

BMJ Open Perceptions of patient safety culture among medical students: a cross-sectional investigation in Heilongjiang Province, China

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ABSTRACT

Objectives Medical school education plays an important role in promoting patient safety. In this study, we assess medical students' perceptions of patient safety culture, identify their educational needs and provide evidence on the most important content relating to patient safety for the medical school curriculum.

Method This cross-sectional study was conducted in four medical universities in Heilongjiang province. Medical students in the first through five years completed an anonymous questionnaire—the Attitudes toward Patient Safety Questionnaire III. We analysed the differences in responses across the four universities and their cohorts.

Results The overall perceptions of patient safety culture across the four medical universities were positive. The highest positive response rate was for 'I have a good understanding of patient safety issues as a result of my undergraduate medical training' (range: 58.4%–99.8%), whereas the lowest positive response rate was for 'medical errors are a sign of incompetence' (14.7%–47.9%). Respondents in the earlier years of school tended to have more positive responses for items concerning working hours and team work; however, fourth and fifth year students had more positive responses for error inevitability. Items with the lowest positive response rates across the cohorts included items related to 'professional incompetence as a cause of error' and 'disclosure responsibility'.

Conclusions While students generally had positive views of patient safety culture, none of them had been exposed to any formal curriculum content on patient safety. Policymakers should focus more on how educational needs vary across schools and cohorts in order to establish appropriate curricula.

INTRODUCTION

Providing patients with a safe and comfortable medical environment is an important task for medical and healthcare organisations worldwide. Indeed, in 1999, the Institute of Medicine (IOM) released a report called 'To Err Is Human: Building a Safer Health System' to highlight the importance of

Strengths and limitations of this study

- This is the first study to use the Attitudes toward Patient Safety Questionnaire III to compare patient safety culture across different medical schools and grades in Heilongjiang province, China.
- We covered almost all the medical colleges in Heilongjiang province.
- The study is limited by the potential non-response bias. Students who responded to the survey might have been more interested than their peers in patient safety, which might have inflated the attitude ratings.
- The results might not be generalisable to all medical colleges in China, although our sample size was large.

patient safety.¹ Studies conducted in several countries have shown that a lack of attention to patient safety can lead to medical errors, which in turn can harm patients and increase their hospitalisation time.^{2,3} Hence, the maintenance and promotion of patient safety is of utmost importance.

The advancement of patient safety requires a fundamental change in the healthcare culture. Reducing harm through an improved safety culture is a global priority.⁴ Policymakers, payers and groups such as the Agency for Healthcare Research and Quality, National Patient Safety Agency and WHO have developed numerous safety initiatives at the national and institutional levels.⁵ However, most of these initiatives targeted doctors, managers and other healthcare professionals and rather less attention has been paid to medical students, who are the next generation of medical workers.⁶ It is essential for medical students to have a good understanding of the patient safety culture because it will doubtlessly influence their

attitude towards patient safety issues throughout their working lives

In 1980, Hilfiker reported that medical graduates lack the ability to handle medical errors.⁷ Even by 1998, Pilpel and his colleagues found that there was not yet any formal document for medical students that described how to handle medical errors.⁸ While the launch of the 'Building a Safer Health Care System' in 1999 triggered a global discussion of patient safety issues,¹ a later study by Leape *et al* concluded that the status of patient safety education is not optimal.⁹ The Australian Health Safety and Quality Committee published the National Patient Safety Education Framework (NPSF) in 2005.¹⁰ Then, in 2008, the WHO constituted the first expert committee on patient safety issues in undergraduate medical curricula.¹¹ Subsequently, the Patient Safety Alliance conducted pilot studies in 11 schools worldwide, and proposed that advocacy for patient safety activities is one of the most important WHO initiatives in the 21st century globally.

The primary prerequisite for the implementation of education on patient safety culture is to understand medical students' current awareness of safety culture. To this end, Carruthers *et al* used the Attitudes toward Patient Safety Questionnaire (APSQ) to study medical students' perceptions of the patient safety culture.¹² Similarly, Liao *et al* surveyed 367 medical students at three medical colleges in the United States about the patient safety culture,⁵ while Bowman *et al* explored knowledge of patient safety culture among 170 medical students at the University of California at San Francisco.¹³ Leung *et al* surveyed second year students at medical schools in Hong Kong and Singapore about their perceptions of patient safety culture and compared their different educational needs.¹⁴ However, patient safety education in areas with low medical standards and high medical risks—for example, in developing countries like China—is still in its infancy.¹⁵ One thing we do understand, from a report exploring safety education content and teaching methods in China,¹⁶ is that patient safety education has not been fully implemented within the curricula and clinical practice therein.

Heilongjiang province, as the healthcare centre of Northeast China, has the largest area and availability of health resources, with a population of more than 30 million people.¹⁷ Heilongjiang province has four prominent medical schools that provide medical and health service personnel training for the entire province: Harbin Medical University, Qiqihar Medical University, Mudanjiang Medical University and the Medical College of Jiamusi University. Of these, Harbin Medical University has the best reputation for education and most stringent entrance requirements, although the others (along with their affiliated tertiary hospitals) enjoy a good reputation as well. However, there are no studies examining perceptions of patient safety culture among medical students in Heilongjiang province, and few in China as a whole. Understanding current perceptions of patient safety culture and identifying medical students'

most urgent educational needs in that area is critical for the effective design and successful implementation of education programmes at Heilongjiang's medical institutions. Consequently, we evaluated the students' perceptions of the patient safety culture at these four medical schools, with the goal of identifying domains critical to transforming patient safety perspectives and addressing students' educational needs.

METHODS

Sampling and data collection

In 2014, we conducted a cross-sectional survey of four medical schools in Heilongjiang province. The cooperation of the schools was obtained by contacting the managers of the student affairs offices. While some of these schools offered courses in doctor–patient relations and evidence-based medicine, none of them had a dedicated or systematic patient safety course. Furthermore, none of the students had received any prior formal teaching on patient safety. As such, we could obtain a baseline assessment of these students' views on the patient safety culture. We used systematic random sampling to select 800 clinical medical students from a roster of all medical undergraduates at each school. We provided these students with detailed explanations of the objective of this investigation; some students expressed interest in participating in the survey, while others declined to participate. Students who were willing to participate were given 2 days to complete the questionnaire anonymously, after which they returned it to a box provided in a counsellor's office. We did not collect respondents' names or any other identifiers. Using this procedure, we obtained 2498 valid questionnaires (total response rate: 78.1%). Of the students who participated, 726 (response rate: 90.8%) came from Harbin Medical University, 631 (78.9%) from Qiqihar Medical University, 459 (57.4%) from Mudanjiang Medical University and 682 (85.3%) from the Medical College of Jiamusi University.

Questionnaire

We used the APSQ-III,^{12 14 18–20} which was specifically designed for students and covers nine key domains related to patient safety culture. The APSQ-III assesses several domains regarding patient safety culture, rather than examining differences in patient safety education. As such, it can more accurately reflect realistic educational needs.¹⁴ The APSQ-III has a stable domain structure and criterion validity; it can also distinguish between diverse student subgroups.¹⁴

The questionnaire comprises 26 items covering nine key patient safety domains:

- Patient safety training received (items 1–3).
- Error reporting confidence (items 4–6).
- Working hours as an error cause (items 7–9).
- Error inevitability (items 10–12).
- Professional incompetence as an error cause (items 13–16).

- f. Disclosure responsibility (items 17–19).
- g. Team functioning (items 20 and 21).
- h. Patient involvement in reducing error (items 22 and 23).
- i. Importance of patient safety in the curriculum (items 24–26).

Data analyses

Responses were recorded on a five-point Likert scale (5=strongly agree and 1=strongly disagree). Responses were grouped into agree (ie, 4 or 5) and disagree (ie, 1 or 2), and overall percentages were obtained.¹⁴ An analysis of variance was used to compare the positive responses rate among students in different years of medical school. We also excluded unanswered questions from the analyses. The significance was set at $P<0.05$.

Patient and public involvement

Patients and public are not involved in the process of this study. As described in more detail in the methods section, we investigated the understanding of patient safety culture by medical students. The participants will be informed of the study results via lectures in their schools.

RESULTS

Of the students who responded to the demographic questions, 1055 (42.4%) were male, and 1435 (57.4%) were female. The response rates varied among the school year cohorts: first year, 399 (16%); second year, 483 (19.3%); third year, 587 (23.5%); fourth year, 746 (29.9%); and fifth year, 283 (11.3%) (table 1).

Table 2 summarises the patient safety culture perceptions, by survey domain, for the total sample and the four subgroups by medical school. The overall highest positive response rates were for the following domains: 'patient safety training received', 'patient involvement in reducing errors', 'I have a good understanding of patient safety issues as a result of my undergraduate medical training' and 'patients have an important role in

preventing medical errors'. The lowest positive response rates were for the domains 'professional incompetence as an error cause', 'disclosure responsibility', 'medical errors are a sign of incompetence' and 'it is not necessary to report errors, which do not result in adverse outcomes for the patient'.

When looking at specific medical schools, the highest positive response rates were found in Mudanjiang Medical College for the domain 'patient safety training received'. Jiamusi Medical College had the second highest rates overall, and its highest positive response rate was for the domain 'working hours as an error cause'. In Qiqihar Medical University, the highest positive response rate was for 'patient involvement in reducing errors'. In all four institutions, the lowest positive response rate was for 'professional incompetence as an error cause'. The overall lowest positive response rates came from Harbin Medical University; the highest positive response rate was for the domain 'patient safety training received' and the lowest for 'error reporting confidence'. We observed statistically significant differences among the schools in their responses to all nine key patient safety domains.

Table 3 summarises the patient safety culture perceptions for the total sample and five school-year cohorts, according to the APSQ-III domains. Perceptions of patient safety culture varied noticeably according to school year. All five cohorts had a positive perception of 'patient safety training received' and 'patient involvement in reducing errors'. However, first and second year students had more positive perceptions of 'working hours as an error cause', while third year students had a more positive view of 'team functioning'. Besides the aforementioned domains, fourth and fifth year students had high positive response rates for 'error inevitability'. The lowest positive response rates were for 'professional incompetence as an error cause' and 'importance of patient safety in the curriculum' for all cohorts. As shown in table 4, there was a significant difference ($p<0.05$) among cohorts in their positive response rates for 'patient safety training

Table 1 Respondents' demographic characteristics

Characteristic	n (%)			
	A	B	C	D
Gender				
Male	322 (44.4)	261 (41.7)	167 (36.4)	305(45)
Female	404 (55.6)	366 (58.3)	292 (63.6)	377(55)
Year in medical school				
First	111 (15.3)	186 (29.5)	36 (7.8)	66 (9.7)
Second	132 (18.2)	146 (23.1)	115 (25.1)	90 (13.2)
Third	154 (21.2)	117 (18.5)	110(24)	206 (30.2)
Fourth	245 (33.7)	100 (15.9)	131 (28.5)	270 (39.6)
Fifth	84 (11.6)	82(13)	67 (14.6)	50 (7.3)
Overall	726 (29.1)	631 (25.3)	459 (18.4)	682 (27.3)

A, Harbin Medical University; B, Qiqihar Medical University; C, Mudanjiang Medical University; D, Medical College of Jiamusi University.

Table 2 Responses to APSQ-III items

Domain	Positive responses (%)*				
	Overall	Between schools			
		A	B	C	D
Patient safety training received	84.9	57.3	90	99.4	98.5
1. My training is preparing me to understand the causes of medical errors.	84.8	56.6	89.7	99	99
2. I have a good understanding of patient safety issues as a result of my undergraduate medical training.	85.2	58.4	90.2	99.8	97
3. My training is preparing me to prevent medical errors.	84.7	56.8	90.1	99.3	99.4
Error-reporting confidence	74.9	53.1	75.8	85.6	88.1
4. I would feel comfortable reporting any errors I had made, no matter how serious the outcome had been for the patient.	71.6	52.9	68.5	80.5	85.7
5. I would feel comfortable reporting any errors other people had made, no matter how serious the outcome had been for the patient.	76.7	53.4	79.8	88.1	89.5
6. I am confident I can talk openly to my supervisor about an error I had made, even if it resulted in potential or actual harm to my patient.	76.5	53.1	79	88.1	89.2
Working hours as an error cause	83.4	56.2	88.2	98	98.7
7. Shorter shifts for doctors will reduce medical errors.	81.7	53.9	85.9	97.1	97.3
8. By not taking regular breaks during shifts, doctors are at an increased risk of making errors.	84.7	57.8	89.8	98.9	99.5
9. The number of hours doctors work increases the likelihood of making medical errors.	83.8	56.8	89	97.9	99.4
Error inevitability	74.9	55.2	80.9	87.1	82.2
10. Even the most experienced and competent doctors make errors.	84.3	56.7	89.4	99.8	98.7
11. A true professional does not make mistakes or errors.†	68.9	53	79.3	86.1	64.8
12. Human error is inevitable.	71.6	56	73.9	75.4	83.2
Professional incompetence as an error cause	58.4	53.25	59.6	61	60
13. Most medical errors result from careless nurses	68.1	56.8	79	79.3	62.1
14. If people paid more attention at work, medical errors would be avoided†	67.2	53.2	62.5	72.8	80.1
15. Most medical errors result from careless doctors†	65.8	55.1	74.2	77.1	61.4
16. Medical errors are a sign of incompetence†	32.5	47.9	22.7	14.7	36.5
Disclosure responsibility	69.4	55.1	72.6	78.4	74.8
17. It is not necessary to report errors which do not result in adverse outcomes for the patient†	60.8	57.6	70.7	69.8	48.8
18. Doctors have a responsibility to disclose errors to patients only if the errors result in patient harm.	80.8	55	85.2	93.8	94.5
19. All medical errors should be reported.	66.7	52.6	61.9	71.6	81
Team functioning	76.9	55.7	77.5	87.6	91.8
20. Better multidisciplinary teamwork will reduce medical errors.	69.2	54.9	64.5	75.4	84.5
21. Teaching students teamwork skills will reduce medical errors.	84.7	56.6	90.5	99.8	99.1
Patient involvement in reducing errors	84.7	56.7	90.2	99.4	98.7
22. Patients have an important role in preventing medical errors.	85.1	56.1	90.5	99.5	98.6
23. Encouraging patients to be more involved in their care can help to reduce the risk of medical errors occurring.	84.5	57.3	90	99.3	98.8
Importance of patient safety in the curriculum	71.6	56.4	78.5	82.4	74.4
24. Teaching students about patient safety should be an important priority in medical students' training.	84.1	55.9	89.5	99.1	98.6
25. Patient safety issues cannot be taught; they can only be learnt through clinical experience, which is gained when one is qualified.†	46.6	55.8	55.4	50	25.3
26. Learning about patient safety issues before I qualify will enable me to become a more effective doctor.	85	57.5	90.7	99.3	99.4

A, Harbin Medical University; B, Qiqihar Medical University; C, Mudanjiang Medical University; D, Medical College of Jiamusi University.

*Positive responses include responses of 'agree' or 'strongly agree'. The denominator for each question might vary because some students did not respond to every question in the survey;

†Negatively worded item, where the positive response rate is based on responses of 'strongly disagree' or 'disagree'.

APSQ-III, Attitudes toward Patient Safety Questionnaire III.

Table 3 Responses to the nine domains of the APSQ-III

Schools	Year in medical school	Positive responses (%)*								
		Patient training received	Patient safety	Error reporting confidence	Working hours as an error cause	Error inevitability	Professional incompetence as error cause	Disclosure responsibility	Team functioning	Patient involvement in reducing errors
A	First	78.6	73.4	79.7	71.9	56.6	66.4	73.9	80.8	50.7
	Second	74.3	62.9	74.4	71.4	56	66.6	64	71.9	49.8
	Third	57.1	52.9	56.2	52.8	51.9	51.4	57.5	55.1	41.5
	Fourth	43.1	40	40.5	45.4	51.1	48.7	42.7	42.8	37.6
	Fifth	45.2	46.4	42.6	41.1	51.8	46.6	51.2	42.7	33.7
B	First	99.4	84.7	95.8	86	61.5	78.2	84.1	98.9	62.6
	Second	97.2	86.8	95	91.1	66.3	78.5	87	99.1	59.8
	Third	98	72.7	95.9	83.8	59.2	63.3	81.3	100	63.5
	Fourth	98.9	86.5	97.3	84.4	60.9	77.5	78.8	97.3	63.5
	Fifth	61.4	51.9	61.2	61.6	51.5	57.4	56.1	58.7	47.2
C	First	99.1	90.3	96.1	91.9	62	84.1	86.4	98.2	63.5
	Second	99.6	90.3	98.3	84.2	63.6	81.2	81.1	99.5	63.2
	Third	100	83.4	97.9	87.1	60.7	78.2	91	100	59.3
	Fourth	97	77.9	96.9	86.9	60	75.2	87.2	95.7	66.5
	Fifth	99.7	79.9	99.4	85.2	58.5	70.9	92.6	100	58.2
D	First	99.1	87.1	99.2	86	63.3	72.7	90.2	97.1	56.7
	Second	98.5	88.7	99.2	83.2	61.3	77.5	91	98.2	54.6
	Third	97.1	87.2	97.2	82.9	59.9	74.8	89.3	99.2	57.8
	Fourth	100	96.1	100	74.2	52.3	67	97.7	100	52.4
	Fifth	100	78	100	79.3	41	74.9	100	100	65.1

*Positive responses include responses of 'agree' or 'strongly agree'. The denominator for each question might vary because some students did not respond to every question in the survey. A, Harbin Medical University; B, Qiqihar Medical University; C, Mudanjiang Medical University; D, Medical College of Jiamusi University. APSQ-III, Attitudes toward Patient Safety Questionnaire III.

Table 4 APSQ-III domains that demonstrated significant differences between the five cohorts across all four schools

Year in medical school	Positive responses (%)†								
	Patient safety training received*	Error reporting confidence*	Working hours as an error cause*	Error inevitability*	Professional incompetence as an error cause	Disclosure responsibility	Team functioning*	Patient involvement in reducing errors*	Importance of patient safety in the curriculum*
First	93.5	82.5	91.7	82.7	60.4	74.4	82.5	93.5	58.1
Second	91.9	81.6	90.9	82.6	61.9	75.8	79.9	91.5	56.9
Third	87.4	74.6	86.4	76	57.8	67	79.7	87.9	54.9
Fourth	80.7	73.2	79.5	68.2	54.4	63.9	75.3	80	51.5
Fifth	72.4	61.8	71.7	64.7	51.6	60.4	71	71	49.1

*P<0.05.

†Positive responses include responses of 'agree' or 'strongly agree'. The denominator for each question might vary because some students did not respond to every question in the survey.

APSQ-III, Attitudes toward Patient Safety Questionnaire III.

received', 'error reporting confidence', 'working hours as an error cause', 'error inevitability', 'team functioning', 'patient involvement in reducing errors', and 'importance of patient safety in the curriculum'.

DISCUSSION

Patient safety is a top healthcare priority, and all medical undergraduates must have the necessary capacity to minimise patient harm as they embark on their future career. Education and training are key to achieving this goal.⁵ Medical students' experiences at medical school, as well as their perceptions about the patient safety culture, have an important influence on their attitudes toward patient safety and their behaviours within this domain.²¹ Therefore, screening their perceptions of the key areas of patient safety, as in the present study, offers an opportunity to improve their clinical acumen and future medical education. It can also be utilised by medical directors and clinical service supervisors for real-time assessment in promoting a safety culture. We also conducted the present study to demonstrate how the APSQ-III can be used to identify differences among school-year cohorts across several medical universities in Northeast China.

The findings of this study highlight that medical students tend to have generally positive perceptions of the patient safety culture.²² Interestingly, although none of our participants had received any formal teaching on the subject, students from all four universities tended to report that they had been trained in this subject well (84.9%). This finding is similar to that of a previous study by Leung *et al* in Hong Kong,¹⁴ who proposed that the result could be due to students' misunderstanding or an inability to distinguish teaching from they have learnt from public media. We also believe that this is because of a rather common psychological phenomenon among students in China—that is, escaping responsibility. This phenomenon refers to the idea that Chinese students are struggling to cope with and protect themselves in an intensely hierarchical environment, which manifests as a fear of telling the truth because of its potential impact on

teachers' evaluations of them. Accordingly, many students do not want to acknowledge errors or defects, and may be unwilling to report problems to avoid poor evaluations or to fit in within their teams.⁵ Therefore, more attention should be paid to this reluctance to 'speak up' in Chinese culture, and greater vigilance is required to prevent the fear of exposing deficiencies.

Leung *et al* found the highest positive response rates for 'working hours as an error cause', 'error inevitability' and 'importance of patient safety in the curriculum', whereas 'patient involvement in reducing error' and 'team functioning' had the lowest overall positive response rates.¹⁴ By contrast, in the present study, 'patient involvement in reducing errors' and 'patient safety training received' had the highest positive response rates, while 'professional incompetence as an error cause' and 'disclosure responsibility' had the lowest. In contrast with students in Hong Kong, students in mainland China responded positively to items relating to 'patient involvement in reducing errors'. A probable reason for this finding is that patients in Hong Kong must adhere to the illness-specific arrangements made by public medical institutions regarding waiting lists, hospitalisation and surgery. Additionally, they cannot choose their own doctors (however, they are generally trusting of doctors and hospitals). In mainland China, however, patients' understanding of their diagnosis and treatment has been continuously improving, and the traditional medical model is gradually being replaced with more active patient participation.²³ The doctor and patient undertake the process of medical decision-making together, and the patient has the right to choose their doctor independently. In addition, medical staff in mainland China often encourage patients and their families to participate in diagnosis and treatment-related procedures.²⁴ This might include encouraging patients or family members to participate in examining the label on an infusion bottle to obtain the name of the drug, reading drug information and so on. Previous research has shown that patient participation can reduce the occurrence of medical errors.²⁵ All these

points might explain why Chinese medical students show positive attitudes for this domain.

We found that responses to the 'professional incompetence as an error cause' domain were more negative compared with responses in the other domains, especially for the following items: 'medical errors are a sign of incompetence' (32.5%), 'medical students generally consider errors as inevitable' (74.9%) and 'even the most experienced and competent doctors make errors' (84.3%). These findings suggest that students lack a proper understanding of the causes for certain errors. Our results are similar to those of Moskowitz *et al*, who found that students in the USA were uncertain as to what constituted an error and what caused errors.¹⁸

Medical students generally agreed that medical errors are caused by humans and a sign of incompetence (32.5%), showing that they lacked awareness about systematic errors. Furthermore, a number of students agreed that long working hours and medical staff incompetence were important causes of errors. This finding indicates that the students emphasised human factors in judging the causes of errors, which aligns with findings from a previous study on students from Hong Kong: in that study, most students reported that 'if they work hard, they can eliminate errors' was an effective strategy for preventing future errors.²⁶ These findings suggest a need for emphasising the potential role of other factors (eg, systemic errors and procedural complexity) during the occurrence of medical errors.

Several students reported positive perceptions of their error reporting confidence, but had less positive perceptions of their responsibility for reporting (ie, what and how to report a problem with patient care when they witness it). Their highly positive views on reporting medical errors (74.9%) are similar to the results of a Turkish study conducted by Karaoglu *et al*,^{27 28} who found that 60.7% (n=147) of students stated that they would report an error to the hospital committee if they had made it themselves. Furthermore, 68.6% (n=166) of the students in that study stated that they would report a medical error if they witnessed one.

In Flin *et al*'s study, most students reported that they would speak up about an error. However, this result was somewhat confusing, since students also had high positive response rates for the item, 'it is not necessary to report errors that do not result in adverse outcomes for the patient' (60.8%).²⁹ More than 50% of the students attending the Medical College at Jiamusi University agreed with this statement. All members of the medical team, including medical students, should be able to recognise unsafe conditions, report errors and strive to improve error disclosure in settings where it is lacking. This persistent cultural change should contribute to the eradication of errors and reduce patient safety concerns.³⁰⁻³²

Numerous students agreed with the following statements: 'my training is preparing me to understand the causes of medical errors' (84.8%) and 'I have a good

understanding of patient safety issues because of my undergraduate medical training' (85.2%). This finding illustrates that medical students tend to have grand expectations regarding patient safety education, which is in line with the findings of Madigosky *et al*.³³ This US-based study also revealed that awareness of patient safety and medical errors can be increased and sustained via an experiential curriculum, which students rated as a valuable experience.^{13 33}

Insights can be gleaned from the differences observed among the four medical schools. The four universities ranked as follows in their positive response rates, in descending order: Mudanjiang Medical University, the Medical College of Jiamusi University, Qiqihar Medical University and Harbin Medical University. Notably, we found no evidence of different reporting practices between the four medical schools. Possibly, the differences in local patient safety cultures, as well as students' social and cultural backgrounds, are significant contributing factors to these different positive response rates.³⁰ However, the present study design did not enable an exploration of these factors; we could only determine the focal aspects of future teaching. For example, Mudanjiang Medical University, the Medical College of Jiamusi University, and Qiqihar Medical University might target education toward the classification and underlying mechanisms of medical errors. In contrast, Harbin Medical University might target students' confidence in error reporting as an area for improvement.

Our results run counter to those from other countries. For example, Flin *et al*'s study in the UK found that most first-year students reported 'medium low' or 'average' levels of knowledge regarding errors and patient safety issues.³⁴⁻³⁸ Our results revealed that positive perceptions of a patient safety culture tended to decrease as students progressed through medical school. As seen in [table 3](#), more senior students appeared to have less positive perceptions of 'error reporting confidence' and 'the importance of patient safety in the curriculum'. Possible reasons for these findings include senior students' experience of working in strong clinical hierarchies, which is known to have a negative influence on error reporting and disclosure of medical errors.³⁹ Furthermore, this decrease in medical error disclosure might emerge as a result of increasing awareness and more realistic self-assessment that students develop during the process of medical education.⁴⁰ It could also be the result of inadequate training and preparation of young doctors. More senior students also appeared to have less positive perceptions of 'the importance of patient safety in the curriculum'. A likely reason for this finding is that because students face an increasing number of courses and pressure of examinations as they progress from their first to their fifth year, they do not want to add new courses to their curriculum. Still, the precise reason for this remains to be determined.

A limitation of this study is the possible non-response bias. Students who agreed to respond to the survey might

have been more interested in patient safety than their non-responding peers. This greater level of interest might have led to the inflation of attitude ratings. Another limitation is that we made use of a non-standardised survey instrument. In addition, the APSQ-III is a self-assessment questionnaire that addresses students' own perceptions of a patient safety culture rather than their actual teachings in this area. Therefore, the present results might not be indicative of students' actual skills and knowledge. Moreover, extrapolation of our findings to other medical colleges should be done with caution. Nevertheless, this is the first use of the APSQ-III to compare patient safety cultures across different schools and school-year cohorts within mainland China. While the present sample was taken from only one region in China, we covered almost all the medical colleges within this rather large province. Furthermore, we recruited a cohort of medical students across all 5 years of their programmes; therefore, this study represents an important advancement in research on patient safety education in China. We believe that our findings can help educators develop suitable curricula for a patient safety education.

In conclusion, our study explored perceptions of the patient safety culture among medical students in China. These findings suggest that medical students' perceptions of patient safety culture can provide a tool for guiding medical education. Institutions should focus more on issues related to the causes of medical errors and error reporting. Shifts in patient safety culture should also be based on situations affecting different schools and cohorts, especially among third-year medical students. Longitudinal studies using a validated instrument should also be conducted to better evaluate patient safety education programmes and their relative impact on local healthcare development. Further studies should also explore the culture of reporting errors and how students in nursing and healthcare education programmes address these errors.

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