionnaire has the advantage of using a validated and tested instrument, which increases the reliability of measurement [45]. In addition, the use of an existing questionnaire allows for comparison with different populations [46]. The mean score ± SD for each item was calculated based on the student responses using the 5-point Likert scale, which ranged between 0 and 4. In addition, the total mean score for each subscale was calculated to allow comparison between different subscales.

Validity and reliability of the survey instrument

Walpola's questionnaire was examined for its psychometric properties in 446 students [40]. The face and content validity of the questionnaire were tested. In addition, exploratory factor analysis was conducted to test the construct validity and the internal consistency of the questionnaire was examined. In addition, the original investigators conducted focus groups among three populations: initially among five pharmacy academics, five practising pharmacists and seven pharmacy student representatives to assess the face validity of the survey instrument. Besides this, we examined Cronbach's alpha measures for the five factors in the questionnaire, which ranged between 0.56 and 0.78. The overall Cronbach's alpha measure was 0.72. This identified the questionnaire as having acceptable stability.

Data collection procedure

In Jordan, we used hard copies of the questionnaire, and the recruitment of participants was conducted in two universities (one private and one government). An electronic version of the questionnaire was used for the students recruited in the other countries. In Saudi Arabia, the survey was distributed in three government universities. In Indonesia, student recruitment was conducted in two government universities, while in India it was conducted in five universities. In Kuwait and Qatar, the study was conducted in one government university in each country, these being the only available ones that offer an undergraduate pharmacy degree program.

Patient and public involvement

Patients were not involved in any aspect of the design or conduct of this study.

Statistical analysis

Data were analysed using SPSS software, version 25 (IBM Corp, Armonk, NY, USA). Continuous variables were reported as mean ($\pm$ standard deviation [SD]), while categorical variables were reported as frequencies and percentages. The Kolmogorov–Smirnov and Shapiro Wilk tests were used to check the normality of the data. Students' scores were interpreted as a continuous scale based on the scale midpoint, where scores above the midpoint represented more positive attitudes towards patient safety for that factor. The one-way ANOVA test and Pearson's correlation coefficient were used to compare the mean scores between different demographic groups and to analyse the correlation between continuous independent variables and students' scores, respectively. Tukey's HSD post-hoc test was conducted to identify the source of significant variation within each group. Additionally, significant predictors of positive attitudes towards patients' safety were determined using multiple linear regression analysis. A confidence interval of 95% ($p<0.05$) was applied to represent the statistical significance of the results, and the level of significance was predetermined as 5%.

RESULTS

Students' demographic characteristics

A total of 2,595 undergraduate pharmacy students participated in the study (Jordan = 1,044, Saudi Arabia = 514, Indonesia = 429, India = 416, Kuwait = 134 and Qatar = 61). About 67.0% (n = 1,752) of the students were female. The majority of the respondents were recruited from Jordan (n= 1,044; 39.9%), followed by Saudi Arabia (n= 514; 19.7%). An approximately similar percentage of participants were recruited from Indonesia (n= 429; 16.5%) and India (n= 416; 16.0%). The lowest percentages of participants came from Kuwait and Qatar, with only 5.2% (n= 134) and 2.4% (n= 61) being recruited from these two countries, respectively. This was expected due to the small population size and, thus, the small number of pharmacy students (Kuwait and Qatar only have one faculty of pharmacy each). The majority of the students were in their thirds and fourth year of study with 21.0% (n= 546) and 26.2% (n= 679), respectively. Only 38.2% (n= 990) of the participants reported that they had had prior or were undergoing current practical experience in a practice setting, with only 27.4% (n= 712) of the participants have been involved in or have witnessed harm to patients while practicing. **Table 1** below summarises the demographic characteristics of the study participants from each country.

Table 1 Pharmacy students' characteristics from each country.

Demographics	Overall (n= 2,595)	Jordan (n= 1,044)	Saudi Arabia (n= 514)	Indonesia (n= 429)	India (n= 416)	Kuwait (n= 134)	Qatar (n= 61)
Gender No. (%)							
Female	1,752 (67.5)	741 (71.0)	323 (62.8)	388 (90.4)	124 (29.8)	115 (85.8)	61 (100)
Year of study No. (%)							
First year	511 (19.7)	74 (7.1)	9 (1.8)	255 (59.4)	165 (39.7)	0 (0.0)	8 (13.1)
Second year	407 (15.7)	148 (14.2)	21 (4.1)	78 (18.2)	108 (26.0)	32 (23.9)	20 (32.8)
Third year	546 (21.0)	243 (23.3)	110 (21.4)	60 (14.0)	57 (13.7)	67 (50.0)	9 (14.8)
Fourth year	679 (26.2)	319 (30.6)	232 (45.1)	29 (6.8)	64 (15.4)	22 (16.4)	13 (21.3)
Fifth year	452 (17.4)	260 (24.9)	142 (27.6)	7 (1.6)	22 (5.3)	13 (9.7)	11 (18.0)
Prior healthcare experience No. (%)							
Yes	990 (38.2)	448 (42.9)	281 (54.7)	39 (9.1)	141 (33.9)	49 (36.6)	32 (52.5)
Ever been involved in or witnessed harm to patients while practicing No. (%)							
Yes	712 (27.4)	249 (23.9)	230 (44.7)	82 (19.1)	110 (26.4)	28 (20.9)	13 (21.3)

Pharmacy students' attitude towards patient safety

The mean score of the participants for the total scale was 37.4 [SD= 7.0] out of 56 (the highest possible score), 66.8%. The first subscale measured students' attitude in terms of "being quality-improvement focused". The participants' score was the highest for this scale, 75.6%. The lowest score was for the "internalising errors regardless of harm" subscale, 49.2%. **Table 2** summarizes these findings.

Table 2 Pharmacy students mean attitude towards patient safety scores in individual subscales and total scale scores (n = 2,595).

Subscale	Number of items	Range	Mean Score (SD)	Students score out of 100%
Being quality improvement focused	4	0-16	12.1 (3.1)	75.6
Acceptability of questioning more senior healthcare professionals' behaviour	2	0-8	5.6 (1.7)	70.0
Attitude towards open disclosure	2	0-8	5.5 (1.7)	68.8
Value of contextual learning	3	0-12	8.2 (2.2)	68.3
Internalising errors regardless of harm	3	0-12	5.9 (3.2)	49.2
Total Scale	14	0-56	37.4 (7.0)	66.8

Abbreviation: SD, Standard deviation

Effect of students' characteristics on their attitude towards patients' safety

Table 3 presents the effect of the students' demographics on their attitude towards patient safety scores. Students' scores significantly differed by country, gender, year of study, having prior experience in healthcare and being involved in or having witnessed harm to patients while practicing ($p < 0.01$). Tukey's HSD post-hoc test confirmed that all countries contributed to the significant difference in the mean score except Indonesia, and that Saudi Arabia, Kuwait and India had the most significant contributions in this variation. Regarding the year of study variable, the Tukey HSD test confirmed that all years of study contributed to the significant variation between groups.

Table 3 Pharmacy students' attitude towards patient safety score by students' characteristics (n= 2,595).

Variable	Patients' safety scores		
	Mean	SD	P-value
Country			
Jordan	38.9	6.7	0.000***
Saudi Arabia	32.1	7.0	
Indonesia	38.6	5.3	
India	40.6	5.5	
Kuwait	32.1	6.6	
Qatar	36.2	3.9	
Gender			
Male	36.6	7.8	0.000***
Female	37.7	6.6	
Year of study			
First year	39.3	6.1	0.000***
Second year	37.8	6.8	
Third year	37.0	6.9	
Fourth year	36.4	7.7	
Fifth year	36.8	7.1	
Prior healthcare experience			
Yes	36.8	7.4	0.001**
No	37.7	6.8	
Ever been involved in or witnessed harm to patients while practicing			
Yes	36.2	7.8	0.001**
No	37.8	6.7	

**p < 0.01
***p < 0.001
Abbreviation: SD, Standard deviation

Simple linear regression analysis showed that all demographic variables were significantly associated with a better attitude towards patients' safety score (p< 0.01). Multiple linear regression analysis showed that female students had a better attitude towards patients' safety score (p= 0.001). In addition, it showed that higher-level students and being involved in or having witnessed harm to patients while practicing were associated with a slightly lower score (p= 0.000), **Table 4**.

Table 4 Multiple regression analysis predicting students' attitude towards patients' safety.

Variable	Model[a]		
	B	**SE**	**ß**
Demographic data			
Females	0.96	0.292	0.06**
Year of study			
Second year	-1.45	0.46	-0.08**
Third year	-2.20	0.43	-0.13***
Fourth year	-2.76	0.42	-0.17***
Fifth year	-2.41	0.42	-0.13***
Having prior experience in healthcare			
Yes	0.21	0.33	0.01
Being involved in or witnessed harm to patients while practicing			
Yes	-1.17	0.33	-0.07***
Constant			
Adjusted R^2			0.030
P-value			0.000

*p < 0.05, **p < 0.01, ***p < 0.001

a: includes gender, year of study, having prior experience in healthcare, and being involved in or witnessed harm to patients while practicing.

B: the average change in the depenedent variable associated with a 1 unit change in the independent variable, statisitcally controlling for the other independent variables; SE: it is the standard deviation of its sampling distribution or an estimate of that standard deviation; ß: a statistical measure that compares the strength of the effect of each individual independent variable to the dependent variable

DISCUSSION

The current study has identified the attitudes of undergraduate pharmacy students towards patients' safety. The sample was collected from different universities in different countries, across all years of study for the pharmacy program, and using a previously validated tool. The data was collected from a large sample compared to previous similar studies. For example, Carruthers et al. (2009) conducted a questionnaire-based study on 364 undergraduate medical students and 66 tutors from one medical school in the UK [6], while Tegegn et al. (2017) conducted their study with a population of 83 students from a single university in Ethiopia [47]. Also, there were previous surveys conducted by Tegegn et al. [47] and Carruthers et al. [6] which did not obtain data on the nationality of the participants. This limited our ability to make direct comparisons between different nationalities settings. The results highlighted that, generally, a positive attitude towards patient safety was an important issue among pharmacy undergraduate students. There was a small but significant difference in attitudes between male and female pharmacy students. These results are comparable with those of another previous study [47], where 86.7% of female respondents had an overall positive attitude to patient safety compared to 83% of their male counterparts. Neither the previous nor the current study was able to explain this difference, and a further study of attitudes of male and female students towards patient safety is required to elucidate whether this is a real gender-influenced trait.

In the current study, there were two factors which have been negatively correlated with attitudes towards patient safety; these are the 'year of study' and "being involved in or having witnessed harm to patients while practicing".

Similar findings were reported in a previous study and showed that students in their early years of study had higher scores (a better attitude towards patient safety) compared to others in their final years of training [48]. This could be justified because some health care students believe that patient safety issues cannot be taught and can only be learned through clinical experience when qualified [48]. This incorrect belief could have arisen among the students due to a lack of formal teaching that have led to the reluctance to adopt patient safety practices. These results are inconsistent with another study's results among pharmacy students in Ethiopia [47]. Such a difference between the studies could be due to variations in the study settings, the recruited participants or, possibly, due to the greater emphasis allocated to teaching patient safety to students in specific countries over others. A follow-up study focusing on the change in attitudes towards the pharmacy teaching course is required. In addition, there is a need for the reinforcement towards patient safety throughout the pharmacy program. This has also been recommended previously in studies about attitudes towards patient safety among medical students [6,49]. In a previous study, medical students who had received education on patient safety attached greater importance to this topic and had more confidence in reporting incidences of poor patient safety [6]. Also, it has been highlighted previously that there is a lack of patient safety education among a range of clinical disciplines, including medical, nursing and pharmacy students [50,51]. Patient safety education has the potential to revolutionise the attitudes of pharmacists and pharmacists-in-training, which has broad implications for practice [50].

In addition to the importance of educating patient safety at the university level, there is a need for constant reinforcement of messages regarding patient safety. In one study, it has been reported that some of the positive messages regarding improving patient care, which were taught to second-year medical students, had been forgotten after one year [32]. Those students were also less likely to be open about the errors they had witnessed and less likely to believe that it was necessary to disclose errors that had not caused patient harm. Similarly, in the present study, it has been found that 49% of students agreed that errors should be internalised, regardless of harm to patients. Pharmacy students in Ethiopia shared the same belief in reporting self-errors, where only half of the students agreed, or strongly agreed, that pharmacists should report errors concerning a patient in situations where harm had occurred [47]. A previous study in Pakistan that assessed the attitudes and perceptions of postgraduate students towards patient safety reported consistent findings: that students felt less confident in reporting any error other people had made in the work environment, no matter how serious the outcome had been for the patient [48]. Many studies from different countries have reported that health care students have a common belief that medical errors are inevitable, and that even very experienced people make medical errors [48,49,52,53]. Reporting medical errors is important, and a failure to report such types of error indicates a lack of awareness of the risky

consequences of such practice to the healthcare services provided to the patients. This finding has an implication for further research to understand the reasons for this behaviour; whether it is from a fear of reprisal from colleagues or patients or a lack of recognition of reporting as part of the duty of care to patients. However, incompatible results have been reported in North America, where the majority of students had positive attitudes towards reporting serious errors when they encountered them, but they had inadequate knowledge about the process of reporting them [54]. Also, in that study, it can be seen that some students had conflicting attitudes towards reporting errors. They believed that reporting them would compromise inter-professional relationships, reduce the patients' confidence in the healthcare system and interrupt the workflow.

Strengths and weaknesses

The current study has many strengths. First, to the best of our knowledge, this study is the first large-scale study comprising participants from multiple nations (six countries), which suggests the evidence is robust and more generalizable. The data was collected from a large sample compared to previous similar studies from different countries. Second, the research used a validated questionnaire and a non-biased recruitment process, which provided reassurance of the quality of the study and the findings reported [40]. However, there are some limitations. The study design itself, a cross-sectional survey design, limited our ability to identify causality between study variables. A further limitation of the current study was the small number of participants from some of the participating countries (Qatar; n= 61, and Kuwait; n= 134), and the dominance of the sample size by students from only two countries Jordan (39.9%) and Saudi Arabia (19.7%). However, due to the small population size in Qatar and Kuwait, and knowing that we recruited students from the only two available faculties of pharmacy in these two countries, we assume that these small numbers are sufficient to draw conclusions from. Future research should consider a wider range of countries during the recruitment phase to identify whether the findings can be expanded. Finally, we were not able to estimate the response rate for our study, which might lead to nonresponse bias, as we could not demonstrate how well the sample drawn from the population of interest. Therefore, the findings should be interpreted carefully.

Implications of Findings to Practice

The findings of this study can help curricula developers to focus on patient safety teaching and make it an essential part of pharmacy curricula. Continuous educational sessions on patient safety and the reporting of errors in patient care will help in raising the students' knowledge and awareness of patient safety and medical errors. In addition, to ensure the quality of care and patient safety, it is important to provide clinical and senior supervision when students are given tasks related to patient safety at all levels of the pharmacy program. Future studies to investigate

the factors and attitudes of pharmacists and pharmacy students are warranted. Cultural and regional factors are important and must be taken into account when conducting future research. However, it is also important to mention that future research should also be conducted at the patient-level to study and explore patient safety from different perspectives.

In conclusion, the current study has revealed the positive attitudes of pharmacy students towards patient safety. There is currently a lack of research regarding the effect of pharmacy students' attitudes and the wider implications for practice. Patient safety should be covered explicitly during the pharmacy students' education and reinforced at each year of study within the curriculum to ensure that the next generation of pharmacists is equipped with the knowledge and behaviours to ensure good patient safety. An additional focus should be placed on the area of patient safety to investigate further the key findings of the current study.

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collected data. Naser conducted to the data analysis. Naser, Alsairafi, Alwafi, Awwad, Awaisu, and Dahmash were involved in interpretation of data. Naser, Alsairafi, Alwafi, Awwad, Awaisu, and Dahmash wrote the first draft of the article. All authors reviewed the manuscript for important intellectual content and provided final approval of the version to be published. All authors agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Competing interests

None declared.

Patient consent

Not required.

Ethics approval

Ethical approval for this study was obtained from the research ethics committees of the participating universities. Permission and approval for the use of the study questionnaire were acquired from the corresponding author of the original study.

Provenance and peer review

Not commissioned; externally peer reviewed.

Data sharing statement

No additional data are available.

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Tables legends:

Table 1 Pharmacy students' characteristics from each country.

Table 2 Pharmacy students mean attitude towards patient safety scores in individual subscales and total scale scores (n = 2,595).

Table 3 Pharmacy students' attitude towards patient safety score by students' characteristics (n = 2,595).

Table 4 Multiple regression analysis predicting students' attitude towards patients' safety.

Tables:

Table 1 Pharmacy students' characteristics from each country.

Demographics	Overall (n= 2,595)	Jordan (n= 1,044)	Saudi Arabia (n= 514)	Indonesia (n= 429)	India (n= 416)	Kuwait (n= 134)	Qatar (n= 61)
Gender No. (%)							
Female	1,752 (67.5)	741 (71.0)	323 (62.8)	388 (90.4)	124 (29.8)	115 (85.8)	61 (100)
Year of study No. (%)							
First year	511 (19.7)	74 (7.1)	9 (1.8)	255 (59.4)	165 (39.7)	0 (0.0)	8 (13.1)
Second year	407 (15.7)	148 (14.2)	21 (4.1)	78 (18.2)	108 (26.0)	32 (23.9)	20 (32.8)
Third year	546 (21.0)	243 (23.3)	110 (21.4)	60 (14.0)	57 (13.7)	67 (50.0)	9 (14.8)
Fourth year	679 (26.2)	319 (30.6)	232 (45.1)	29 (6.8)	64 (15.4)	22 (16.4)	13 (21.3)
Fifth year	452 (17.4)	260 (24.9)	142 (27.6)	7 (1.6)	22 (5.3)	13 (9.7)	11 (18.0)
Prior healthcare experience No. (%)							
Yes	990 (38.2)	448 (42.9)	281 (54.7)	39 (9.1)	141 (33.9)	49 (36.6)	32 (52.5)
Ever been involved in or witnessed harm to patients while practicing No. (%)							
Yes	712 (27.4)	249 (23.9)	230 (44.7)	82 (19.1)	110 (26.4)	28 (20.9)	13 (21.3)

Table 2 Pharmacy students mean attitude towards patient safety scores in individual subscales and total scale scores (n = 2,595).

Subscale	Number of items	Range	Mean Score (SD)	Students score out of 100%
Being quality improvement focused	4	0-16	12.1 (3.1)	75.6
Acceptability of questioning more senior healthcare professionals' behaviour	2	0-8	5.6 (1.7)	70.0
Attitude towards open disclosure	2	0-8	5.5 (1.7)	68.8
Value of contextual learning	3	0-12	8.2 (2.2)	68.3
Internalising errors regardless of harm	3	0-12	5.9 (3.2)	49.2
Total Scale	14	0-56	37.4 (7.0)	66.8

Abbreviation: SD, Standard deviation

Table 3 Pharmacy students' attitude towards patient safety score by students' characteristics (n = 2,595).

	Patients' safety scores		
Variable	**Mean**	**SD**	**P-value**
Country			
Jordan	38.9	6.7	
Saudi Arabia	32.1	7.0	
Indonesia	38.6	5.3	0.000***
India	40.6	5.5	
Kuwait	32.1	6.6	
Qatar	36.2	3.9	
Gender			
Male	36.6	7.8	0.000***
Female	37.7	6.6	
Year of study			
First year	39.3	6.1	
Second year	37.8	6.8	
Third year	37.0	6.9	0.000***
Fourth year	36.4	7.7	
Fifth year	36.8	7.1	
Prior healthcare experience			
Yes	36.8	7.4	0.001**
No	37.7	6.8	
Ever been involved in or witnessed harm to patients while practicing			
Yes	36.2	7.8	0.001**
No	37.8	6.7	

**p < 0.01
***p < 0.001
Abbreviation: SD, Standard deviation

Table 4 Multiple regression analysis predicting students' attitude towards patients' safety.

Variable	Model[a]		
	B	**SE**	**ß**
Demographic data			
Females	0.96	0.292	0.06**
Year of study			
Second year	-1.45	0.46	-0.08**
Third year	-2.20	0.43	-0.13***
Fourth year	-2.76	0.42	-0.17***
Fifth year	-2.41	0.42	-0.13***
Having prior experience in healthcare			
Yes	0.21	0.33	0.01
Being involved in or witnessed harm to patients while practicing			
Yes	-1.17	0.33	-0.07***
Constant			
Adjusted R^2			0.030
P-value			0.000

*p < 0.05, **p < 0.01, ***p < 0.001
a: includes gender, year of study, having prior experience in healthcare, and being involved in or witnessed harm to patients while practicing.
B: the average change in the depenedent variable associated with a 1 unit change in the independent variable, statisitcally controlling for the other independent variables; SE: it is the standard deviation of its sampling distribution or an estimate of that standard deviation; ß: a statistical measure that compares the strength of the effect of each individual independent variable to the dependent variable

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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1 and 2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4 and 5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5 and 6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5 and 6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Not applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5 , 6 and 7
Bias	9	Describe any efforts to address potential sources of bias	Not applicable
Study size	10	Explain how the study size was arrived at	5 and 6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7
		(*b*) Describe any methods used to examine subgroups and interactions	7
		(*c*) Explain how missing data were addressed	Not applicable
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	Not applicable
		(*e*) Describe any sensitivity analyses	Not applicable
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	Not applicable
		(c) Consider use of a flow diagram	Not applicable
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8 and 9
		(b) Indicate number of participants with missing data for each variable of interest	Not applicable
Outcome data	15*	Report numbers of outcome events or summary measures	8 -12
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Not applicable
		(*b*) Report category boundaries when continuous variables were categorized	Not applicable
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Not applicable
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Not applicable
Discussion			
Key results	18	Summarise key results with reference to study objectives	12
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	14
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	12-14
Generalisability	21	Discuss the generalisability (external validity) of the study results	14
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	17

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Attitudes of pharmacy students towards patient safety: a cross-sectional study from six developing countries

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1 **Article title:** Attitudes of pharmacy students towards patient safety: a cross-sectional study from six developing

2 countries

3 **Short-running title:** Attitudes of pharmacy students towards patient safety

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ABSTRACT

Objective: To evaluate the attitudes of undergraduate pharmacy students towards patient safety in six developing countries.

Design: A cross-sectional study.

Setting: Participants were enrolled from the participating universities in six countries.

Participants: Undergraduate pharmacy students from the participating universities in six developing countries (Jordan, Saudi Arabia, Kuwait, Qatar, India and Indonesia) were invited to participate in the study between October 2018 and September 2019.

Primary outcome: Attitudes towards patient safety was measured using 14-item questionnaire that contained five subscales: being quality-improvement focused, internalising errors regardless of harm, value of contextual learning, acceptability of questioning more senior healthcare professionals' behaviour, and attitude towards open disclosure. Multiple-linear regression analysis was used to identify predictors of positive attitudes towards patient safety.

Results: A total of 2,595 students participated in this study (1,044 from Jordan, 514 from Saudi Arabia, 134 from Kuwait, 61 from Qatar, 416 from India and 429 from Indonesia). Overall, the pharmacy students reported a positive attitude towards patient safety with a mean score of 37.4 (SD= 7.0) out of 56 (66.8%). The "being quality-improvement focused" subscale had the highest score, 75.6%. The subscale with the lowest score was "internalising errors regardless of harm", 49.2%. Female students had significantly better attitudes towards patient safety scores compared to male students (p=0.001). Being at a higher level of study and involvement in or witnessing harm to patients while practising were important predictors of negative attitudes towards patient safety (p<0.001).

Conclusion: Patient safety content should be covered comprehensively in pharmacy curricula and reinforced in each year of study. This should be more focused on students in their final year of study and who have started their training. This will ensure that the next generation of pharmacists are equipped with the requisite knowledge, core competencies and attitudes to ensure optimal patient safety when they practice.

Keywords: Attitude; Patient; Pharmacy; Safety; Students.

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66   **Strengths and limitations of this study**

67   • This is the first study comprising participants from multiple countries to investigate the attitudes of

68   undergraduate pharmacy students towards patient safety in the Middle East region.

69   • We were not able to estimate the response rate for our study, which might have led to nonresponse bias.

70   • The study sample was mainly dominated by students from two countries (Jordan and Saudi Arabia),

71   while there was a small number of participants from Qatar and Kuwait.

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INTRODUCTION

Patient safety is one of the main concerns of healthcare systems during the provision of healthcare services and is increasingly being used as a measure of healthcare quality. The World Health Organization (WHO) has stressed the importance of reducing healthcare errors and establishing action plans to reduce patient harm and increase patient safety [1]. Medical errors are associated with high probability of patients harm and high mortality rate which raised the need for strategies that are evidence-based to enhance patient safety [2]. Research results revealed that around 10.0% of patients admitted to hospital within developed countries have a chance of being harmed, and up to 18.0% of hospital admissions experienced adverse events. Besides, there is a growing concern pertinent to the level of harm among patients in developing countries that could be attributed to the lack of accountability [3-5].

One of the best strategies to promote safer attitudes towards patient safety is education [6,7]. Patient safety education for undergraduate healthcare students has been considered a crucial element in minimising patient harm and developing a positive patient safety culture [8]. Several key international organisations have made recommendations to reshape healthcare professional education curricula to guarantee that they foster students' attitudes toward patient safety through enhancing their knowledge, skills and attitudes [9-14]. In recent years, pharmacy degree programmes have included content related to patient safety through curriculum guides [5], including the WHO's Patient Safety Curriculum Guide for Medical Schools [15] and their Multiprofessional Patient Safety Curriculum Guide [16-19]. Pharmacy students, in developing countries, gain some practical experience in healthcare settings at an earlier stage of their studies, either through experiential education placements or simulation-based programs [20]. However, unlike other healthcare professions, pharmacists' training is not well structured and does not mandate close monitoring of students during their training by preceptors. Although patient-centred care and patient safety might have been embedded through the curriculum, it has been mostly informal and theoretical [4,5,21].

Unfortunately, there is no recent studies that described the curricula in the Middle Eastern countries, However, a study in 2008, in Jordan reported that curricula at various pharmacy schools covers only 20% of allocated credit hours in pharmaceutical care which covers elements of patient safety. A study with sample of government and private universities in Jordan concluded that none of the evaluated universities had adopted a structured patient-oriented training for students [22]. In Qatar, the pharmacy practice focuses mainly on medication dispensing, and patient care that includes patient safety is still in its infancy [23]. Similar situations are present in Kuwait and Saudi Arabia where pharmaceutical care is only a focused in Pharm D program not the BSc Pharmacy program [24]. The situation in India is not widely different, there is no standard curriculum and it varies across universities. Most pharmacy school's education is away from practice sites and compulsory training is not required [25]. In Indonesia,

126 recent study in 2020 revealed that the provision of the pharmaceutical care that covers patient cantered care and

127 safety by community pharmacists in Malaysia is minimal [26].

128 In developing countries, there are cultural concerns, where pharmacy students are intimidated by other healthcare

129 professionals particularly, physicians, when they are in the clinical practice setting which will hamper patient

130 safety. The 'hierarchical difference in medical knowledge' will make young pharmacists' reluctance to question

131 decisions made by physicians [5,27]. Therefore, improving patient safety in developing countries requires changing

132 attitude particularly in shifting the blame culture in healthcare settings.

133 Efforts to foster patient safety in developing countries must be augmented and education systems during

134 undergraduate level must provide knowledge to improve patient safety [27].

135 Despite the increasing effort to enhance patient safety through improving healthcare professional curricula, this

136 improvement is considered challenging, and progress is very slow [5,12,13,28-33]. Developing positive attitudes among

137 university students is important as it is positively related to their achievement [34]. The accomplishment of

138 educational goals related to delivering safe and quality healthcare services requires students to have positive

139 attitudes towards patient safety [34,35]. Since attitude can substantially impact an individual's behaviour and practice

140 [36], it is crucial that pharmacy students' attitudes towards patient safety are understood and evaluated particularly

141 in developing countries.

142 Previous studies have explored the attitudes and values of healthcare students towards patient safety in different

143 countries, using different instruments [18,19,37-44]. The most widely-used validated tool is the patient safety/medical

144 fallibility survey, which was originally developed by Madigosky et al. for use among medical students [37]. This

145 tool was validated to assess the patient safety attitudes of pharmacy students by Walpola et al. [45]. However, there

146 are a limited number of studies that have focused on attitudes of undergraduate pharmacy students towards patient

147 safety, especially in developing countries. Therefore, the aim of this study was to evaluate the attitudes of

148 undergraduate pharmacy students towards patient safety in six developing countries.

149 **METHODS**

150 **Study design**

151 A quantitative cross-sectional survey using a self-administered questionnaire was conducted to explore patient

152 safety attitudes and values among pharmacy students in six developing countries (Jordan, Saudi Arabia, Kuwait,

153 Qatar, India and Indonesia). To achieve the study aim, a self-administered questionnaire approach was adopted.

154 This approach has the advantage of being easily administered to a large number of participants within a short time

155 period, eliminating interviewer bias [46]. In addition, this technique can easily explain students' behaviour [47].

Sample size

157 Based on the original study conducted by Walpola et al. [45], a sample size of 200 students from each country was

158 considered adequately representative. The original study estimated the appropriate sample size based on

159 Boomsma's method of estimating a minimum sample size to conduct a confirmatory factor analysis based on the

160 number of items to number of factors ratio of the model [48].

Sampling strategy

162 The study population included undergraduate pharmacy students across all professional years of study. A

163 convenience sampling technique was used to recruit eligible participants as it was not feasible to determine a

164 sampling frame in each of the six countries. This sampling technique is a type of non-probability sampling method,

165 in which participants from the target population who met the inclusion criteria of the study were easily accessible

166 due to geographical proximity, availability at a given time, or were willing to take part in the study [49]. Student

167 recruitment was conducted by researchers (AN, OA) in Jordan, (A. Alsharif) in Saudi Arabia, (ZA) in Kuwait,

168 (A. Awaisu) in Qatar, (SH) in India and (AK) in Indonesia. The questionnaire was administered either as a hard-

169 copy or electronically to eligible participants in a consistent manner to reduce the risk of assessment bias. All the

170 undergraduate pharmacy students in the participating universities were approached and invited to take part in the

171 study. For students who agreed to participate, the questionnaire was administered either as a hard copy or

172 electronically after the study aim and objectives had been explained.

Survey instrument

174 A previously validated questionnaire [45] was used in this study to explore the attitudes of undergraduate pharmacy

175 students towards patient safety. This questionnaire was originally developed and validated by Walpola and

176 colleagues, who validated an adaptation of Madigosky et al's questionnaire (the Patient Safety/Medical Fallibility

177 Curriculum Survey) [37], to evaluate attitudes and values of pharmacy students towards patient safety. Walpola et

178 al.'s 14-item questionnaire comprised five subscales: (1) quality-improvement focused (four questions), (2)

179 internalising errors regardless of harm (three questions), (3) value of contextual learning (three questions), (4)

180 acceptability of questioning more senior healthcare professionals' behaviour (two questions), and (5) attitude

181 towards open disclosure (two questions). The study questionnaire asked undergraduate pharmacy students about

182 the degree of applicability of each item to them using a 5-point Likert scale. Response options ranged from 0 to

183 4, where 0 meant "strongly disagree" and 4 meant "strongly agree". Three items (items numbered 5, 6, and 7)

184 were negatively worded and, thus, were reversely scored during the analysis, where 0 meant "strongly agree" and

185 4 meant "strongly disagree". The total possible score for the questionnaire ranged between 0 and 56 and could be

186   interpreted based on the mid-point of the highest possible score of the scale (equal to 28): the higher the score,

187   the better the attitude towards patient safety. Besides, the following data were collected: participant's gender, year

188   of study, prior practical experience in healthcare settings- if applicable, and involvement in an incident that

189   resulted in harm or potential harm as a result of receiving healthcare.

190   The use of a pre-existing questionnaire has the advantage of using a validated and tested instrument, which

191   increases the reliability of measurement [50]. In addition, the use of an existing questionnaire allows for comparison

192   with different populations [51]. The mean score ± SD for each item was calculated based on the student responses

193   using the 5-point Likert scale, which ranged between 0 and 4. In addition, the total mean score for each subscale

194   was calculated to allow comparison between different subscales.

195   **Validity and reliability of the survey instrument**

196   Walpola's questionnaire was examined for its psychometric properties in 446 students [45]. The face and content

197   validity of the questionnaire were tested. In addition, exploratory factor analysis was conducted to test the

198   construct validity and the internal consistency of the questionnaire was examined. In addition, the original

199   investigators conducted focus groups among three populations: initially among five pharmacy academics, five

200   practising pharmacists and seven pharmacy student representatives to assess the face validity of the survey

201   instrument. Besides this, we examined Cronbach's alpha measures for the five factors in the questionnaire, which

202   ranged between 0.56 and 0.78. The overall Cronbach's alpha measure was 0.72. This identified the questionnaire

203   as having acceptable stability.

204   **Pre-testing of the questionnaire**

205   A pilot study using the original questionnaire was conducted on 45 pharmacy students (from different Arab

206   nationalities) in Jordan, who met the inclusion criteria for the study. Students were asked about the clarity and

207   comprehensibility of the questionnaire, and if any of the questions were difficult to understand. Students

208   confirmed that the questionnaire was considered easy to understand and to complete.

209   **Data collection procedure**

210   In Jordan, we used hard copies of the questionnaire, and the recruitment of participants was conducted in two

211   universities (one private and one government). An electronic version of the questionnaire was used for the students

212   recruited in the other countries. In Saudi Arabia, the survey was distributed in three government universities. In

213   Indonesia, student recruitment was conducted in two government universities, while in India it was conducted in

214   five universities. In Kuwait and Qatar, the study was conducted in one government university in each country,

215   these being the only available ones that offer an undergraduate pharmacy degree program.

216   **Patient and public involvement**

217   Patients were not involved in any aspect of the design or conduct of this study.

218   **Statistical analysis**

219   Data were analysed using SPSS software, version 25 (IBM Corp, Armonk, NY, USA). Continuous variables were

220   reported as mean (± standard deviation [SD]), while categorical variables were reported as frequencies and

221   percentages. The Kolmogorov–Smirnov and Shapiro Wilk tests were used to check the normality of the data.

222   Students' scores were interpreted as a continuous scale based on the scale midpoint, where scores above the

223   midpoint represented more positive attitudes towards patient safety for that factor. The one-way ANOVA test and

224   Pearson's correlation coefficient were used to compare the mean scores between different demographic groups

225   and to analyse the correlation between continuous independent variables and students' scores, respectively.

226   Tukey's HSD post-hoc test was conducted to identify the source of significant variation within each group.

227   Additionally, significant predictors of positive attitudes towards patients' safety were determined using multiple

228   linear regression analysis. A confidence interval of 95% (p<0.05) was applied to represent the statistical

229   significance of the results, and the level of significance was predetermined as 5%.

230   **RESULTS**

231   **Students' demographic characteristics**

232   A total of 2,595 undergraduate pharmacy students participated in the study (Jordan = 1,044, Saudi Arabia = 514,

233   Indonesia = 429, India = 416, Kuwait = 134 and Qatar = 61). About 67.0% (n = 1,752) of the students were female.

234   The majority of the respondents were recruited from Jordan (n= 1,044; 39.9%), followed by Saudi Arabia (n=

235   514; 19.7%). An approximately similar percentage of participants were recruited from Indonesia (n= 429; 16.5%)

236   and India (n= 416; 16.0%). The lowest percentages of participants came from Kuwait and Qatar, with only 5.2%

237   (n= 134) and 2.4% (n= 61) being recruited from these two countries, respectively. This was expected due to the

238   small population size and, thus, the small number of pharmacy students (Kuwait and Qatar only have one faculty

239   of pharmacy each). The majority of the students were in their thirds and fourth year of study with 21.0% (n= 546)

240   and 26.2% (n= 679), respectively. Only 38.2% (n= 990) of the participants reported that they had had prior or

241   were undergoing current practical experience in a practice setting, with only 27.4% (n= 712) of the participants

242   have been involved in or have witnessed harm to patients while practicing. **Table 1** below summarises the

243   demographic characteristics of the study participants from each country.

244 **Table 1** Pharmacy students' characteristics from each country.

Demographics	Overall (n= 2,595)	Jordan (n= 1,044)	Saudi Arabia (n= 514)	Indonesia (n= 429)	India (n= 416)	Kuwait (n= 134)	Qatar (n= 61)
Gender No. (%)							
Female	1,752 (67.5)	741 (71.0)	323 (62.8)	388 (90.4)	124 (29.8)	115 (85.8)	61 (100)
Year of study No. (%)							
First year	511 (19.7)	74 (7.1)	9 (1.8)	255 (59.4)	165 (39.7)	0 (0.0)	8 (13.1)
Second year	407 (15.7)	148 (14.2)	21 (4.1)	78 (18.2)	108 (26.0)	32 (23.9)	20 (32.8)
Third year	546 (21.0)	243 (23.3)	110 (21.4)	60 (14.0)	57 (13.7)	67 (50.0)	9 (14.8)
Fourth year	679 (26.2)	319 (30.6)	232 (45.1)	29 (6.8)	64 (15.4)	22 (16.4)	13 (21.3)
Fifth year	452 (17.4)	260 (24.9)	142 (27.6)	7 (1.6)	22 (5.3)	13 (9.7)	11 (18.0)
Prior healthcare experience No. (%)							
Yes	990 (38.2)	448 (42.9)	281 (54.7)	39 (9.1)	141 (33.9)	49 (36.6)	32 (52.5)
Ever been involved in or witnessed harm to patients while practicing No. (%)							
Yes	712 (27.4)	249 (23.9)	230 (44.7)	82 (19.1)	110 (26.4)	28 (20.9)	13 (21.3)

Pharmacy students' attitude towards patient safety

The mean score of the participants for the total scale was 37.4 [SD= 7.0] out of 56 (the highest possible score), 66.8%. The first subscale measured students' attitude in terms of "being quality-improvement focused". The participants' score was the highest for this scale, 75.6%. The lowest score was for the "internalising errors regardless of harm" subscale, 49.2%.

The highest mean score for the total scale was for India (40.6 (SD= 5.5), 72.5%). India had the highest subscale score for the subscale "value of contextual learning" (9.5 (SD= 1.7), 79.2%). Qatar had the highest subscale score for two subscales which are "being quality improvement focused" (13.9 (SD= 1.6), 86.9%) and "acceptability of questioning more senior healthcare professionals' behaviour" (6.5 (SD= 1.3), 81.3%). The score of the subscale "attitude towards open disclosure" was similar across students from Indonesia, India, and Qatar with a mean score that range between 6.0 (SD= 1.4) to 6.0 (SD= 1.7), 75.0%. Jordan had the highest subscale score for the subscale "internalising errors regardless of harm" (8.1 (SD= 2.6), 67.5%). **Table 2** summarizes these findings.

275 **Table 2** Pharmacy students mean attitude towards patient safety scores in individual subscales and total scale scores stratified by country (n = 2,595).

Subscale	Number of items	Range	Overall		Jordan		Saudi Arabia		Indonesia		India		Kuwait		Qatar	
			Mean Score (SD)	Students score out of 100%	Mean Score (SD)	Students score out of 100%	Mean Score (SD)	Students score out of 100%	Mean Score (SD)	Students score out of 100%	Mean Score (SD)	Students score out of 100%	Mean Score (SD)	Students score out of 100%	Mean Score (SD)	Students score out of 100%
Being quality improvement focused	4	0-16	12.1 (3.1)	**75.6**	11.7 (2.8)	**73.1**	10.4 (3.4)	**65.0**	13.7 (1.9)	**85.6**	13.4 (1.9)	**83.8**	11.5 (4.5)	**71.9**	13.9 (1.6)	**86.9**
Acceptability of questioning more senior healthcare professionals' behaviour	2	0-8	5.6 (1.7)	**70.0**	5.4 (1.6)	**67.5**	4.9 (1.8)	**61.3**	6.3 (1.4)	**78.8**	6.3 (1.3)	**78.8**	5.1 (2.2)	**63.8**	6.5 (1.3)	**81.3**
Attitude towards open disclosure	2	0-8	5.5 (1.7)	**68.8**	5.6 (1.7)	**70.0**	4.7 (1.6)	**58.8**	6.0 (1.7)	**75.0**	6.0 (1.5)	**75.0**	5.0 (2.0)	**62.5**	6.0 (1.4)	**75.0**
Value of contextual learning	3	0-12	8.2 (2.2)	**68.3**	8.1 (2.0)	**67.5**	7.1 (2.4)	**59.2**	9.2 (1.8)	**76.7**	9.5 (1.7)	**79.2**	6.6 (2.3)	**55.0**	8.0 (2.1)	**66.7**
Internalising errors regardless of harm	3	0-12	5.9 (3.2)	**49.2**	8.1 (2.6)	**67.5**	5.0 (2.7)	**41.7**	3.4 (2.0)	**28.3**	5.4 (2.8)	**45.0**	3.9 (3.3)	**32.5**	1.9 (1.5)	**15.8**
Total Scale	14	0-56	37.4 (7.0)	**66.8**	38.9 (6.7)	**69.5**	32.1 (7.0)	**57.3**	38.6 (5.3)	**68.9**	40.6 (5.5)	**72.5**	32.1 (6.6)	**57.3**	36.2 (3.9)	**64.6**

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277 Abbreviation: SD, Standard deviation

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287 **Effect of students' characteristics on their attitude towards patients' safety**

288 **Table 3** presents the effect of the students' demographics on their attitude towards patient safety scores. Students'

289 scores significantly differed by country, gender, year of study, having prior experience in healthcare and being

290 involved in or having witnessed harm to patients while practicing ($p < 0.01$). Tukey's HSD post-hoc test confirmed

291 that all countries contributed to the significant difference in the mean score except Indonesia, and that Saudi

292 Arabia, Kuwait and India had the most significant contributions in this variation. Regarding the year of study

293 variable, the Tukey HSD test confirmed that all years of study contributed to the significant variation between

294 groups.

295 **Table 3** Pharmacy students' attitude towards patient safety score by students' characteristics (n= 2,595).

Variable	Patients' safety scores		
	Mean	**SD**	**P-value**
Country			
Jordan	38.9	6.7	
Saudi Arabia	32.1	7.0	
Indonesia	38.6	5.3	0.000***
India	40.6	5.5	
Kuwait	32.1	6.6	
Qatar	36.2	3.9	
Gender			
Male	36.6	7.8	0.000***
Female	37.7	6.6	
Year of study			
First year	39.3	6.1	
Second year	37.8	6.8	
Third year	37.0	6.9	0.000***
Fourth year	36.4	7.7	
Fifth year	36.8	7.1	
Prior healthcare experience			
Yes	36.8	7.4	0.001**
No	37.7	6.8	
Ever been involved in or witnessed harm to patients while practicing			
Yes	36.2	7.8	0.001**
No	37.8	6.7	

296 **p < 0.01, ***p < 0.001, Abbreviation: SD, Standard deviation

297 Simple linear regression analysis showed that all demographic variables were significantly associated with a better

298 attitude towards patients' safety score (p< 0.01). Multiple linear regression analysis showed that female students

299 had a better attitude towards patients' safety score (p= 0.001). In addition, it showed that higher-level students

300 and being involved in or having witnessed harm to patients while practicing were associated with a slightly lower

301 score (p= 0.000), **Table 4**.

302   **Table 4** Multiple regression analysis predicting students' attitude towards patients' safety.

Variable	Model[a]		
	B	**SE**	**ß**
Demographic data			
Females	0.96	0.292	0.06**
Year of study			
Second year	-1.45	0.46	-0.08**
Third year	-2.20	0.43	-0.13***
Fourth year	-2.76	0.42	-0.17***
Fifth year	-2.41	0.42	-0.13***
Having prior experience in healthcare			
Yes	0.21	0.33	0.01
Being involved in or witnessed harm to patients while practicing			
Yes	-1.17	0.33	-0.07***
Constant			
Adjusted R^2			0.030
P-value			0.000

303 *p < 0.05, **p < 0.01, ***p < 0.001
304 a: includes gender, year of study, having prior experience in healthcare, and being involved in or witnessed harm to patients while
305 practicing.
306 B: the average change in the depenedent variable associated with a 1 unit change in the independent variable, statisitcally controlling
307 for the other independent variables; SE: it is the standard deviation of its sampling distribution or an estimate of that standard deviation;
308 ß: a statistical measure that compares the strength of the effect of each individual independent variable to the dependent variable

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DISCUSSION

311 The current study has identified the attitudes of undergraduate pharmacy students towards patients' safety. The

312 sample was collected from different universities in different countries, across all years of study for the pharmacy

313 program, and using a previously validated tool. The data was collected from a large sample compared to previous

314 similar studies. For example, Carruthers et al. (2009) conducted a questionnaire-based study on 364 undergraduate

315 medical students and 66 tutors from one medical school in the UK [6], while Tegegn et al. conducted their study

316 with a population of 83 students from a single university in Ethiopia [52]. Also, there were previous surveys

317 conducted by Tegegn et al. [52] and Carruthers et al. [6] which did not obtain data on the nationality of the participants.

318 This limited our ability to make direct comparisons between different nationalities settings. The results highlighted

319 that, generally, a positive attitude towards patient safety was an important issue among pharmacy undergraduate

320 students. There was a small but significant difference in attitudes between male and female pharmacy students.

321 These results are comparable with those of another previous study [52], where 86.7% of female respondents had an

322   overall positive attitude to patient safety compared to 83% of their male counterparts. Neither the previous nor

323   the current study was able to explain this difference, and a further study of attitudes of male and female students

324   towards patient safety is required to elucidate whether this is a real gender-influenced trait. Female students could

325   be more emotional and sensitive to patients' health outcomes, therefore, this would make them more proactive

326   and have stronger drive to act towards safer practices.

327   Comparison in terms of patient safety elements revealed variations among countries. The first subscale focused

328   on "students being quality improvement focused" with results highlighting the superiority of Qatar, Indonesia,

329   and India over the other countries. Such difference could be attributed to students in these countries receiving

330   education more pertinent to patient safety and the science behind it that could cover medication errors, drug

331   adverse events and their effect in optimizing patient outcomes. Although there are no recent research indicating

332   that in these countries patient safety is fundamental in curricula, results reflect presence of such teaching modules,

333   where studies reported that integrating patient safety in curricula will improve student knowledge [53]. Similar

334   results were obtained in the second and third subscales which focused on addressing "the acceptability of

335   questioning more senior healthcare professionals' behaviour" and "attitude towards open disclosure" which

336   apparently put an emphasis on something that is a consequence of what has been taught. In these subscales the

337   scores were lower than the first subscale and this could be expected, where students attitude will enable them to

338   develop a culture of understanding and preventing errors from occurring [45], which apparently requires practice

339   and elements that are beyond knowledge and hence the lower score of these two subscales were obtained when

340   compared to the first one.

341   As for the fourth subscale "value of contextual learning", Indonesia and India scored the highest. Here the domain

342   is assessing the students belief in the need to the delivery of patient safety interventions and teaching materials

343   [45]. Apparently, students who have good level of knowledge about patient safety will value the need to integrate

344   that into curricula and healthcare setting and hence the results reflected that. The last subscale assessed" students'

345   attitude pertinent to internalising errors regardless of harm", this subscale is related to the attitude of students in

346   internalising the error rather than taking action and this section provides good indication whether students would

347   manage risks and errors that could or not affect patients. Results showed that Jordan scored the highest among the

348   seven countries while Qatar scored the lowest. Although Jordan did not score the highest among the countries in

349   the first four subscales, it scored around the mean and none of the sections was below 67.0% indicating a positive

350   attitude towards patient safety. This last subscale is critical in fostering a patient safety culture. As this attitude is

351   related to the presence of transparency and willingness to reporting errors. Despite variations and slightly lower

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352 scores, Jordan scores were above average and their score in the final subsection rated the highest among the seven

353 countries. Future research is required to assess the pharmacy curricula in developing countries. Interestingly,

354 students' attitude towards patient safety in Kuwait and Saudi Arabia, neighbouring countries with similar cultural

355 values, reported the lowest among the seven countries. The average of scores for the two countries showed results

356 that are shy above the 50% mark. It could be expected that in these two countries patient safety is still in its infancy

357 phase.

358 In the current study, there were two factors which have been negatively correlated with attitudes towards patient

359 safety; these are the 'year of study' and "being involved in or having witnessed harm to patients while practicing".

360 Similar findings were reported in a previous study and showed that students in their early years of study had

361 higher scores (a better attitude towards patient safety) compared to others in their final years of training [54]. This

362 could have arisen among the students due to a lack of formal and well-structured teaching on patient safety that

363 build up with years of study and have led to the reluctance to adopt patient safety practices. In addition, other

364 literature reported that professional socialisation plays a big role in shifting students' and interns' attitudes [55],

365 which could be another important influencing factor. These results are inconsistent with another study's results

366 among pharmacy students in Ethiopia [52]. Such a difference between the studies could be due to variations in the

367 study settings, the recruited participants or, possibly, due to the greater emphasis allocated to teaching patient

368 safety to students in specific countries over others. A follow-up study focusing on the change in attitudes towards

369 the pharmacy teaching course is required. In addition, there is a need for the reinforcement towards patient safety

370 throughout the pharmacy program. This has also been recommended previously in studies about attitudes towards

371 patient safety among medical students [6,56]. In a previous study, medical students who had received education on

372 patient safety attached greater importance to this topic and had more confidence in reporting incidences of poor

373 patient safety [6]. Also, it has been highlighted previously that there is a lack of patient safety education among a

374 range of clinical disciplines, including medical, nursing and pharmacy students [57,58]. Patient safety education has

375 the potential to revolutionise the attitudes of pharmacists and pharmacists-in-training, which has broad

376 implications for practice [57].

377 In addition to the importance of educating patient safety at the university level, there is a need for constant

378 reinforcement of messages regarding patient safety. In one study, it has been reported that some of the positive

379 messages regarding improving patient care, which were taught to second-year medical students, had been

380 forgotten after one year [37]. Those students were also less likely to be open about the errors they had witnessed and

381 less likely to believe that it was necessary to disclose errors that had not caused patient harm. Similarly, in the

382 present study, it has been found that 49% of students agreed that errors should be internalised, regardless of harm

383 to patients. Pharmacy students in Ethiopia shared the same belief in reporting self-errors, where only half of the

384 students agreed, or strongly agreed, that pharmacists should report errors concerning a patient in situations where

385 harm had occurred [52]. A previous study in Pakistan that assessed the attitudes and perceptions of postgraduate

386 students towards patient safety reported consistent findings: that students felt less confident in reporting any error

387 other people had made in the work environment, no matter how serious the outcome had been for the patient [54].

388 Many studies from different countries have reported that health care students have a common belief that medical

389 errors are inevitable, and that even very experienced people make medical errors [54,56,59,60]. Reporting medical

390 errors is important, and a failure to report such types of error indicates a lack of awareness of the risky

391 consequences of such practice to the healthcare services provided to the patients. This finding has an implication

392 for further research to understand the reasons for this behaviour; whether it is from a fear of reprisal from

393 colleagues or patients or a lack of recognition of reporting as part of the duty of care to patients. However,

394 incompatible results have been reported in North America, where the majority of students had positive attitudes

395 towards reporting serious errors when they encountered them, but they had inadequate knowledge about the

396 process of reporting them [61]. Also, in that study, it can be seen that some students had conflicting attitudes towards

397 reporting errors. They believed that reporting them would compromise inter-professional relationships, reduce the

398 patients' confidence in the healthcare system and interrupt the workflow.

399 **Strengths and weaknesses**

400 The current study has many strengths. First, to the best of our knowledge, this study is the first large-scale study

401 comprising participants from multiple nations (six countries), which suggests the evidence is robust and more

402 generalizable. The data was collected from a large sample compared to previous similar studies from different

403 countries. Second, the research used a validated questionnaire and a non-biased recruitment process, which

404 provided reassurance of the quality of the study and the findings reported [45]. However, there are some limitations.

405 The study design itself, a cross-sectional survey design, limited our ability to identify causality between study

406 variables. A further limitation of the current study was the small number of participants from some of the

407 participating countries (Qatar; n= 61, and Kuwait; n= 134), and the dominance of the sample size by students

408 from only two countries Jordan (39.9%) and Saudi Arabia (19.7%). However, due to the small population size in

409 Qatar and Kuwait, and knowing that we recruited students from the only two available faculties of pharmacy in

410 these two countries, we assume that these small numbers are sufficient to draw conclusions from. Future research

411 should consider a wider range of countries during the recruitment phase to identify whether the findings can be

412 expanded. Finally, we were not able to estimate the response rate for our study, which might lead to nonresponse

413 bias, as we could not demonstrate how well the sample drawn from the population of interest. Therefore, the

414 findings should be interpreted carefully.

415 **Implications of Findings to Practice**

416 The findings of this study can help curricula developers to focus on patient safety teaching and make it an essential

417 part of pharmacy curricula. Continuous educational sessions on patient safety and the reporting of errors in patient

418 care will help in raising the students' knowledge and awareness of patient safety and medical errors. In addition,

419 to ensure the quality of care and patient safety, it is important to provide clinical and senior supervision when

420 students are given tasks related to patient safety at all levels of the pharmacy program. Future studies to investigate

421 the factors and attitudes of pharmacists and pharmacy students are warranted. Cultural and regional factors are

422 important and must be taken into account when conducting future research. However, it is also important to

423 mention that future research should also be conducted at the patient-level to study and explore patient safety from

424 different perspectives.

425 In conclusion, the current study has revealed the positive attitudes of pharmacy students towards patient safety.

426 There is currently limited number of research regarding the effect of pharmacy students' attitudes and the wider

427 implications for practice specifically, the Middle East and other developing countries. Patient safety should be

428 covered explicitly during the pharmacy students' education and reinforced at each year of study within the

429 curriculum to ensure that the next generation of pharmacists is equipped with the knowledge and behaviours to

430 ensure good patient safety. An additional focus should be placed on the area of patient safety to investigate further

431 the key findings of the current study.

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468 **Contributors**

469 The authors who contributed to the work described in this paper are as follows: Naser contributed to the study

470 design. Naser, Alsairafi, Awaisu, Alwafi, Hussain, Awwad, Alsharif, and Kautsar conducted the study and

471 collected data. Naser conducted to the data analysis. Naser, Alsairafi, Alwafi, Awwad, Awaisu, and Dahmash

472 were involved in interpretation of data. Naser, Alsairafi, Alwafi, Awwad, Awaisu, and Dahmash wrote the first

473 draft of the article. All authors reviewed the manuscript for important intellectual content and provided final

474 approval of the version to be published. All authors agreed to be accountable for all aspects of the work in ensuring

475 that questions related to the accuracy or integrity of any part of the work are appropriately investigated and

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479 **Competing interests**

480 None declared.

481 **Patient consent**

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483 **Ethics approval**

484 Ethical approval for this study was obtained from the research ethics committees (REC) of the participating

485 universities in Jordan (REC at faculty of pharmacy at Isra University (PH – 2019 – 07), Saudi Arabia (Prince

486 Norah bint Abdul Rahman University Institutional Review Board (19 – 0038), Kuwait (Health Sciences Centre

487 Ethical Committee at Kuwait University (VDR/EC), Indonesia (REC of Universitas Padjadjaran

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489 questionnaire were acquired from the corresponding author of the original study.

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492 **Data sharing statement**

493 No additional data are available.

494

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496 **References**

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643 **Tables legends:**

644 **Table 1** Pharmacy students' characteristics from each country.

645 **Table 2** Pharmacy students mean attitude towards patient safety scores in individual subscales and total scale

646 scores stratified by country (n = 2,595).

647 **Table 3** Pharmacy students' attitude towards patient safety score by students' characteristics (n = 2,595).

648 **Table 4** Multiple regression analysis predicting students' attitude towards patients' safety.

649

Tables:

Table 1 Pharmacy students' characteristics from each country.

Demographics	**Overall** (n= 2,595)	**Jordan** (n= 1,044)	**Saudi Arabia** (n= 514)	**Indonesia** (n= 429)	**India** (n= 416)	**Kuwait** (n= 134)	**Qatar** (n= 61)
Gender No. (%)							
Female	1,752 (67.5)	741 (71.0)	323 (62.8)	388 (90.4)	124 (29.8)	115 (85.8)	61 (100)
Year of study No. (%)							
First year	511 (19.7)	74 (7.1)	9 (1.8)	255 (59.4)	165 (39.7)	0 (0.0)	8 (13.1)
Second year	407 (15.7)	148 (14.2)	21 (4.1)	78 (18.2)	108 (26.0)	32 (23.9)	20 (32.8)
Third year	546 (21.0)	243 (23.3)	110 (21.4)	60 (14.0)	57 (13.7)	67 (50.0)	9 (14.8)
Fourth year	679 (26.2)	319 (30.6)	232 (45.1)	29 (6.8)	64 (15.4)	22 (16.4)	13 (21.3)
Fifth year	452 (17.4)	260 (24.9)	142 (27.6)	7 (1.6)	22 (5.3)	13 (9.7)	11 (18.0)
Prior healthcare experience No. (%)							
Yes	990 (38.2)	448 (42.9)	281 (54.7)	39 (9.1)	141 (33.9)	49 (36.6)	32 (52.5)
Ever been involved in or witnessed harm to patients while practicing No. (%)							
Yes	712 (27.4)	249 (23.9)	230 (44.7)	82 (19.1)	110 (26.4)	28 (20.9)	13 (21.3)

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Table 2 Pharmacy students mean attitude towards patient safety scores in individual subscales and total scale scores stratified by country (n = 2,595).

Subscale	Number of items	Range	Overall		Jordan		Saudi Arabia		Indonesia		India		Kuwait		Qatar	
			Mean Score (SD)	Students score out of 100%	Mean Score (SD)	Students score out of 100%	Mean Score (SD)	Students score out of 100%	Mean Score (SD)	Students score out of 100%	Mean Score (SD)	Students score out of 100%	Mean Score (SD)	Students score out of 100%	Mean Score (SD)	Students score out of 100%
Being quality improvement focused	4	0-16	12.1 (3.1)	**75.6**	11.7 (2.8)	**73.1**	10.4 (3.4)	**65.0**	13.7 (1.9)	**85.6**	13.4 (1.9)	**83.8**	11.5 (4.5)	**71.9**	13.9 (1.6)	**86.9**
Acceptability of questioning more senior healthcare professionals' behaviour	2	0-8	5.6 (1.7)	**70.0**	5.4 (1.6)	**67.5**	4.9 (1.8)	**61.3**	6.3 (1.4)	**78.8**	6.3 (1.3)	**78.8**	5.1 (2.2)	**63.8**	6.5 (1.3)	**81.3**
Attitude towards open disclosure	2	0-8	5.5 (1.7)	**68.8**	5.6 (1.7)	**70.0**	4.7 (1.6)	**58.8**	6.0 (1.7)	**75.0**	6.0 (1.5)	**75.0**	5.0 (2.0)	**62.5**	6.0 (1.4)	**75.0**
Value of contextual learning	3	0-12	8.2 (2.2)	**68.3**	8.1 (2.0)	**67.5**	7.1 (2.4)	**59.2**	9.2 (1.8)	**76.7**	9.5 (1.7)	**79.2**	6.6 (2.3)	**55.0**	8.0 (2.1)	**66.7**
Internalising errors regardless of harm	3	0-12	5.9 (3.2)	**49.2**	8.1 (2.6)	**67.5**	5.0 (2.7)	**41.7**	3.4 (2.0)	**28.3**	5.4 (2.8)	**45.0**	3.9 (3.3)	**32.5**	1.9 (1.5)	**15.8**
Total Scale	14	0-56	37.4 (7.0)	**66.8**	38.9 (6.7)	**69.5**	32.1 (7.0)	**57.3**	38.6 (5.3)	**68.9**	40.6 (5.5)	**72.5**	32.1 (6.6)	**57.3**	36.2 (3.9)	**64.6**

Abbreviation: SD, Standard deviation

Table 3 Pharmacy students' attitude towards patient safety score by students' characteristics (n = 2,595).

Variable	Patients' safety scores		
	Mean	SD	P-value
Country			
Jordan	38.9	6.7	0.000***
Saudi Arabia	32.1	7.0	
Indonesia	38.6	5.3	
India	40.6	5.5	
Kuwait	32.1	6.6	
Qatar	36.2	3.9	
Gender			
Male	36.6	7.8	0.000***
Female	37.7	6.6	
Year of study			
First year	39.3	6.1	0.000***
Second year	37.8	6.8	
Third year	37.0	6.9	
Fourth year	36.4	7.7	
Fifth year	36.8	7.1	
Prior healthcare experience			
Yes	36.8	7.4	0.001**
No	37.7	6.8	
Ever been involved in or witnessed harm to patients while practicing			
Yes	36.2	7.8	0.001**
No	37.8	6.7	

**p < 0.01
***p < 0.001
Abbreviation: SD, Standard deviation

Table 4 Multiple regression analysis predicting students' attitude towards patients' safety.

Variable	Model[a]		
	B	SE	ß
Demographic data			
Females	0.96	0.292	0.06**
Year of study			
Second year	-1.45	0.46	-0.08**
Third year	-2.20	0.43	-0.13***

Fourth year	-2.76	0.42	-0.17***
Fifth year	-2.41	0.42	-0.13***
Having prior experience in healthcare			
Yes	0.21	0.33	0.01
Being involved in or witnessed harm to patients while practicing			
Yes	-1.17	0.33	-0.07***
Constant			
Adjusted R^2			0.030
P-value			0.000

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$
a: includes gender, year of study, having prior experience in healthcare, and being involved in or witnessed harm to patients while practicing.
B: the average change in the depenedent variable associated with a 1 unit change in the independent variable, statisitcally controlling for the other independent variables; SE: it is the standard deviation of its sampling distribution or an estimate of that standard deviation;
ß: a statistical measure that compares the strength of the effect of each individual independent variable to the dependent variable

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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1 and 2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4 and 5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5 and 6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5 and 6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Not applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5 , 6 and 7
Bias	9	Describe any efforts to address potential sources of bias	Not applicable
Study size	10	Explain how the study size was arrived at	5 and 6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7
		(*b*) Describe any methods used to examine subgroups and interactions	7
		(*c*) Explain how missing data were addressed	Not applicable
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	Not applicable
		(*e*) Describe any sensitivity analyses	Not applicable
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	Not applicable
		(c) Consider use of a flow diagram	Not applicable
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8 and 9
		(b) Indicate number of participants with missing data for each variable of interest	Not applicable
Outcome data	15*	Report numbers of outcome events or summary measures	8 -12
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Not applicable
		(*b*) Report category boundaries when continuous variables were categorized	Not applicable
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Not applicable
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Not applicable
Discussion			
Key results	18	Summarise key results with reference to study objectives	12
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	14
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	12-14
Generalisability	21	Discuss the generalisability (external validity) of the study results	14
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	17

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Attitudes of pharmacy students towards patient safety: a cross-sectional study from six developing countries

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1   **Article title:** Attitudes of pharmacy students towards patient safety: a cross-sectional study from six developing

2   countries

3   **Short-running title:** Attitudes of pharmacy students towards patient safety

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36   **ABSTRACT**

37   **Objective:** To evaluate the attitudes of undergraduate pharmacy students towards patient safety in six developing

38   countries.

39   **Design:** A cross-sectional study.

40   **Setting:** Participants were enrolled from the participating universities in six countries.

41   **Participants:** Undergraduate pharmacy students from the participating universities in six developing countries

42   (Jordan, Saudi Arabia, Kuwait, Qatar, India and Indonesia) were invited to participate in the study between

43   October 2018 and September 2019.

44   **Primary outcome:** Attitudes towards patient safety was measured using 14-item questionnaire that contained

45   five subscales: being quality-improvement focused, internalising errors regardless of harm, value of contextual

46   learning, acceptability of questioning more senior healthcare professionals' behaviour, and attitude towards open

47   disclosure. Multiple-linear regression analysis was used to identify predictors of positive attitudes towards patient

48   safety.

49   **Results:** A total of 2,595 students participated in this study (1,044 from Jordan, 514 from Saudi Arabia, 134 from

50   Kuwait, 61 from Qatar, 416 from India and 429 from Indonesia). Overall, the pharmacy students reported a

51   positive attitude towards patient safety with a mean score of 37.4 (SD= 7.0) out of 56 (66.8%). The "being quality-

52   improvement focused" subscale had the highest score, 75.6%. The subscale with the lowest score was

53   "internalising errors regardless of harm", 49.2%. Female students had significantly better attitudes towards patient

54   safety scores compared to male students (p=0.001). Being at a higher level of study and involvement in or

55   witnessing harm to patients while practising were important predictors of negative attitudes towards patient safety

56   (p<0.001).

57   **Conclusion:** Patient safety content should be covered comprehensively in pharmacy curricula and reinforced in

58   each year of study. This should be more focused on students in their final year of study and who have started their

59   training. This will ensure that the next generation of pharmacists are equipped with the requisite knowledge, core

60   competencies and attitudes to ensure optimal patient safety when they practice.

61   **Keywords:** Attitude; Patient; Pharmacy; Safety; Students.

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66 **Strengths and limitations of this study**

67 • This is the first study comprising participants from multiple countries to investigate the attitudes of
68   undergraduate pharmacy students towards patient safety in the Middle East region.

69 • We were not able to estimate the response rate for our study, which might have led to nonresponse bias.

70 • The study sample was mainly dominated by students from two countries (Jordan and Saudi Arabia),
71   while there was a small number of participants from Qatar and Kuwait.

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INTRODUCTION

Patient safety is one of the main concerns of healthcare systems during the provision of healthcare services and is increasingly being used as a measure of healthcare quality. The World Health Organization (WHO) has stressed the importance of reducing healthcare errors and establishing action plans to reduce patient harm and increase patient safety [1]. Medical errors are associated with high probability of patients harm and high mortality rate which raised the need for strategies that are evidence-based to enhance patient safety [2]. Research results revealed that around 10.0% of patients admitted to hospital within developed countries have a chance of being harmed, and up to 18.0% of hospital admissions experienced adverse events. Besides, there is a growing concern pertinent to the level of harm among patients in developing countries that could be attributed to the lack of accountability [3-5].

One of the best strategies to promote safer attitudes towards patient safety is education [6,7]. Patient safety education for undergraduate healthcare students has been considered a crucial element in minimising patient harm and developing a positive patient safety culture [8]. Several key international organisations have made recommendations to reshape healthcare professional education curricula to guarantee that they foster students' attitudes toward patient safety through enhancing their knowledge, skills and attitudes [9-14]. In recent years, pharmacy degree programmes have included content related to patient safety through curriculum guides [5], including the WHO's Patient Safety Curriculum Guide for Medical Schools [15] and their Multiprofessional Patient Safety Curriculum Guide [16-19]. Pharmacy students, in developing countries, gain some practical experience in healthcare settings at an earlier stage of their studies, either through experiential education placements or simulation-based programs [20]. However, unlike other healthcare professions, pharmacists' training is not well structured and does not mandate close monitoring of students during their training by preceptors. Although patient-centred care and patient safety might have been embedded through the curriculum, it has been mostly informal and theoretical [4,5,21].

Unfortunately, there is no recent studies that described the curricula in the Middle Eastern countries, However, a study in 2008, in Jordan reported that curricula at various pharmacy schools covers only 20% of allocated credit hours in pharmaceutical care which covers elements of patient safety. A study with sample of government and private universities in Jordan concluded that none of the evaluated universities had adopted a structured patient-oriented training for students [22]. In Qatar, the pharmacy practice focuses mainly on medication dispensing, and patient care that includes patient safety is still in its infancy [23]. Similar situations are present in Kuwait and Saudi Arabia where pharmaceutical care is only a focused in Pharm D program not the BSc Pharmacy program [24]. The situation in India is not widely different, there is no standard curriculum and it varies across universities. Most pharmacy school's education is away from practice sites and compulsory training is not required [25]. In Indonesia,

126 recent study in 2020 revealed that the provision of the pharmaceutical care that covers patient cantered care and

127 safety by community pharmacists in Malaysia is minimal [26].

128 In developing countries, there are cultural concerns, where pharmacy students are intimidated by other healthcare

129 professionals particularly, physicians, when they are in the clinical practice setting which will hamper patient

130 safety. The 'hierarchical difference in medical knowledge' will make young pharmacists' reluctance to question

131 decisions made by physicians [5,27]. Therefore, improving patient safety in developing countries requires changing

132 attitude particularly in shifting the blame culture in healthcare settings.

133 Efforts to foster patient safety in developing countries must be augmented and education systems during

134 undergraduate level must provide knowledge to improve patient safety [27].

135 Despite the increasing effort to enhance patient safety through improving healthcare professional curricula, this

136 improvement is considered challenging, and progress is very slow [5,12,13,28-33]. Developing positive attitudes among

137 university students is important as it is positively related to their achievement [34]. The accomplishment of

138 educational goals related to delivering safe and quality healthcare services requires students to have positive

139 attitudes towards patient safety [34,35]. Since attitude can substantially impact an individual's behaviour and practice

140 [36], it is crucial that pharmacy students' attitudes towards patient safety are understood and evaluated particularly

141 in developing countries.

142 Previous studies have explored the attitudes and values of healthcare students towards patient safety in different

143 countries, using different instruments [18,19,37-44]. The most widely-used validated tool is the patient safety/medical

144 fallibility survey, which was originally developed by Madigosky et al. for use among medical students [37]. This

145 tool was validated to assess the patient safety attitudes of pharmacy students by Walpola et al. [45]. However, there

146 are a limited number of studies that have focused on attitudes of undergraduate pharmacy students towards patient

147 safety, especially in developing countries. Therefore, the aim of this study was to evaluate the attitudes of

148 undergraduate pharmacy students towards patient safety in six developing countries.

149 **METHODS**

150 **Study design**

151 A quantitative cross-sectional survey using a self-administered questionnaire was conducted to explore patient

152 safety attitudes and values among pharmacy students in six developing countries (Jordan, Saudi Arabia, Kuwait,

153 Qatar, India and Indonesia). To achieve the study aim, a self-administered questionnaire approach was adopted.

154 This approach has the advantage of being easily administered to a large number of participants within a short time

155 period, eliminating interviewer bias [46]. In addition, this technique can easily explain students' behaviour [47].

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Sample size

157   Based on the original study conducted by Walpola et al. [45], a sample size of 200 students from each country was

158   considered adequately representative. The original study estimated the appropriate sample size based on

159   Boomsma's method of estimating a minimum sample size to conduct a confirmatory factor analysis based on the

160   number of items to number of factors ratio of the model [48].

161   **Sampling strategy**

162   The study population included undergraduate pharmacy students across all professional years of study. A

163   convenience sampling technique was used to recruit eligible participants as it was not feasible to determine a

164   sampling frame in each of the six countries. This sampling technique is a type of non-probability sampling method,

165   in which participants from the target population who met the inclusion criteria of the study were easily accessible

166   due to geographical proximity, availability at a given time, or were willing to take part in the study [49]. Student

167   recruitment was conducted by researchers (AN, OA) in Jordan, (A. Alsharif) in Saudi Arabia, (ZA) in Kuwait,

168   (A. Awaisu) in Qatar, (SH) in India and (AK) in Indonesia. The questionnaire was administered either as a hard-

169   copy or electronically to eligible participants in a consistent manner to reduce the risk of assessment bias. All the

170   undergraduate pharmacy students in the participating universities were approached and invited to take part in the

171   study. For students who agreed to participate, the questionnaire was administered either as a hard copy or

172   electronically after the study aim and objectives had been explained.

173   **Survey instrument**

174   A previously validated questionnaire [45] was used in this study to explore the attitudes of undergraduate pharmacy

175   students towards patient safety. This questionnaire was originally developed and validated by Walpola and

176   colleagues, who validated an adaptation of Madigosky et al's questionnaire (the Patient Safety/Medical Fallibility

177   Curriculum Survey) [37], to evaluate attitudes and values of pharmacy students towards patient safety. Walpola et

178   al.'s 14-item questionnaire comprised five subscales: (1) quality-improvement focused (four questions), (2)

179   internalising errors regardless of harm (three questions), (3) value of contextual learning (three questions), (4)

180   acceptability of questioning more senior healthcare professionals' behaviour (two questions), and (5) attitude

181   towards open disclosure (two questions). The study questionnaire asked undergraduate pharmacy students about

182   the degree of applicability of each item to them using a 5-point Likert scale. Response options ranged from 0 to

183   4, where 0 meant "strongly disagree" and 4 meant "strongly agree". Three items (items numbered 5, 6, and 7)

184   were negatively worded and, thus, were reversely scored during the analysis, where 0 meant "strongly agree" and

185   4 meant "strongly disagree". The total possible score for the questionnaire ranged between 0 and 56 and could be

186 interpreted based on the mid-point of the highest possible score of the scale (equal to 28): the higher the score,

187 the better the attitude towards patient safety. Besides, the following data were collected: participant's gender, year

188 of study, prior practical experience in healthcare settings- if applicable, and involvement in an incident that

189 resulted in harm or potential harm as a result of receiving healthcare.

190 The use of a pre-existing questionnaire has the advantage of using a validated and tested instrument, which

191 increases the reliability of measurement [50]. In addition, the use of an existing questionnaire allows for comparison

192 with different populations [51]. The mean score ± SD for each item was calculated based on the student responses

193 using the 5-point Likert scale, which ranged between 0 and 4. In addition, the total mean score for each subscale

194 was calculated to allow comparison between different subscales.

195 **Validity and reliability of the survey instrument**

196 Walpola's questionnaire was examined for its psychometric properties in 446 students [45]. The face and content

197 validity of the questionnaire were tested. In addition, exploratory factor analysis was conducted to test the

198 construct validity and the internal consistency of the questionnaire was examined. In addition, the original

199 investigators conducted focus groups among three populations: initially among five pharmacy academics, five

200 practising pharmacists and seven pharmacy student representatives to assess the face validity of the survey

201 instrument. Besides this, we examined Cronbach's alpha measures for the five factors in the questionnaire, which

202 ranged between 0.56 and 0.78. The overall Cronbach's alpha measure was 0.72 (Cronbach's alpha value for each

203 subscale is included in the supplements). This identified the questionnaire as having acceptable stability.

204 **Pre-testing of the questionnaire**

205 A pilot study using the original questionnaire was conducted on 45 pharmacy students (from different Arab

206 nationalities) in Jordan, who met the inclusion criteria for the study. Students were asked about the clarity and

207 comprehensibility of the questionnaire, and if any of the questions were difficult to understand. Students

208 confirmed that the questionnaire was considered easy to understand and to complete.

209 **Data collection procedure**

210 In Jordan, we used hard copies of the questionnaire, and the recruitment of participants was conducted in two

211 universities (one private and one government). An electronic version of the questionnaire was used for the students

212 recruited in the other countries. In Saudi Arabia, the survey was distributed in three government universities. In

213 Indonesia, student recruitment was conducted in two government universities, while in India it was conducted in

214 five universities. In Kuwait and Qatar, the study was conducted in one government university in each country,

215 these being the only available ones that offer an undergraduate pharmacy degree program.

216   **Patient and public involvement**

217   It was not appropriate or possible to involve patients or the public in the design, or conduct, or reporting, or

218   dissemination plans of our research.

219   **Statistical analysis**

220   Data were analysed using SPSS software, version 25 (IBM Corp, Armonk, NY, USA). Continuous variables were

221   reported as mean (± standard deviation [SD]), while categorical variables were reported as frequencies and

222   percentages. The Kolmogorov–Smirnov and Shapiro Wilk tests were used to check the normality of the data.

223   Students' scores were interpreted as a continuous scale based on the scale midpoint, where scores above the

224   midpoint represented more positive attitudes towards patient safety for that factor. The one-way ANOVA test and

225   Pearson's correlation coefficient were used to compare the mean scores between different demographic groups

226   and to analyse the correlation between continuous independent variables and students' scores, respectively.

227   Tukey's HSD post-hoc test was conducted to identify the source of significant variation within each group.

228   Additionally, significant predictors of positive attitudes towards patients' safety were determined using multiple

229   linear regression analysis. A confidence interval of 95% (p<0.05) was applied to represent the statistical

230   significance of the results, and the level of significance was predetermined as 5%.

231   **RESULTS**

232   **Students' demographic characteristics**

233   A total of 2,595 undergraduate pharmacy students participated in the study (Jordan = 1,044, Saudi Arabia = 514,

234   Indonesia = 429, India = 416, Kuwait = 134 and Qatar = 61). About 67.0% (n = 1,752) of the students were female.

235   The majority of the respondents were recruited from Jordan (n= 1,044; 39.9%), followed by Saudi Arabia (n=

236   514; 19.7%). An approximately similar percentage of participants were recruited from Indonesia (n= 429; 16.5%)

237   and India (n= 416; 16.0%). The lowest percentages of participants came from Kuwait and Qatar, with only 5.2%

238   (n= 134) and 2.4% (n= 61) being recruited from these two countries, respectively. This was expected due to the

239   small population size and, thus, the small number of pharmacy students (Kuwait and Qatar only have one faculty

240   of pharmacy each). The majority of the students were in their thirds and fourth year of study with 21.0% (n= 546)

241   and 26.2% (n= 679), respectively. Only 38.2% (n= 990) of the participants reported that they had had prior or

242   were undergoing current practical experience in a practice setting, with only 27.4% (n= 712) of the participants

243   have been involved in or have witnessed harm to patients while practicing. **Table 1** below summarises the

244   demographic characteristics of the study participants from each country.

245 **Table 1** Pharmacy students' characteristics from each country.

Demographics	Overall (n= 2,595)	Jordan (n= 1,044)	Saudi Arabia (n= 514)	Indonesia (n= 429)	India (n= 416)	Kuwait (n= 134)	Qatar (n= 61)
Gender No. (%)							
Female	1,752 (67.5)	741 (71.0)	323 (62.8)	388 (90.4)	124 (29.8)	115 (85.8)	61 (100)
Year of study No. (%)							
First year	511 (19.7)	74 (7.1)	9 (1.8)	255 (59.4)	165 (39.7)	0 (0.0)	8 (13.1)
Second year	407 (15.7)	148 (14.2)	21 (4.1)	78 (18.2)	108 (26.0)	32 (23.9)	20 (32.8)
Third year	546 (21.0)	243 (23.3)	110 (21.4)	60 (14.0)	57 (13.7)	67 (50.0)	9 (14.8)
Fourth year	679 (26.2)	319 (30.6)	232 (45.1)	29 (6.8)	64 (15.4)	22 (16.4)	13 (21.3)
Fifth year	452 (17.4)	260 (24.9)	142 (27.6)	7 (1.6)	22 (5.3)	13 (9.7)	11 (18.0)
Prior healthcare experience No. (%)							
Yes	990 (38.2)	448 (42.9)	281 (54.7)	39 (9.1)	141 (33.9)	49 (36.6)	32 (52.5)
Ever been involved in or witnessed harm to patients while practicing No. (%)							
Yes	712 (27.4)	249 (23.9)	230 (44.7)	82 (19.1)	110 (26.4)	28 (20.9)	13 (21.3)

247 **Pharmacy students' attitude towards patient safety**

248 The mean score of the participants for the total scale was 37.4 [SD= 7.0] out of 56 (the highest possible score),

249 66.8%. The first subscale measured students' attitude in terms of "being quality-improvement focused". The

250 participants' score was the highest for this scale, 75.6%. The lowest score was for the "internalising errors

251 regardless of harm" subscale, 49.2%.

252 The highest mean score for the total scale was for India (40.6 (SD= 5.5), 72.5%). India had the highest subscale

253 score for the subscale "value of contextual learning" (9.5 (SD= 1.7), 79.2%). Qatar had the highest subscale score

254 for two subscales which are "being quality improvement focused" (13.9 (SD= 1.6), 86.9%) and "acceptability of

255 questioning more senior healthcare professionals' behaviour" (6.5 (SD= 1.3), 81.3%). The score of the subscale

256 "attitude towards open disclosure" was similar across students from Indonesia, India, and Qatar with a mean score

257 that range between 6.0 (SD= 1.4) to 6.0 (SD= 1.7), 75.0%. Jordan had the highest subscale score for the subscale

258 "internalising errors regardless of harm" (8.1 (SD= 2.6), 67.5%). **Table 2** summarizes these findings.

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276 **Table 2** Pharmacy students mean attitude towards patient safety scores in individual subscales and total scale scores stratified by country (n = 2,595).

Subscale	Number of items	Range	Overall Mean Score (SD)	Overall Students score out of 100%	Jordan Mean Score (SD)	Jordan Students score out of 100%	Saudi Arabia Mean Score (SD)	Saudi Arabia Students score out of 100%	Indonesia Mean Score (SD)	Indonesia Students score out of 100%	India Mean Score (SD)	India Students score out of 100%	Kuwait Mean Score (SD)	Kuwait Students score out of 100%	Qatar Mean Score (SD)	Qatar Students score out of 100%
Being quality improvement focused	4	0-16	12.1 (3.1)	**75.6**	11.7 (2.8)	**73.1**	10.4 (3.4)	**65.0**	13.7 (1.9)	**85.6**	13.4 (1.9)	**83.8**	11.5 (4.5)	**71.9**	13.9 (1.6)	**86.9**
Acceptability of questioning more senior healthcare professionals' behaviour	2	0-8	5.6 (1.7)	**70.0**	5.4 (1.6)	**67.5**	4.9 (1.8)	**61.3**	6.3 (1.4)	**78.8**	6.3 (1.3)	**78.8**	5.1 (2.2)	**63.8**	6.5 (1.3)	**81.3**
Attitude towards open disclosure	2	0-8	5.5 (1.7)	**68.8**	5.6 (1.7)	**70.0**	4.7 (1.6)	**58.8**	6.0 (1.7)	**75.0**	6.0 (1.5)	**75.0**	5.0 (2.0)	**62.5**	6.0 (1.4)	**75.0**
Value of contextual learning	3	0-12	8.2 (2.2)	**68.3**	8.1 (2.0)	**67.5**	7.1 (2.4)	**59.2**	9.2 (1.8)	**76.7**	9.5 (1.7)	**79.2**	6.6 (2.3)	**55.0**	8.0 (2.1)	**66.7**
Internalising errors regardless of harm	3	0-12	5.9 (3.2)	**49.2**	8.1 (2.6)	**67.5**	5.0 (2.7)	**41.7**	3.4 (2.0)	**28.3**	5.4 (2.8)	**45.0**	3.9 (3.3)	**32.5**	1.9 (1.5)	**15.8**
Total Scale	14	0-56	37.4 (7.0)	**66.8**	38.9 (6.7)	**69.5**	32.1 (7.0)	**57.3**	38.6 (5.3)	**68.9**	40.6 (5.5)	**72.5**	32.1 (6.6)	**57.3**	36.2 (3.9)	**64.6**

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278   Abbreviation: SD, Standard deviation

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288 **Effect of students' characteristics on their attitude towards patients' safety**

289 **Table 3** presents the effect of the students' demographics on their attitude towards patient safety scores. Students'

290 scores significantly differed by country, gender, year of study, having prior experience in healthcare and being

291 involved in or having witnessed harm to patients while practicing (p < 0.01). Tukey's HSD post-hoc test confirmed

292 that all countries contributed to the significant difference in the mean score except Indonesia, and that Saudi

293 Arabia, Kuwait and India had the most significant contributions in this variation. Regarding the year of study

294 variable, the Tukey HSD test confirmed that all years of study contributed to the significant variation between

295 groups.

296 **Table 3** Pharmacy students' attitude towards patient safety score by students' characteristics (n= 2,595).

Variable	Patients' safety scores		
	Mean	**SD**	**P-value**
Country			
Jordan	38.9	6.7	
Saudi Arabia	32.1	7.0	
Indonesia	38.6	5.3	0.000***
India	40.6	5.5	
Kuwait	32.1	6.6	
Qatar	36.2	3.9	
Gender			
Male	36.6	7.8	0.000***
Female	37.7	6.6	
Year of study			
First year	39.3	6.1	
Second year	37.8	6.8	
Third year	37.0	6.9	0.000***
Fourth year	36.4	7.7	
Fifth year	36.8	7.1	
Prior healthcare experience			
Yes	36.8	7.4	0.001**
No	37.7	6.8	
Ever been involved in or witnessed harm to patients while practicing			
Yes	36.2	7.8	0.001**
No	37.8	6.7	

297 **p < 0.01, ***p < 0.001, Abbreviation: SD, Standard deviation

298   Simple linear regression analysis showed that all demographic variables were significantly associated with a better

299   attitude towards patients' safety score (p< 0.01). Multiple linear regression analysis showed that female students

300   had a better attitude towards patients' safety score (p= 0.001). In addition, it showed that higher-level students

301   and being involved in or having witnessed harm to patients while practicing were associated with a slightly lower

302   score (p= 0.000), **Table 4**.

303   **Table 4** Multiple linear regression analysis predicting students' attitude towards patients' safety.

Variable	Model[a]			
	B	**SE**	**ß**	**95% Confidence interval**
Demographic data				
Males	Reference category			
Females	0.96	0.292	0.06**	(0.38 – 1.53)
Year of study				
First year	Reference category			
Second year	-1.45	0.46	-0.08**	(-2.35 - -0.54)
Third year	-2.20	0.43	-0.13***	(-3.04 - -1.36)
Fourth year	-2.76	0.42	-0.17***	(-3.60 - -1.93)
Fifth year	-2.41	0.42	-0.13***	(-3.34 - -1.48)
Having prior experience in healthcare				
No	Reference category			
Yes	0.21	0.33	0.01	(-0.43 – 0.85)
Being involved in or witnessed harm to patients while practicing				
No	Reference category			
Yes	-1.17	0.33	-0.07***	(-1.81 - -0.53)
Constant				
Adjusted R^2	0.030			
P-value	0.000			

304   *p < 0.05, **p < 0.01, ***p < 0.001
305   a: includes gender, year of study, having prior experience in healthcare, and being involved in or witnessed harm to patients while
306   practicing.
307   B: the average change in the depenedent variable associated with a 1 unit change in the independent variable, statisitcally controlling
308   for the other independent variables; SE: it is the standard deviation of its sampling distribution or an estimate of that standard deviation;
309   ß: a statistical measure that compares the strength of the effect of each individual independent variable to the dependent variable

310 **DISCUSSION**

311 The current study has identified the attitudes of undergraduate pharmacy students towards patients' safety. The

312 sample was collected from different universities in different countries, across all years of study for the pharmacy

313 program, and using a previously validated tool. The data was collected from a large sample compared to previous

314 similar studies. For example, Carruthers et al. (2009) conducted a questionnaire-based study on 364 undergraduate

315 medical students and 66 tutors from one medical school in the UK [6], while Tegegn et al. conducted their study

316 with a population of 83 students from a single university in Ethiopia [52]. Also, there were previous surveys

317 conducted by Tegegn et al. [52] and Carruthers et al. [6] which did not obtain data on the nationality of the participants.

318 This limited our ability to make direct comparisons between different nationalities settings. The results highlighted

319 that, generally, a positive attitude towards patient safety was an important issue among pharmacy undergraduate

320 students. There was a small but significant difference in attitudes between male and female pharmacy students.

321 These results are comparable with those of another previous study [52], where 86.7% of female respondents had an

322 overall positive attitude to patient safety compared to 83% of their male counterparts. Neither the previous nor

323 the current study was able to explain this difference, and a further study of attitudes of male and female students

324 towards patient safety is required to elucidate whether this is a real gender-influenced trait. Female students could

325 be more emotional and sensitive to patients' health outcomes, therefore, this would make them more proactive

326 and have stronger drive to act towards safer practices.

327 Comparison in terms of patient safety elements revealed variations among countries. The first subscale focused

328 on "students being quality improvement focused" with results highlighting the superiority of Qatar, Indonesia,

329 and India over the other countries. Such difference could be attributed to students in these countries receiving

330 education more pertinent to patient safety and the science behind it that could cover medication errors, drug

331 adverse events and their effect in optimizing patient outcomes. Although there are no recent research indicating

332 that in these countries patient safety is fundamental in curricula, results reflect presence of such teaching modules,

333 where studies reported that integrating patient safety in curricula will improve student knowledge [53]. Similar

334 results were obtained in the second and third subscales which focused on addressing "the acceptability of

335 questioning more senior healthcare professionals' behaviour" and "attitude towards open disclosure" which

336 apparently put an emphasis on something that is a consequence of what has been taught. In these subscales the

337 scores were lower than the first subscale and this could be expected, where students attitude will enable them to

338 develop a culture of understanding and preventing errors from occurring [45], which apparently requires practice

339 and elements that are beyond knowledge and hence the lower score of these two subscales were obtained when

340 compared to the first one.

341 As for the fourth subscale "value of contextual learning", Indonesia and India scored the highest. Here the domain

342 is assessing the students belief in the need to the delivery of patient safety interventions and teaching materials

343 [45]. Apparently, students who have good level of knowledge about patient safety will value the need to integrate

344 that into curricula and healthcare setting and hence the results reflected that. The last subscale assessed" students'

345 attitude pertinent to internalising errors regardless of harm", this subscale is related to the attitude of students in

346 internalising the error rather than taking action and this section provides good indication whether students would

347 manage risks and errors that could or not affect patients. Results showed that Jordan scored the highest among the

348 seven countries while Qatar scored the lowest. Although Jordan did not score the highest among the countries in

349 the first four subscales, it scored around the mean and none of the sections was below 67.0% indicating a positive

350 attitude towards patient safety. This last subscale is critical in fostering a patient safety culture. As this attitude is

351 related to the presence of transparency and willingness to reporting errors. Despite variations and slightly lower

352 scores, Jordan scores were above average and their score in the final subsection rated the highest among the seven

353 countries. Future research is required to assess the pharmacy curricula in developing countries. Interestingly,

354 students' attitude towards patient safety in Kuwait and Saudi Arabia, neighbouring countries with similar cultural

355 values, reported the lowest among the seven countries. The average of scores for the two countries showed results

356 that are shy above the 50% mark. It could be expected that in these two countries patient safety is still in its infancy

357 phase.

358 In the current study, there were two factors which have been negatively correlated with attitudes towards patient

359 safety; these are the 'year of study' and "being involved in or having witnessed harm to patients while practicing".

360 Similar findings were reported in a previous study and showed that students in their early years of study had

361 higher scores (a better attitude towards patient safety) compared to others in their final years of training [54]. This

362 could have arisen among the students due to a lack of formal and well-structured teaching on patient safety that

363 build up with years of study and have led to the reluctance to adopt patient safety practices. In addition, other

364 literature reported that professional socialisation plays a big role in shifting students' and interns' attitudes [55],

365 which could be another important influencing factor. These results are inconsistent with another study's results

366 among pharmacy students in Ethiopia [52]. Such a difference between the studies could be due to variations in the

367 study settings, the recruited participants or, possibly, due to the greater emphasis allocated to teaching patient

368 safety to students in specific countries over others. A follow-up study focusing on the change in attitudes towards

369   the pharmacy teaching course is required. In addition, there is a need for the reinforcement towards patient safety

370   throughout the pharmacy program. This has also been recommended previously in studies about attitudes towards

371   patient safety among medical students [6,56]. In a previous study, medical students who had received education on

372   patient safety attached greater importance to this topic and had more confidence in reporting incidences of poor

373   patient safety [6]. Also, it has been highlighted previously that there is a lack of patient safety education among a

374   range of clinical disciplines, including medical, nursing and pharmacy students [57,58]. Patient safety education has

375   the potential to revolutionise the attitudes of pharmacists and pharmacists-in-training, which has broad

376   implications for practice [57].

377   In addition to the importance of educating patient safety at the university level, there is a need for constant

378   reinforcement of messages regarding patient safety. In one study, it has been reported that some of the positive

379   messages regarding improving patient care, which were taught to second-year medical students, had been

380   forgotten after one year [37]. Those students were also less likely to be open about the errors they had witnessed and

381   less likely to believe that it was necessary to disclose errors that had not caused patient harm. Similarly, in the

382   present study, it has been found that 49% of students agreed that errors should be internalised, regardless of harm

383   to patients. Pharmacy students in Ethiopia shared the same belief in reporting self-errors, where only half of the

384   students agreed, or strongly agreed, that pharmacists should report errors concerning a patient in situations where

385   harm had occurred [52]. A previous study in Pakistan that assessed the attitudes and perceptions of postgraduate

386   students towards patient safety reported consistent findings: that students felt less confident in reporting any error

387   other people had made in the work environment, no matter how serious the outcome had been for the patient [54].

388   Many studies from different countries have reported that health care students have a common belief that medical

389   errors are inevitable, and that even very experienced people make medical errors [54,56,59,60]. Reporting medical

390   errors is important, and a failure to report such types of error indicates a lack of awareness of the risky

391   consequences of such practice to the healthcare services provided to the patients. This finding has an implication

392   for further research to understand the reasons for this behaviour; whether it is from a fear of reprisal from

393   colleagues or patients or a lack of recognition of reporting as part of the duty of care to patients. However,

394   incompatible results have been reported in North America, where the majority of students had positive attitudes

395   towards reporting serious errors when they encountered them, but they had inadequate knowledge about the

396   process of reporting them [61]. Also, in that study, it can be seen that some students had conflicting attitudes towards

397   reporting errors. They believed that reporting them would compromise inter-professional relationships, reduce the

398   patients' confidence in the healthcare system and interrupt the workflow.

Strengths and weaknesses

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400 The current study has many strengths. First, to the best of our knowledge, this study is the first large-scale study

401 comprising participants from multiple nations (six countries), which suggests the evidence is robust and more

402 generalizable. The data was collected from a large sample compared to previous similar studies from different

403 countries. Second, the research used a validated questionnaire and a non-biased recruitment process, which

404 provided reassurance of the quality of the study and the findings reported [45]. However, there are some limitations.

405 The study design itself, a cross-sectional survey design, limited our ability to identify causality between study

406 variables. A further limitation of the current study was the small number of participants from some of the

407 participating countries (Qatar; n= 61, and Kuwait; n= 134), and the dominance of the sample size by students

408 from only two countries Jordan (39.9%) and Saudi Arabia (19.7%). However, due to the small population size in

409 Qatar and Kuwait, and knowing that we recruited students from the only two available faculties of pharmacy in

410 these two countries, we assume that these small numbers are sufficient to draw conclusions from. Future research

411 should consider a wider range of countries during the recruitment phase to identify whether the findings can be

412 expanded. Finally, we were not able to estimate the response rate for our study, which might lead to nonresponse

413 bias, as we could not demonstrate how well the sample drawn from the population of interest. Therefore, the

414 findings should be interpreted carefully.

Implications of Findings to Practice

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416 The findings of this study can help curricula developers to focus on patient safety teaching and make it an essential

417 part of pharmacy curricula. Continuous educational sessions on patient safety and the reporting of errors in patient

418 care will help in raising the students' knowledge and awareness of patient safety and medical errors. In addition,

419 to ensure the quality of care and patient safety, it is important to provide clinical and senior supervision when

420 students are given tasks related to patient safety at all levels of the pharmacy program. Future studies to investigate

421 the factors and attitudes of pharmacists and pharmacy students are warranted. Cultural and regional factors are

422 important and must be taken into account when conducting future research. However, it is also important to

423 mention that future research should also be conducted at the patient-level to study and explore patient safety from

424 different perspectives.

425 In conclusion, the current study has revealed the positive attitudes of pharmacy students towards patient safety.

426 There is currently limited number of research regarding the effect of pharmacy students' attitudes and the wider

427 implications for practice specifically, the Middle East and other developing countries. Patient safety should be

428 covered explicitly during the pharmacy students' education and reinforced at each year of study within the

curriculum to ensure that the next generation of pharmacists is equipped with the knowledge and behaviours to ensure good patient safety. An additional focus should be placed on the area of patient safety to investigate further the key findings of the current study.

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Contributors

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460   and Kautsar conducted the study and collected data. Naser conducted to the data analysis. Naser, Alsairafi, Alwafi,

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462   and Dahmash wrote the first draft of the article. All authors reviewed the manuscript for important intellectual

463   content and provided final approval of the version to be published. All authors agreed to be accountable for all

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465   appropriately investigated and resolved.

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Competing interests

469   None declared.

Patient consent

471   Not required.

Ethics approval

473   Ethical approval for this study was obtained from the research ethics committees (REC) of the participating

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475   Norah bint Abdul Rahman University Institutional Review Board (19 – 0038), Kuwait (Health Sciences Centre

476   Ethical Committee at Kuwait University (VDR/EC), Indonesia (REC of Universitas Padjadjaran

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Provenance and peer review

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Data sharing statement

482   No additional data are available.

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635 **Tables legends:**

636 **Table 1** Pharmacy students' characteristics from each country.

637 **Table 2** Pharmacy students mean attitude towards patient safety scores in individual subscales and total scale

638 scores stratified by country (n = 2,595).

639 **Table 3** Pharmacy students' attitude towards patient safety score by students' characteristics (n = 2,595).

640 **Table 4** Multiple linear regression analysis predicting students' attitude towards patients' safety.

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Cronbach alpha values:

Scale	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	Number of Items
"Being quality improvement focused" subscale	0.783	0.783	4
"Value of contextual learning" subscale	0.586	0.585	3
"Internalising errors regardless of harm" subscale	0.746	0.755	3
"Acceptability of questioning more senior healthcare professionals' behaviour" subscale	0.633	0.634	2
"Attitude towards open disclosure" subscale	0.561	0.562	2
Total scale	**0.724**	0.755	14

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1 and 2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4 and 5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5 and 6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5 and 6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Not applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5 , 6 and 7
Bias	9	Describe any efforts to address potential sources of bias	Not applicable
Study size	10	Explain how the study size was arrived at	5 and 6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7
		(*b*) Describe any methods used to examine subgroups and interactions	7
		(*c*) Explain how missing data were addressed	Not applicable
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	Not applicable
		(*e*) Describe any sensitivity analyses	Not applicable
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	Not applicable
		(c) Consider use of a flow diagram	Not applicable
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8 and 9
		(b) Indicate number of participants with missing data for each variable of interest	Not applicable
Outcome data	15*	Report numbers of outcome events or summary measures	8 -12
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Not applicable
		(*b*) Report category boundaries when continuous variables were categorized	Not applicable
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Not applicable
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Not applicable
Discussion			
Key results	18	Summarise key results with reference to study objectives	12
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	14
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	12-14
Generalisability	21	Discuss the generalisability (external validity) of the study results	14
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	17

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.