Patient Safety Education for Undergraduate Students: A Systematic Review

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Abstract

Background: To reduce harm caused by health care is a global priority. Medical students should be able to recognize unsafe conditions, systematically report errors and near misses, investigate and improve such systems with a thorough understanding of human fallibility, and disclose errors to patients. Incorporating the knowledge of how to do this into the medical student curriculum is an urgent necessity. This paper aims to systematically review patient safety education for undergraduate students in terms of its content, teaching strategies, talents and resources so as to provide evidence on how to promote patient safety curriculum for medical schools.

Methods: We searched MEDLIN, ERIC, Academic Source Premier(ASP), EMBASE and three Chinese Databases (Chinese Biomedical Literature Database, CBM; China National Knowledge Infrastructure, CNKI; Wangfang Data) from 1980 to Dec. 2009. The pre-specified form of inclusion and exclusion criteria was developed for literature screening. The quality of included studies was assessed using Darcy Reed and Gemma Flores-Mateo criteria. Two reviewers did the selection of studies, quality assessment, and data extraction independently. Different opinions were resolved by consensus or seek help from the third person.

Results: This was a description study. A total of seven studies met the selection criteria, and no relevant Chinese studies. Only one study included patient safety education in medical curriculum and the rest of studies integrated it into clinical rotation or medical clerkships. Seven studies were all pre and post study design of which only one study was controlled deigned. There was a great difference in their contents, teaching strategies and talents, resources and outcome evaluation across each study. The effects of patient safety curriculum on medical students’ knowledge, skills, and attitudes were different.

Conclusions: Overall, there are only a few relevant studies on patient safety undergraduate
education for medical schools, which have been implemented either as a selective course or a lecture or integrated into existing curriculum in developed countries. Patient safety education will be a big challenge to integrate it into existing medical education curriculum.

**Background**

Health care outcomes have significantly improved with the scientific discoveries of modern medicine. But we also know as a result of studies undertaken in many countries that alongside these benefits are significant risks to patient safety. An extensive literature has been published about the effect of adverse drug reactions and medication errors since the Harvard study in 1991 first described the extent of harm to patients, other countries have found similar results notwithstanding the difference in their cultures and health system(1-6). To change the culture of healthcare organizations, medical students should be able to recognize unsafe conditions, systematically report errors and near misses, investigate and improve such systems with a thorough understanding of human fallibility, and disclose errors to patients(7). They should be taught about human error and the factors influencing adverse events at the very beginning when entering medical schools(8). Incorporating the knowledge of how to do this into the medical student curriculum is an urgent necessity(9).

To help medical schools introduce and promote patient safety education, the World Health Organization (WHO) published a curriculum guide for teaching medical students about patient safety in 2009(9). The 11 topics were designed and its evaluation to test its objective was developed(10). Traditionally, curricula for medical students have focused on pure clinical skills: diagnosis of illness, treatment of disease, after-care and follow-up. However, team working, quality improvement, risk management and human factors have been overlooked(9). The new WHO guide will enable and encourage medical schools to
include patient safety in their courses.

To date, there are quite a number of countries have initiated or implemented patient safety education or training, especially pilot studies on the knowledge and attitudes of undergraduate medical students towards patient safety and medical error (7,8,12,15). Majority of these studies focused on the evaluation of before and after survey of patient safety education for medical students (7,8,11-15). On the other hand, some studies on patient safety education mostly focused on medical care providers especially residents and the nurses and had not paid much attention to medical undergraduate students training. With the growing recognition of that “medical errors were usually caused by failures of systems, not failures of individuals” (16), therefore patient safety education and training have a key role to play in achieving this goal that harm to patients is minimized, and more fundamental change is required within healthcare curricular, that is, a clear acknowledgement of the importance of creating a patient safety culture at the very beginning (17). There are a few countries and medical colleges followed the trend of patient safety education implemented the plan (7,8,11-15). Although a number of pilot survey studies published on patient safety education, no systematic review has been done in this field which is especially important before we promote its implementation. Therefore, it is needed to conduct this research aiming to systematically review studies on patient safety education curriculum for undergraduate medical students including its content, teaching strategies and talents, resources, and effects etc. so as to provide evidence on how to promote patient safety curriculum for medical schools.

Method

Inclusion and exclusion criteria

Studies were included if they satisfied all of the following criteria:

Study design: either randomized controlled or non-randomized studies including pre/post
or descriptive studies reporting the effects of patient safety curriculum/training on undergraduate medical students.

**Study subjects:** any studies if included undergraduate medical students.

**Interventions:** concepts, skills, and knowledge on patient safety were delivered in existing curriculum/training.

**Outcomes:** teaching strategies and talents, course design, duration, and evaluation on patient safety curriculum, improvement of knowledge, skill and attitude on patient safety reported or described by included studies.

Studies such as commentaries, review, theoretical and methodology analyses on patient safety were excluded.

**Literature searching**

We conducted a comprehensive literature searching including MEDLINE, ERIC, Academic Source Premier (ASP), EMBASE and three Chinese Databases (Chinese Biomedical Literature Database, CBM; China National Knowledge Infrastructure, CNKI; Wangfang Data). The searching time was from 1980 to 2009 and relevant reference lists of studies identified in the electronic searching were retrieved. The searching terms were the following: ‘medical errors’, ‘patient safety’, ‘medical education’, ‘curriculum’, ‘teach’, ‘medical student’, ‘undergraduate’ etc.

**Study selection**

Two reviewers independently selected studies initially based on title, key words and abstract of retrieved record. Studies that did not meet the inclusion criteria were discarded during the initial review. When uncertainty existed we retrieved and assessed the full text studies. Full-text studies were retrieved for further assessment if the information available Different opinions were resolved by discussion to reach consensus between the reviewers.
Quality assessment

Two reviewers independently assessed the quality of all included studies using the quality criteria by Gemma Flores-Mateo and Darcy Reed (18, 19) with 13 items. We added one item “is the course design assessed?” Items 1-6 for the completeness of study, items 7-12 for scientific quality, and items 13 and 14 for reliability and validity of evaluation instruments. We assessed each item as “Yes” (1 point) or “No” (0 point). Quality scores were calculated and classified as: poor quality (score < 6), moderate quality (score between 6 and 9), high quality (score between 10 and 14).

Data extraction

Two reviewers extracted data that met the inclusion criteria by using pre-specified extraction form independently mainly on the following information: study design, study subjects, teaching strategies and content, outcome measure etc.

Data analysis

Meta-analysis or pooled results was performed or calculated if data synthesis was possible, otherwise descriptive analysis was conducted.

Results

Study searching and selection(Figure 1)

We identified 1481 studies based on our initial searching. After applying the inclusion and exclusion criteria, a total of seven studies(7,8,11-15) were finally included.

Study characteristics (Table 1)

Table 1 presents some basic information mainly including study design, implementation year, and characteristics of learner and instructor, teaching content and strategy respectively. Most included studies were in USA, and most course implemented in grade 3 and the teaching talents were mixed with interdisciplinary professionals, including clinician, ethicists and medical education experts etc. Most course design was implemented
either as a selective course or in clinical rotation and internship training, which was not integrated into undergraduate medical education system formally; the duration of the course, contents and teaching strategies varied in each study. Most studies were per and post survey studies of which only one by Anderson 2009 was a controlled study (13). Three other studies reported the sources of questionnaire and conducted pre-tests (7,8,12).

**Quality assessment (Table 2)**

The quality of included studies was assessed using Darcy Reed and Gemma Flores-Mateo criteria (18, 19). The review found that the lowest score of study quality was 3, while the highest score was 10 (mean = 6.88). All studies met the first six items. But no study conducted power analysis to determine sample size or assessed the reliability of evaluation questionnaire. Four studies conducted evaluation on course design (7,8,11,13).

**Effects on medical students’ knowledge, skills, and attitudes on patient safety  （Table 3）**

Seven studies all reported the effects of patient safety curriculum on student’s knowledge, skills and attitudes, and the surveys were all performed by self-made questionnaire (7,8,11-15). Results were showed in Table 3 and summaries were described as the followings.

Patient safety knowledge were delivered including definition and content of medical error, rates and types of adverse events in healthcare, error classification, contributing factors to medical error, overview of mechanisms for learning from error etc. Six studies reported that patient safety knowledge were improved after course was given (7,8,11, 13-15).

Patient safety skills were trained including recognition of error, dealing with error, reporting and learning from error, supporting others involved in error etc. Six studies reported patient safety skills were improved after course was given(7,8,11, 13-15).
Students’ attitudes to patient safety were explored including focusing on cause rather than culprit, willing to learn from mistakes, being prepared to acknowledge and deal with error, being prepared to reflect on practice, trust and respect etc. Three studies evaluating attitudes towards patient safety all reported their attitudes were improved(7,12,15), One study demonstrated there was no change of attitudes after one year follow-up(8).

In addition, three studies evaluated long-term effects of the course(7,8,11). Four studies surveyed students the contents and teaching strategies, teaching resources and talents (7,8,11,13). Six studies obtained full ethical approval from Institutional Review Board and other Ethics Committees(7,8,11,13-15), two studies were funded by National Patient Safety Agency (8,13).

Discussion

Medical schools have begun to incorporate patient safety/medical errors content into their curricula, but to our knowledge, little has been published so far about these efforts. Although our recent initial literature searching including MEDLINE, Educational Resources Information Center, Academic Source Premier and EMBASE and CBM and CNKI has yielded a total of 1481 relevant studies, only a few studies meet our criteria and most of them are case reports or studies, and none of the studies were identified from China.

Patient safety in undergraduate education

The results indicate that patient safety curriculum are mostly implemented in developed countries in USA and UK, and most of them are optional courses or integrated into clinical internship or skill courses, which has not been implemented into undergraduate medical education system formally. On the other hand, the review shows that there is a great difference in its course design and contents, learners, teaching resources and talents, outcome evaluation etc. For example, 1) course design and content ranges from 4 to 30
hours(11,15) and none of studies systematically cover eight areas of patient safety knowledge. 2) teaching formats: there are eight kinds of educational formats in delivery of the curricula including interactive lectures/discussion, material readings, case-based discussions, seminars, small group discussions, role play, interdisciplinary team work, videotaped simulation with a standardized patient; 3) outcome evaluation: all included studies adopted a pre/post questionnaire evaluation strategy to measure whether there is an improvement in students’ patient safety knowledge, skills and attitudes, but no uniform criteria to evaluate their teaching effect. No study explicitly expounded which teaching material of patient safety education for undergraduate students was based on. 4) learners’ characteristics are also varied from Year 1 to 3.

In addition, the results have demonstrated that students’ knowledge, skills, and attitudes to patient safety have been improved with pre and post survey in most studies (7,11,14,15). The review also found that there is a better implementation on patient safety education in study with funding support (8,13) than those without funding.

**Quality of included studies**

There is no high quality study identified. Most included studies on teaching patient safety and medical fallibility issues are descriptive studies. So we use criteria developed by Gemma Flores-Mateo et al for quality assessment. Seven studies only meet the first six items of completeness of quality criteria, while other items are poorly met. As patient safety is a newly initiative movement or project for medical education, we assume that there will be growing more research with high quality of design in this field in future.

Currently many studies have focused on students’ knowledge, skills, and attitudes on patient safety (7,8,12,15), the results indicate that the majority of Year 1 medical students reported ‘medium low’ or ‘average’ levels of knowledge of error and patient safety issues, but they hope to learn patient safety knowledge, and skill. To improve patient safety, it is
not enough to just construct a system of medical quality assurance and continuous improvement and to build up a harmonious medical and patient safety culture environment. Addressing the issue from the fundamentals, namely, undergraduate medical education, is the most important step.

The implementation of patient safety education in medical schools should meet the local needs although WHO published a curriculum guide for teaching medical students about patient safety in 2009(9,10). E.g. in China, patient safety education can be delivered as selected or continuing education courses in different educational format including lectures, ward round-based teaching, small group learning, case-based discussions, role play, and incorporating into problem-based learning(20,21). Some basic knowledge should be integrated into traditional medical curriculum including using multimedia teaching format such as real-case-based discussion to teach students events and knowledge regarding patient safety in the first two years. While greater emphasis should be placed on skills training in the later years, such as interdisciplinary activities, professional mentoring, simulation by standardized patients, so that medical students could have a full understanding of their healthcare service role in real medical setting(22).

Finally, the key of patient safety education lies in prevention, not remedy, so the ideal educational strategy with regard to patient safety should be considered as an entire curriculum to teach students on how to prevent mistakes in clinical practice(11).

**Conclusion**

There is a significant difference in patient safety education for medical students regarding to course design, and contents, learners and outcome evaluation etc in the included studies. As a new multi-discipline knowledge, patient safety will be a big challenge for us to integrate it into existing medical education curriculum.
Competing interests

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article.

Authors’ contributions

MMZ and JL conceptualized and designed the study. LL, YRD, PXC and YLN acquired and analyzed with the support of MMZ. JL provided methodology support. MMZ, LL, YLN draft the manuscript. MMZ and JL revised it critically for important intellectual content and English proof. Barraclough BH provided expert suggestions and revised the manuscript. All authors approved the final manuscript for publication.

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References


Figure

Total (n = 1,481)

- Duplication-elimination (n=77)
- Non-English-language studies (n=9)

Review titles and abstracts=(n=1,395)

- Further duplication-elimination (n=99)
- Studies not related to patient safety (n=1214)
- Surveys of patient safety knowledge (n=17)
- Commentaries and letters (n=16)
- Teaching particular clinical procedure (n=15)
- Evaluating specific medical teaching methods (n=8)
- Testing the effectiveness of special teaching tools (n=6)

In-depth review of full-text (n=20)

- Evaluating specific teaching methods (n=5)
- Reviews (n=7)
- Meeting abstracts (n=3)

Final Included studies (n=7)

- Retrieved articles (n=2)

Figure 1 Flow Diagram for searching and selection processes
Additional files provided with this submission:

Additional file 1: 1.doc, 68K
http://www.biomedcentral.com/imedia/1617939927501382/supp1.doc
Additional file 2: 2.doc, 48K
http://www.biomedcentral.com/imedia/2483284350138243/supp2.doc
Additional file 3: 3.doc, 48K
http://www.biomedcentral.com/imedia/1546431750138244/supp3.doc