







Patient Safety Awareness Among Medical and Pharmacy Students at Admission: A Comparative Study

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Purpose: Providing medical and pharmacy schools students with effective patient safety education is one of the important factors in improving the quality of health care delivery. To provide effective education, understanding the level of patient safety awareness among medical and pharmacy school students at the time of admission and implementing tailored educational approaches based on their characteristics are essential. This study was performed to measure and compare the level of patient safety awareness between medical and pharmacy school students at the time of admission, to aid in improving effectiveness of patient safety education.

Methods: A total of 132 first-year medical school students and 367 first-year pharmacy school students enrolled at Teikyo University in 2019 completed an anonymous and self-administered questionnaire upon admission. The questionnaire included questions regarding the demographics of the participants as well as a translated and modified survey classifying patient safety awareness into “perception”, “knowledge”, and “attitude” which were evaluated on a 5-point Likert scale (Cronbach’s alpha coefficient was 0.70). To assess overall patient safety awareness, we calculated the total scores for the three sub-constructs using a 5-point Likert scale—Strongly Agree (5 points), Agree (4 points), Neutral (3 points), Disagree (2 points), and Strongly Disagree (1 point)—and compared these scores between the two groups.

Results: The total scores (mean \pm standard deviation) were 104.2 ± 10.2 for medical school students and 97.2 ± 9.9 for pharmacy school students (mean difference: 7.1, $p < 0.001$, 95% Confidence Interval (CI): 4.9–9.2). After controlling for confounders through analysis of covariance, a statistically significant difference was observed between the two groups (Least Square mean: 5.6, $p < 0.001$, 95% CI: 3.3–7.9). A higher percentage of medical school students exhibited positive responses across three sub-constructs when compared to their counterparts.

Conclusion: Medical school students had a higher level of patient safety awareness than pharmacy school students at the time of admission, prior to receiving patient safety education.

Keywords: patient safety education, medical student, pharmacy student, first-year student, medical school admission

Introduction

“To Err Is Human: Building a Safer System”, published by the Institute of Medicine in 1999, reported that 98,000 hospitalized patients die every year in the United States as a result of preventable adverse events that occur in hospitals, which shocked the world.¹ In 2022, the Organization for Economic Co-operation and Development reported that, in developed countries, the total cost of treating patients harmed by inappropriate medical care reached 13% of health care expenditures, and that adverse events are not only a health hazard to patients but also an impediment to social and economic growth.² According to the Japan Medical Safety Research Organization, the number of deaths due to adverse events in Japan was 300 in the 2022 fiscal year.³ Some cases have become an object of public concern, including a case

of 8 consecutive deaths caused by laparoscopic surgeries at a university hospital.⁴ Improving the quality of health care and establishing a culture of patient safety remain important social problems today, and health care professionals in various hospital departments receive daily education on patient safety.^{5–7} There is also an emphasis placed on patient safety education in healthcare-related disciplines.⁸ In 2009, the World Health Organization (WHO) published the Patient Safety Curriculum Guide for Medical Schools, which provides international guidelines for patient safety education for medical students.⁹ In 2011, the Multi-professional Patient Safety Curriculum Guide was also published by the WHO to assist in the teaching of patient safety not only in medical schools but also in pharmacy, nursing, dentistry, and midwifery schools.¹⁰ Since then, students wanting to become healthcare professionals in various countries have received patient safety education based on the guidelines.^{11–13}

In Japan, patient safety education for medical and pharmacy school students was implemented for the first time in the Model Core Curriculum for Medical Education in 2001 and the Model Core Curriculum for Pharmaceutical Education in 2002. In 2022, both curricula added significantly more information on the topic of patient safety.^{14,15} Because of this increased emphasis in the curricula, patient safety education for medical and pharmacy school students has recently attracted a greater attention in Japan.¹⁶ However, in 2021, Toyabe et al examined the level of patient safety education after implementing the curricula for medical, nursing, and dental students at national universities and reported that patient safety education at national universities remains insufficient in both quantity and content, with significant gaps identified among the universities.¹⁷ To deliver effective patient safety education, understanding the level of patient safety awareness among medical and pharmacy school students at the time of admission and implementing tailored approaches based on their characteristics are important. In a previous study, it was reported that a significant number of first-year students exhibited a high level of patient safety awareness in a health sciences university.¹⁸ Another study suggested that, nursing and midwifery students reportedly had a higher level of patient safety awareness than medical students.¹⁹ However, in our search of the literature, there were no reports of comparing the level of patient safety awareness among medical and pharmacy school students prior to or following receiving formal patient safety education.

It is reported in a previous study that a significant number of medical school students at the time of admission had a high level of patient safety awareness.²⁰ Another study suggested that a significant number of pharmacy school students had positive attitudes toward patient safety.²¹ Additionally, a study that included both medical and pharmacy school students, both groups had a high level of awareness in terms of the importance of patient safety and were highly motivated to learn it, although whether or not they had received patient safety education was unknown.²² Another study that included medical doctors, pharmacists, and nurses reported that medical doctors had a higher level of patient safety awareness than pharmacists and nurses.²³

The results of these studies suggest that both medical and pharmacy school students have a high level of patient safety awareness, while a comparative analysis of the two groups has not been done. They also suggest that medical doctors are likely to have a higher level of patient safety awareness than pharmacists. Therefore, we conducted a comparative analysis of medical and pharmacy school students based on a hypothesis that differences in the level of patient safety awareness may exist as early as at the time of admission, aiming to gain insights into more tailored approaches to patient safety education in medical and pharmacy schools.

Materials and Methods

Study Participants and Date of Study

This study was a complete survey of 132 first-year medical school students (hereafter referred to as “medical students”) and 367 first-year pharmacy school students (hereafter referred to as “pharmacy students”) who were enrolled at Teikyo University in the 2019 academic year. Both groups of students were provided with survey forms on April 4th, 2019, immediately after their enrollment. The questionnaires were collected on the same day after all questions were answered.

Study Methods

We used an anonymous and self-administered questionnaire to collect data. The questionnaire included questions regarding the demographics of the participants as well as a translated and modified survey classifying patient safety

awareness into “perception”, “knowledge”, and “attitude”.¹⁹ The questionnaire items were answered by a 5-point Likert scale.

Questions 1–4 asked about the students’ backgrounds (ie sex, age, presence of medical professionals in the participant’s family, and whether the participants themselves or someone close to them had experienced an adverse event). Questions 5–15 asked about “perception”, questions 16–25 asked about “knowledge”, and questions 26–33 asked about “attitude”. Questions 5–33 used a 5-point Likert scale (strongly agree/very good, agree/good, neutral/fair, disagree/poor, strongly disagree/very poor). In this study, we defined positive responses as “strongly agree” and “agree” in the affirmative form. Likewise, we defined negative responses as “disagree” and “strongly disagree” in the affirmative form. In the analysis, questions in the negative form were reworded into the affirmative form. To assess overall patient safety awareness, we calculated the total scores for the question groups on “perception”, “knowledge”, and “attitude”, using a 5-point Likert scale—Strongly Agree (5 points), Agree (4 points), Neutral (3 points), Disagree (2 points), and Strongly Disagree (1 point)—and compared these scores between the two groups. The results are expressed as mean \pm standard deviation.

For the development and validation of the questionnaire, second-year medical and pharmacy school students were involved. For the development of the questionnaire, an expert involved in patient safety education in the medical and pharmacy school was also engaged, while for the translation of the questionnaire used by Nabilou et al, an expert in medical English education was also involved.¹⁹ Additionally, we conducted a pilot study using the questionnaire on 20 second-year medical school students and 20 second-year pharmacy school students who did not participate in this study and had not yet received patient safety education. According to the pilot study conducted by Nabilou et al ($\alpha = 0.72$), Cronbach’s coefficient alpha test was used to analyze the results.¹⁹

Before administering the questionnaire, study participants were provided with a written description of the study, including the methods and objectives, with an additional verbal explanation. This description explained that participation was voluntary and that those who gave written consent were considered research participants. This study was approved by the Ethical Review Board for Medical and Health Research Involving Human Subjects of Teikyo University (authorization No. Teirin 17–104).

Statistical Analysis

The chi-square test was used to analyze attributes in questions 1–4, while descriptive statistics were used to analyze responses to questions regarding “perception”, “knowledge”, and “attitude” toward patient safety (questions 5–33). Additionally, for each question from 5 to 33, statistical estimation was conducted. We calculated the total scores of student responses to each question based on a 5-point Likert scale—Strongly Agree (5 points), Agree (4 points), Neutral (3 points), Disagree (2 points), and Strongly Disagree (1 point)—and presented the mean values and 95% Confidence Intervals (CI) for each group. Cronbach’s coefficient alpha test was used to assess the reliability of the questions. Student’s *t*-test was used to compare the total scores between medical and pharmacy students. Shu et al and Kamran et al, who assessed the level of patient safety awareness among medical students, identified factors for patient safety awareness, including the presence of medical professionals in the family and the experience of adverse events.^{20,24} Drawing on these studies, analysis of covariance (ANCOVA) was conducted to compare the level of patient safety awareness between the two groups, while controlling for the influence of sex, age, presence of medical professionals in the participant’s family, and experiences of adverse events of themselves or someone close to them. *p* values of < 0.05 were considered statistically significant. R version 4.0.3 (R Core Team [2020], R: A language and environment for statistical computing, R Foundation for Statistical Computing, Vienna, Austria, <http://www.R-project.org/>) was used for the analysis.

Results

Response Rate and Demographics

Participants who answered questions 1–33 were defined as valid participants. The response rate was 84.8% (112/132) for medical students and 97.0% (356/367) for pharmacy students. Table 1 shows the participant demographics. With regard

Table 1 Demographics of the Participants

Questions 1–4 (Participant Demographics)		Medical Students, n (%)	Pharmacy Students, n (%)	p value
Sex	Male	67 (59.8)	113 (31.7)	<0.001
	Female	45 (40.2)	243 (68.3)	
Age	≤18	23 (20.5)	254 (71.3)	<0.001
	≥19	89 (79.5)	102 (28.7)	
Presence of medical professionals in the family	Yes	82 (73.2)	167 (46.9)	<0.001
	No	30 (26.8)	189 (53.1)	
Experience of adverse events	Yes	5 (4.5)	22 (6.2)	0.497
	No	107 (95.5)	334 (93.8)	

to the distribution of sex, there were 67 male medical students compared to 45 female students. Meanwhile, among pharmacy students, there were 113 male students and 243 female students ($p < 0.001$). The age of the medical students was 20.3 ± 3.5 years and that of pharmacy students was 18.5 ± 1.1 years ($p < 0.001$). Among the medical students, 73.2% (82/112) had a medical professional in the family, whereas the percentage was 46.9% (167/356) for pharmacy students ($p < 0.001$). In terms of reported adverse events, 4.5% (5/112) of medical students and 6.2% (22/356) of pharmacy students reported such experiences in themselves or someone close to them ($p = 0.497$). Cronbach's alpha coefficient was 0.70, while the alpha score in the pilot study was 0.75.

Perception

Table 2 shows the results of the responses to “perception” questions regarding patient safety awareness.

For question 8, “If I saw a medical error, I would report it to my supervisor”, which asked about the participant's response in the occurrence of an adverse event accident, 84.8% of medical students and 75.6% of pharmacy students provided positive responses. For question 10, “If a medical error occurs because of my medical practice, I would always report it to my supervisor”, which asked about the participant's response when causing an adverse event, 90.2% of the medical students and 83.4% of pharmacy students provided positive responses. For question 11, “Establishing a system for reporting medical errors will lead to a reduction in the number of such errors”, which inquired about the importance

Table 2 Student Responses to “Perception” Questions Regarding Patient Safety Awareness*

“Perception” Items	Students	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)	Mean Values of Total Points (95% CI)	p-value
Q 5 Adverse events are inevitable	Medical	15.2	60.7	10.7	10.7	2.7	2.3 (2.1–2.4)	0.584
	Pharmacy	9.3	59.6	24.4	5.6	1.1	2.3 (2.2–2.4)	
Q 6 Competent medical doctors do not cause adverse events that lead to patient harm	Medical	1.8	10.7	20.5	45.5	21.4	3.7 (3.6–3.9)	0.510
	Pharmacy	1.1	9.8	14.9	55.6	18.5	3.8 (3.7–3.9)	
Q 7 Adverse events can be eliminated through the efforts of medical doctors	Medical	0.9	41.1	25.9	25.9	6.3	3.0 (2.9–3.2)	0.246
	Pharmacy	7.0	33.4	32.6	23.3	3.7	3.2 (3.1–3.3)	
Q 8 If I saw an adverse events, I would report it to my supervisor	Medical	33.9	50.9	9.8	4.5	0.9	4.1 (4.0–4.3)	0.005
	Pharmacy	19.4	56.2	18.0	5.3	1.1	3.9 (3.8–4.0)	
Q 9 If there is no harm to a patient, then there is no need to report adverse events to my supervisor	Medical	0.0	8.9	12.5	37.5	41.1	4.1 (3.9–4.3)	0.879
	Pharmacy	0.8	4.2	14.6	45.5	34.8	4.1 (4.0–4.2)	

(Continued)

Table 2 (Continued).

“Perception” Items	Students	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)	Mean Values of Total Points (95% CI)	p-value
Q 10 If an adverse event occurs because of my medical practice, I would always report it to my supervisor	Medical	43.8	46.4	7.1	2.7	0.0	4.3 (4.2–4.4)	0.014
	Pharmacy	31.2	52.2	13.2	3.4	0.0	4.1 (4.0–4.2)	
Q 11 Establishing a system for reporting adverse events will lead to a reduction in the number of adverse events	Medical	36.6	44.6	8.9	9.8	0.0	4.1 (3.9–4.3)	0.024
	Pharmacy	20.2	55.3	16.3	7.3	0.8	3.9 (3.8–4.0)	
Q 12 Working more carefully can effectively prevent the recurrence of similar adverse events	Medical	29.5	57.1	5.4	8.0	0.0	4.1 (3.9–4.2)	0.386
	Pharmacy	29.5	59.0	8.7	2.5	0.3	4.1 (4.1–4.2)	
Q 13 Punishing the parties involved in adverse events does not reduce adverse events	Medical	8.9	40.2	29.5	18.8	2.7	2.7 (2.5–2.8)	0.233
	Pharmacy	11.0	46.9	22.8	16.6	2.8	2.5 (2.4–2.6)	
Q 14 Increased safety awareness within hospitals would help reduce adverse events	Medical	38.4	58.9	2.7	0.0	0.0	4.4 (4.3–4.5)	0.028
	Pharmacy	31.2	60.7	6.2	1.4	0.6	4.2 (4.1–4.3)	
Q 15 healthcare professionals actively report adverse events to reduce the number of such events	Medical	1.8	24.1	44.6	27.7	1.8	3.0 (2.8–3.1)	0.861
	Pharmacy	3.4	21.9	47.8	23.3	3.7	3.0 (2.9–3.1)	

Notes: * We calculated the total scores of student responses to each question based on a 5-point Likert scale—Strongly Agree (5 points), Agree (4 points), Neutral (3 points), Disagree (2 points), and Strongly Disagree (1 point)—and presented the mean values and 95% CI for each group.

of establishing a reporting system, 81.2% of the medical students and 75.5% of pharmacy students provided positive responses. For question 13, “Punishing the parties involved in medical errors does not reduce medical errors”, which asked about the responsibility of the individual who causes an adverse event, 49.1% of the medical students and 57.9% of pharmacy students provided positive responses and 21.5% of the medical students and 19.4% of pharmacy students provided negative responses.

As compared with pharmacy students, medical students tended to provide more positive responses to questions related to their sense of responsibility and accountability as a potential party to be directly involved in adverse events, including reporting to a supervisor after an adverse event occurs and establishing a reporting system for adverse events. In question 13, which asked about the responsibility of an individual who caused an adverse event, medical students were more likely than pharmacy students to consider that punishing the individual would lead to a decrease in the number of adverse events.

Knowledge

Table 3 shows the results of the responses to “knowledge” questions regarding patient safety awareness.

For question 21, “You know about ‘team medicine,’” 93.8% of medical students and 91.9% of pharmacy students provided positive responses. For question 23, “You know about ‘informed consent,’” 97.3% of medical students and 74.2% of pharmacy students provided positive responses. In contrast, for question 17, “You know about ‘near-miss,’” 35.7% of medical students and 16.8% of pharmacy students provided positive responses. For question 19, “You know about the ‘Medical Accident Investigation System, *’” 23.3% of medical students and 9.8% of pharmacy students provided positive responses.

Many students of both groups were knowledgeable about “team medicine” (question 21) and “informed consent” (question 23), concepts that are also relatively well known to the public. In particular, as compared to pharmacy students, medical students tended to provide more positive responses to the questions. On the other hand, students in both groups did not have sufficient knowledge of practical concepts regarding patient safety such as “near-miss” (question 17) and the “Medical Accident Investigation System” (question 19). A higher percentage of medical students than pharmacy students

Table 3 Student Responses to “Knowledge” Questions Regarding Patient Safety Awareness

“Knowledge” Items	Students	Very Good (%)	Good (%)	Fair (%)	Poor (%)	Very Poor (%)	Mean Values of Total Points (95% CI)	p-value
Q 16 You know about “time out”	Medical	0.0	7.1	2.7	30.4	59.8	1.6 (1.4–1.7)	0.517
	Pharmacy	1.1	8.4	3.1	27.8	59.6	1.6 (1.5–1.7)	
Q 17 You know about “near-miss”	Medical	14.3	21.4	2.7	19.6	42.0	2.5 (2.2–2.8)	<0.001
	Pharmacy	4.2	12.6	2.8	18.3	62.1	1.8 (1.7–1.9)	
Q 18 You know about “double-check”	Medical	9.8	42.9	4.5	12.5	30.4	2.9 (2.6–3.2)	0.490
	Pharmacy	9.3	38.5	4.5	16.9	30.9	2.8 (2.6–2.9)	
Q 19 You know about “Medical Accident Investigation System”*	Medical	4.5	18.8	2.7	25.9	48.2	2.1 (1.8–2.3)	0.003
	Pharmacy	1.1	8.7	4.8	30.6	54.8	1.7 (1.6–1.8)	
Q 20 You know about “triage”	Medical	18.8	37.5	0.9	15.2	27.7	3.0 (2.8–3.3)	<0.001
	Pharmacy	9.6	17.1	1.7	17.7	53.9	2.1 (2.0–2.3)	
Q 21 You know about “team medicine”	Medical	27.7	66.1	5.4	0.0	0.9	4.2 (4.1–4.3)	0.651
	Pharmacy	30.9	61.0	3.1	3.4	1.7	4.2 (4.1–4.2)	
Q 22 You are aware of an accident in which several patients died after undergoing laparoscopic surgery at a university hospital†	Medical	14.3	42.9	1.8	21.4	19.6	3.1 (2.8–3.4)	<0.001
	Pharmacy	6.5	34.3	3.4	25.0	30.9	2.6 (2.5–2.7)	
Q 23 You know about “informed consent”	Medical	32.1	65.2	1.8	0.0	0.9	4.3 (4.2–4.4)	<0.001
	Pharmacy	23.9	50.3	3.9	6.7	15.2	3.6 (3.5–3.7)	
Q 24 You know about “evidence-based-medicine”	Medical	11.6	43.8	4.5	22.3	17.9	3.1 (2.8–3.3)	<0.001
	Pharmacy	3.9	12.4	4.8	30.3	48.6	1.9 (1.8–2.0)	
Q 25 Communication skills of healthcare professionals are relevant to adverse events	Medical	18.8	54.5	12.5	10.7	3.6	3.7 (3.6–3.9)	<0.001
	Pharmacy	12.6	40.4	12.6	26.4	7.9	3.2 (3.1–3.4)	

Notes: *The Medical Accident Investigation System was implemented by the Japan Medical Safety Research Organization (Medsafe Japan) in October 2015. This system targets unforeseen death caused by medical care that was reported as an adverse event, defined as “death or stillbirth cases which are caused or may have been caused by the care provided by employees of the medical institutions and are unforeseen by the administrator”. This system aims to ensure medical safety by preventing the recurrence of similar adverse events. †Adverse events at Gunma University Hospital occurring from 2010 to 2014 that resulted in the death of eight patients after laparoscopic surgery by the same doctors.

responded more positively to questions about knowledge of practical concepts. In comparing the responses to “perception” and “attitude” between medical students who responded positively to practical concepts (questions 17 and 19) and other medical students, we found that the levels of “perception” and “attitude” tended to be high in both groups, regardless of their responses. We observed the same trend among pharmacy students.

Attitude

Table 4 shows the results of the responses to the “attitude” questions regarding patient safety awareness.

For most of the questions, including question 28, which asked about the importance of patient safety, and question 29, which asked about the participants’ willingness to learn about patient safety, the percentage of positive responses exceeded 80% in both groups. For each of these questions, a higher percentage of medical students than pharmacy students responded positively. Question 32, which inquired about disclosing a medical error to the patients, 22.3% of medical students and 22.1% of pharmacy students answered positively. Question 33, which asked about sharing all facts of the medical error with their colleagues to prevent recurrence, 80.4% of medical students and 82.3% of pharmacy students answered positively.

Responses to the questionnaire were stratified according to sex, age, presence of medical professionals in the family, and experience of adverse events, and responses to the “perception”, “knowledge”, and “attitude” categories of the questionnaires were analyzed. No major features were found that would affect our conclusions.

Table 4 Student Responses to “Attitude” Questions Regarding Patient Safety Awareness

“Attitude” Items	Students	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)	Mean values of Total Points (95% CI)	p-value
Q 26 healthcare professionals should routinely spend part of their professional time in improving patient care	Medical	60.7	38.4	0.9	0.0	0.0	4.6 (4.5–4.7)	<0.001
	Pharmacy	39.0	56.2	4.2	0.3	0.3	4.3 (4.3–4.4)	
Q 27 “Patient safety” is an important topic in healthcare	Medical	67.0	32.1	0.9	0.0	0.0	4.7 (4.6–4.8)	<0.001
	Pharmacy	40.2	55.9	2.8	1.1	0.0	4.4 (4.3–4.4)	
Q 28 Learning about patient safety is important in medical schools	Medical	63.4	34.8	1.8	0.0	0.0	4.6 (4.5–4.7)	0.001
	Pharmacy	45.8	50.8	2.2	0.8	0.3	4.4 (4.3–4.5)	
Q 29 You would like to learn more about “patient safety”	Medical	44.6	51.8	2.7	0.9	0.0	4.4 (4.3–4.5)	<0.001
	Pharmacy	28.9	55.1	12.4	2.5	1.1	4.1 (4.0–4.2)	
Q 30 You do not wish to support or advise a peer to decide how to respond to an adverse event	Medical	1.8	3.6	17.0	50.9	26.8	4.0 (3.8–4.1)	0.024
	Pharmacy	2.0	6.7	24.7	47.2	19.4	3.8 (3.7–3.8)	
Q 31 You want to analyze a case to find the cause of an adverse events	Medical	47.3	50.9	1.8	0.0	0.0	4.5 (4.4–4.6)	<0.001
	Pharmacy	29.5	66.3	3.7	0.6	0.0	4.2 (4.2–4.3)	
Q 32 You will not disclose an adverse event to the patient	Medical	2.7	19.6	33.9	33.0	10.7	3.3 (3.1–3.5)	0.719
	Pharmacy	3.7	17.4	41.0	25.6	12.4	3.3 (3.2–3.4)	
Q 33 You will share all facts of the adverse event with your colleagues to prevent recurrence	Medical	26.8	53.6	17.0	2.7	0.0	4.0 (3.9–4.2)	0.688
	Pharmacy	27.2	55.1	15.7	2.0	0.0	4.1 (4.0–4.1)	

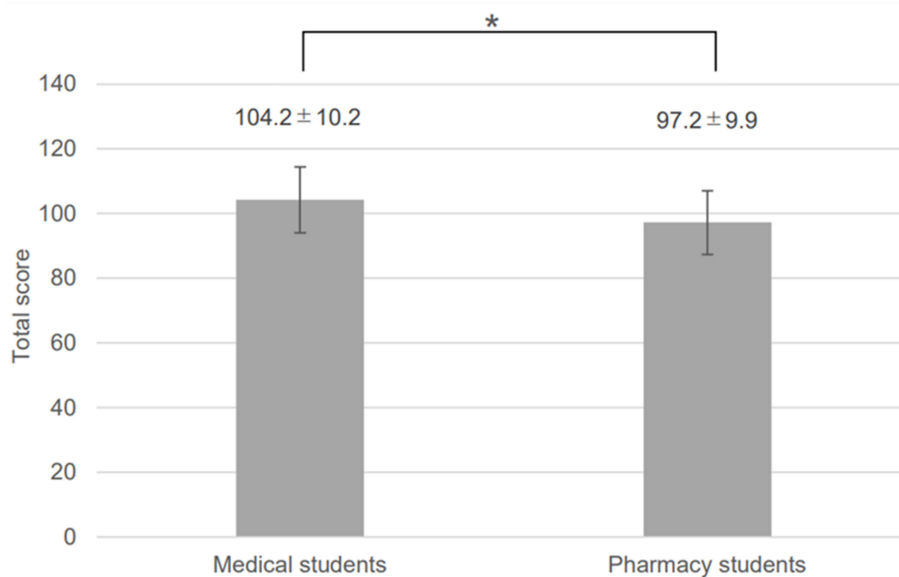
Total Score

Figure 1 shows the results of the total scores we calculated to assess overall patient safety awareness for the question groups on “perception”, “knowledge”, and “attitude” using a 5-point Likert scale. The total scores were 104.2 ± 10.2 for medical students and 97.2 ± 9.9 for pharmacy students (mean difference: 7.1, $p < 0.001$, 95% CI: 4.9–9.2). After controlling for confounders through ANCOVA, a statistically significant difference was observed in the total scores between the two groups (Least Square mean (LS mean): 5.6, $p < 0.001$, 95% CI: 3.3–7.9).

Discussion

The total score of the medical students was statistically significantly higher than that of the pharmacy students. Additionally, in their responses to the questionnaire, a higher proportion of medical students than pharmacy students provided positive responses in all “perception”, “knowledge”, and “attitude” categories (questions 5–33). Therefore, medical students are considered to have a higher level of patient safety awareness at the time of admission compared to pharmacy students.

In the “perception” category assuming the results of the total scores, medical students responded more positively than pharmacy students to the questions related to reporting adverse events (questions 8, 10, 11). These questions addressed students’ sense of accountability and responsibility for adverse events. In previous studies, it was suggested that both medical and pharmacy students at the completion of their medical and pharmacy education have a high level of awareness in terms of reporting adverse events.^{25–28} The results obtained in this study suggest that while both groups demonstrated a high level of accountability and responsibility for adverse events similarly to the previous studies, medical students recognized themselves as more likely than pharmacy students to cause adverse events in the future. In the study of medical doctors, pharmacists, and nurses, Alharbi et al reported that medical doctors have a higher level of patient safety awareness than pharmacists.²³ Considering the results of this study, it could be concluded that the difference in the level of patient safety awareness between medical and pharmacy students prior to receiving patient safety education might be a reflection of the difference in their sense of accountability and responsibility for adverse events based on each profession. In question 13, it was suggested that medical students are more likely than pharmacy



	Least square mean	95% confidence interval	p value
Medical students/Pharmacy students	5.6	3.3–7.9	<0.001
Sex (male/female)	-2.2	-4.1 to -0.3	0.023
Age ($\leq 18/\geq 19$) (y)	-1.0	-1.5 to -0.5	<0.001
Medical professionals in the family (yes/no)	1.1	-0.8 to 2.9	0.257
Experience with medical accidents (yes/no)	0.8	-3.1 to 4.6	0.699

Figure 1 The total scores based on the three sub-constructs of patient safety awareness. The total scores were 104.2 ± 10.2 and 97.2 ± 9.9 for medical and pharmacy students, respectively. * mean difference: 7.1, $p < 0.001$, 95% CI: 4.9–9.2. ANCOVA was also performed on the results of the total scores, and a statistically significant difference was found between the two groups (LS mean: 5.6, $p < 0.001$, 95% CI: 3.3–7.9).

students to consider adverse events as a matter of personal responsibility. Roh et al's study also reported that medical students, prior to receiving patient safety education, exhibit a strong sense of responsibility and perceive adverse events as a matter of personal accountability.²⁹ Furthermore, in this study, medical students were found to be more reluctant to share information about adverse events compared to pharmacy students (questions 32 and 33). It has also been pointed out that healthcare professionals tend to hesitate to report adverse events due to fear of being held accountable.^{30,31} These results also suggest that medical students possess a stronger sense of responsibility toward such events.

Kutaimy et al reported that implementing a patient safety education program for medical students in their first year, earlier than the typical third- or fourth-year clinical rotation stage, resulted in an overall improvement in medical students' "knowledge" and "attitudes" toward patient safety.³² Additionally, they noted that introducing patient safety education earlier inevitably increased the number of opportunities for medical students to be exposed to patient safety knowledge.³² Kim et al reported that medical students' motivation to learn decreases as they progress through their academic years.³³ Considering these previous findings with the results of this study, it can be concluded that introducing more advanced and practical contents at earlier stages, when medical students possess higher motivation to learn, would contribute to the effectiveness of patient safety education for medical students. This study also showed that pharmacy students possess a high level of patient safety awareness; however, compared to medical students, their patient safety awareness was lower across all domains. These results suggest that pharmacy students might have a lower sense of responsibility and accountability for adverse events compared to medical students. According to the report by the Japan Council for Quality Health Care's Project to Collect Medical Accident Information based on a study done over a 14-year period starting in 2011, there were 8121 cases of adverse events involving pharmacists and 32,480 cases involving medical doctors.³⁴ Although medical doctors have a higher likelihood of being involved in adverse events, pharmacists still have a significant potential to be involved in such events. Therefore, patient safety education for pharmacy students

should emphasize that pharmacists also have the potential to cause adverse events, while providing thorough education starting with foundational content.

This study has some limitations. First, this cross-sectional study included only 132 medical students and 367 pharmacy students who were enrolled at Teikyo University during the 2019 academic year; the number of participants was small and was from a single institution. Other confounders and bias could have also been present. In the future, a multicenter study that includes other universities and a longitudinal study to assess patient safety awareness over time is needed. Future research that compares and examines patient safety awareness at the time of admission across different healthcare-related disciplines may also provide valuable insights into developing more tailored approaches to enhancing students' awareness of patient safety. Prior to this study, there have been few studies focused on differences in the level of patient safety awareness among medical and pharmacy students at the time of admission. This study was an initial attempt to investigate differences in the level of patient safety awareness among students across different disciplines at the time of admission. Further studies should include a longitudinal design with a greater number of students across different institutions and a wider variety of healthcare-related disciplines to gain insights into more tailored approaches to patient safety education.

Conclusion

This study showed that, at the time of admission, medical students had a higher level of patient safety awareness compared to pharmacy students and exhibit a greater sense of responsibility and accountability for adverse events. The results suggest the importance of implementing patient safety education with consideration of underlying differences in the characteristics of patient safety awareness in each group from the early stages of admission. For example, an outcome of patient safety education for medical students may be significantly improved by leveraging their high level of patient safety awareness at the time of admission, introducing them to more practical and advanced contents in their first years. Additionally, an outcome of patient safety education for pharmacy students may be significantly improved by initially placing an emphasis on promoting overall awareness around a significant likelihood of being involved in adverse events, while providing thorough education starting with foundational content.

Abbreviations

WHO, World Health Organization; CI, Confidence Interval; ANCOVA, analysis of covariance; LS mean, Least Square Mean.

Ethical Approval

The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethical Review Board for Medical and Health Research Involving Human Subjects of Teikyo University (authorization number: Teirin 17-104) on October 23rd, 2017.

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Disclosure

The authors report no conflicts of interest in this work.

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