



UNIVERSITY OF ABERDEEN

WHO Patient Safety Curriculum Guide for Medical Schools

Evaluation Study

Report to WHO Patient Safety Programme

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EXECUTIVE SUMMARY

This report describes the development of a set of evaluation tools designed to accompany the World Health Organization (WHO) Patient Safety Curriculum Guide for Medical Schools. Secondly, it presents the results of the evaluation of the implementation of the Curriculum Guide in ten medical schools from nine countries across the world and all WHO regions. The WHO Patient Safety Curriculum Guide for Medical Schools was published in February 2009 and the evaluation study ran for 16 months from September 2009.

The study confirms that within 18 months of release, the Patient Safety Curriculum Guide for Medical Schools has been implemented in curricula across the world. Each of the 11 topics in the Curriculum Guide was taught by at least one of the participating medical schools during the study period. Faculty who participated in the study have confirmed that the Curriculum Guide was an important resource and helped them implement patient safety teaching in their curricula. Each school involved in this evaluation study has indicated that they plan to retain and further develop patient safety teaching as part of the core curriculum.

Students reported positive intentions and attitudes with regard to patient safety and that their knowledge of patient safety increased after the teaching. They were supportive of further integration of patient safety teaching in the medical undergraduate curriculum.

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1. INTRODUCTION

Landmark studies highlighting the prevalence of medical error and subsequent publications on patient safety within healthcare systems have resulted in widespread concern regarding the safety of patients receiving healthcare¹⁻⁴. One of the fundamental issues to be addressed is the proper education and training of healthcare professionals to enable them to perform effectively in the workplace whilst ensuring patient safety^{5,6}. Healthcare students should now be aware of the problem of patient safety, they should understand error and human factors science and they should acquire the knowledge and skills to improve patient safety³⁻⁶. It is acknowledged that patient safety science is unfamiliar territory for many medical educators^{7,8}. Curriculum developers and tutors may be unclear whether patient safety skills can be taught, be unfamiliar with patient safety science and furthermore be unsure how to integrate such teaching into the curriculum^{7,8}. This unfamiliarity represents a significant barrier for the timely, but major, curriculum changes being recommended. In 2008, the WHO Patient Safety Programme sponsored the development of the WHO Patient Safety Curriculum Guide for Medical Schools^{9,10}. This report outlines the evaluation of how this initial Curriculum Guide has been used to aid the implementation of patient safety teaching in the participating medical schools.

1.1 WHO Patient Safety Curriculum Guide for Medical Schools

The Patient Safety Programme published the WHO Patient Safety Curriculum Guide for Medical Schools in February 2009^{9,10}. The stated aims of the Curriculum Guide were to :

1. support patient safety education by creating and disseminating Curriculum resources worldwide, to facilitate training of medical students and prepare them for safe practice in the workplace;
2. provide a Curriculum Guide that can be easily adapted to suit the educational needs in patient safety of medical students and educators;
3. empower medical schools and universities to build capacity in teaching patient safety;
4. ensure the Curriculum Guide is at all times culturally sensitive to the needs of all countries and applicable to different health education systems;
5. raise awareness and engage commitment of the need for patient safety teaching and learning.

Ultimately, a Curriculum Guide should be applicable to all healthcare students, however in the first instance a pragmatic approach was taken: initially a Curriculum Guide addressing the educational needs for one profession, medicine, would be produced.

The Curriculum Guide was based on the Australian Patient Safety Education Framework which describes the knowledge, skills and behaviours required of all healthcare professionals for patient safety^{11,12}. This resource was used to identify the topic areas and competencies required of medical students. The development of the Curriculum Guide was undertaken by a team from the University of Sydney and Monash University. An International Expert Working Group with representatives from the six WHO regions commented and reviewed the content of the Curriculum Guide throughout its development.

The Curriculum Guide was designed to provide the foundation knowledge and skills in patient safety that would prepare medical students for safe clinical practice. It is organised into two parts^{9,10}. Part A is a teachers' guide, which provides practical advice on how to use the Curriculum Guide resources, (contained in Part B), advice on how to include patient safety teaching in existing university curricula, advice on skills development to teach patient safety and advice on how to evaluate and assess patient safety topics. Part B provides 11 'ready-to-teach' patient safety topics which can be integrated into an established curriculum. An overview of each topic is provided along with suggested teaching strategies; references for relevant tools and resources; sets of teaching slides; and suggestions for topic evaluation and student assessment. The Curriculum Guide was made available on-line in February 2009 and was downloaded over 1000 times during the first six months after release¹³.

1.2 Evaluation of the WHO Patient Safety Curriculum Guide for Medical Schools

As part of WHO normative functions, an evaluation study of the Patient Safety Curriculum Guide would be used to assess its effectiveness as a resource for teaching patient safety to undergraduate and graduate medical students. The feedback from this evaluation would be used to inform future editions of the Curriculum Guide and enhance the understanding of successful methods of introducing patient safety to curricula.

A team from the University of Aberdeen (which included members with experience in patient safety research and medical education) was commissioned by WHO to develop an evaluation strategy, along with a suite of evaluation tools designed to accompany the pilot testing activities of the Curriculum Guide. Subsequently, this group was asked to undertake a study

designed to evaluate the use of the Curriculum Guide in the implementation of patient safety teaching to the undergraduate medical curriculum in a sample of schools from the six WHO regions. The aims of this study were to assess (i) how the tutors judged that the Curriculum Guide assisted the implementation of patient safety teaching and (ii) the effect on a) student learning and b) student perceptions of introducing patient safety teaching from the Curriculum Guide.

This report describes the evaluation of the implementation of patient safety teaching topics from the WHO Patient Safety Curriculum Guide for Medical Schools in 12 medical schools in the first 16 months after its publication.

2. EVALUATION STUDY

2.1 Educational Evaluation

The systematic appraisal of the quality of teaching and effects on learning is known as educational evaluation¹⁴⁻¹⁶. This is an essential undertaking whenever there is educational innovation or change¹⁴⁻¹⁶. Such evaluation seeks to provide formative feedback that might inform improvement, and redesign if required, of the content and / or the delivery of the curriculum. During the process of evaluation, consideration should be given to the drivers for implementation, the process of implementation and delivery, and also the product (outcomes) of the implementation¹⁷. A range of evaluation methods can be used in order to describe and explain different components of interest: identifying where teaching or resources can be improved; or judging the effectiveness of student learning and changes in behaviour^{14,15}. The methods should be designed to address the issues in question.

2.2 WHO Patient Safety Curriculum Guide for Medical Schools: strategy for evaluation

The first step for the study group was to develop a strategy for the evaluation of the Curriculum Guide implementation. In the development of the WHO Patient Safety Curriculum Guide for Medical Schools, consideration had been given not only to the breadth of knowledge, skills and behaviours required of medical graduates, but also how to aid the introduction of patient safety education in medical schools across the world. To achieve this, the Curriculum Guide had to be usable over a wide range of different ethnic, cultural and economic backgrounds in universities which employ a range of curricular structures and learning modalities. Therefore, to be able to explore the utility of the Curriculum Guide across

such a wide constituency, efforts were made to ensure that a diverse range of medical schools from the six WHO regions (Africa, the Americas, Eastern Mediterranean, Europe, South East Asia and Western Pacific) would be recruited to the evaluation study.

Implementing curriculum change may challenge and result in change to existing methods of teaching and sources of knowledge⁹. Whilst explicit “Patient Safety” teaching has appeared in medical school curricula in recent years, the Curriculum Guide includes topic areas such as Human Factors, Quality Improvement which may be unfamiliar to curriculum managers and medical educators^{7,8}.

The curriculum intervention resulting from the WHO Patient Safety Curriculum Guide for Medical Schools is inherently complex as it is built from a number of components, which may act both independently and inter-dependently^{17,18}. Medical schools employ a range of curricular structures and learning modalities and when introducing new patient safety materials into the curriculum, tutors would necessarily introduce different topics at different times. Given the complexity, scope and range of this implementation project, it was recognised that the evaluation would have to take place across a wide range of student experience, diverse teaching and learning styles and different levels of resource. Thus a variety of evaluation tools, available in several formats for administration, were required for students and tutors to provide a rich stream of both quantitative and qualitative data.

In order to learn from evaluation, it is important to consider not just the results of a new curricular intervention, but also to consider the intricate process required in changing the curriculum. Understanding context is crucial when assessing whether the effective introduction of the WHO Patient Safety Curriculum Guide for Medical Schools in one setting might be transferable to another setting, given the likely variability in curriculum design and pedagogic approaches amongst other variables¹⁹. The context in which the Curriculum Guide was applied, and evaluated, must be described, so that individual Medical Schools can determine the relevance of the results to their own situation. For these reasons, we felt that careful consideration had to be given to the implementation context and process during the evaluation study.

Although many individuals and groups could be considered to be interested and / or affected by curriculum change (e.g. faculty not involved in the patient safety teaching, patients and relatives) the focus of this evaluation study was to assess the usefulness and usability of the Curriculum Guide. The key stakeholders in this case would be the tutors who were asked to develop and deliver teaching on the patient safety materials and the students who would learn from these interventions. Therefore the study would only focus on these two groups. Evaluation tools were designed to answer two key questions:

- 1. *Can the WHO Patient Safety Curriculum Guide for Medical Schools be used to support the implementation of explicit patient safety education to medical students across the six WHO regions?***
- 2. *What is the impact of the inclusion of patient safety teaching to the curriculum on medical student learning, and what are the student views on the implementation of this material to their curriculum?***

3. METHOD

3.1 Evaluation tools

The next step was to develop a suite of evaluation tools (see Appendices 2 and 3 for details of the tools) and to determine when they would best be administered (see Table 1 and Table 2 for detail on the timing of administration for each of the 13 tutor and 13 student evaluation tools). Medical school curriculum evaluation has not always been influenced and guided by theory¹⁴. In this study, attempts were made to draw on a relevant theoretical basis where possible (see below). It was hoped that this would provide a better understanding of the possible barriers and facilitators to implementation. The evaluation would take place in a wide range of universities with a range of resources and employing a range of curricular structures and methods of evaluation. The evaluation tools would ideally be easy to administer and then return the data to the study team by local university staff. Questionnaires which are commonly used throughout educational institutions and therefore familiar to both staff and students were considered to be the most practical and reliable method of data collection and were designed for all areas of interest. However to enhance the collection of qualitative data, there were options made available for schools to run focus groups for tutors or for students, In addition an on-line discussion forum was developed where students or tutors could communicate their thoughts on patient safety teaching and learning with peers from their own or other schools participating in the study.

Feedback was to be also gathered from tutors in the first year of implementing the teaching material from the Curriculum Guide in order for the educators' experience to be shared with others. Questionnaires were developed to gather this feedback after the tutors had taught each topic and then at the end of the study period, with an option of participating in a focus group. It was felt that this gathering of qualitative data (from free text questions in the various questionnaires or in focus groups) would facilitate a richer exploration of medical educators' use of the Curriculum Guide and would identify relevant issues and concepts. The aim was to identify the factors which are seen as most important by educators and to help gain a deeper

understanding of differences relating to geographical area or medical school which would also be key to developing tailored interventions to meet local need.

Where possible, evaluation tools were developed to give some indication of the impact of the patient safety teaching on the students beyond the end of the academic session. Long term follow up would not be possible due to the 15 month timeframe of the study and the challenges of following students and assessing changes in their behaviours across many countries and knowing how this related to particular teaching. Azjen's Theory of Planned Behaviour was used where appropriate in the design of before and after questionnaires for the Patient Safety topics, in order to evaluate behavioural intentions²⁰. This theory states that behaviour is driven by intention, and that intention is influenced by attitudes, subjective norms and perceived behavioural control. His model has been used in an educational context to measure student intentions following teaching as a proxy measure of actual behaviour in the clinical environment once qualified²⁰.

The evaluation tools were designed as follows (see Table 1 for timing of questionnaire completion):

1. Can the WHO Patient Safety Curriculum Guide for Medical Schools be used to support the implementation of explicit patient safety education across the six WHO regions?

- A questionnaire was designed to gather from the project leads in each participating school the background demographic information about the participating universities, the medical schools' curriculum structure, and their plans for inclusion of topics from the WHO Patient Safety Curriculum Guide for Medical Schools during the study period.
- A questionnaire (the Tutor Immediate Evaluation questionnaire) to assess the views of tutors soon after the experience of teaching topic(s) from the WHO Patient Safety Curriculum Guide for Medical Schools (this questionnaire was to be completed for each topic taught).
- A guide was provided for a focus group, which could be run by local tutors at the end of the implementation study period where several tutors had been involved in delivery of patient safety teaching. This was intended to gather information on tutor views on the appropriateness of the patient safety topic(s), process of implementation and usefulness of curricular supporting materials²¹⁻²³.
- Where it was not possible for participants to facilitate a Tutor focus group at their medical school, a further tutor questionnaire was used (Faculty Questionnaire).

Table 1: Tutor evaluation tools

Focus of evaluation tool	Evaluation tool	Timing of administration
Topic 1: What is patient safety?	Post topic questionnaire designed to evaluate the tutors' views on the topic implementation and their own learning	Immediately after the topic completion
Topic 2: What is human factors and why is it so important to patient safety?	Post topic questionnaire designed to evaluate the tutors' views on the topic implementation and their own learning	Immediately after the topic completion
Topic 3: Understanding systems and the impact of complexity on patient care	Post topic questionnaire designed to evaluate the tutors' views on the topic implementation and their own learning	Immediately after the topic completion
Topic 4: Being an effective team player	Post topic questionnaire designed to evaluate the tutors' views on the topic implementation and their own learning	Immediately after the topic completion
Topic 5: Understanding and learning from errors	Post topic questionnaire designed to evaluate the tutors' views on the topic implementation and their own learning	Immediately after the topic completion
Topic 6: Understanding and managing clinical risk	Post topic questionnaire designed to evaluate the tutors' views on the topic implementation and their own learning	Immediately after the topic completion
Topic 7: Introduction to quality improvement methods	Post topic questionnaire designed to evaluate the tutors' views on the topic implementation and their own learning	Immediately after the topic completion
Topic 8: Engaging with patients and carers	Post topic questionnaire designed to evaluate the tutors' views on the topic implementation and their own learning	Immediately after the topic completion
Topic 9: Minimizing infection through improved infection control	Post topic questionnaire designed to evaluate the tutors' views on the topic implementation and their own learning	Immediately after the topic completion
Topic 10: Patient safety and invasive procedures	Post topic questionnaire designed to evaluate the tutors' views on the topic implementation and their own learning	Immediately after the topic completion
Topic 11: Improving medication safety	Post topic questionnaire designed to evaluate the tutors' views on the topic implementation and their own learning	Immediately after the topic completion
Faculty questionnaire	Questionnaire evaluating tutors' reflection of patient safety teaching overall	After the completion of all patient safety teaching
Focus groups materials	Focus group to evaluate the reflection on patient safety teaching overall	After the completion of all patient safety teaching

2. What is the impact of the inclusion of patient safety teaching to the curriculum on student learning, and what are the students' views on the implementation of this material to the curriculum?

- Review of the content of topic 1 'What is patient safety?' by the evaluation team suggested that the patient safety student learning could be evaluated using a questionnaire previously designed and validated by the study team²⁴. This questionnaire would be administered immediately before and approximately one – two months after completion of the patient safety teaching in order to assess the students' self ratings of patient safety knowledge, their attitudes and intentions with respect to patient safety and whether this changed following the curriculum change. The content and layout of the before and after topic questionnaires were identical.
- Review of the content of topic 5 'Understanding and learning from errors' by the evaluation team suggested that student learning on this module could be evaluated using a questionnaire (similar to the questionnaire used for Topic 1 but with two additional sections) previously designed and validated by the study team²⁵. This questionnaire would be administered immediately before and approximately one – two months after completion of the patient safety teaching to assess the students' self ratings of patient safety knowledge and their attitudes and intentions with respect to patient safety and whether these had changed following the curriculum intervention. The content and layout of the before and after topic questionnaires for administration were identical.
- Review of topics 6, 9, 10 and 11 indicated that clinical scenarios could be written which would allow the assessment of students' behavioural intentions for clinical practice with reference to the specific topic content. These questionnaires were to be completed immediately before and then around one – two months after completion of the patient safety topic teaching to allow evaluation of any change in the students' cognitions following the course.
- Review of patient safety topics 2,3,4,7 and 8 indicated that clinical scenarios suitable for the assessment of students' behavioural intentions for clinical practice would not be possible. Therefore a questionnaire was developed to assess the views of students immediately after working on these patient safety curricular guide topics (see Table 2).
- A guide for a focus group for students, which could be run towards the end of the implementation study period, was designed to gather information on student views of learning about patient safety²¹⁻²³. Where a focus group was not possible, then the

student assessment of patient safety implementation questionnaire could be administered.

- A student evaluation of patient safety implementation questionnaire was designed to explore and gather information on the students' reflections of their experience of the patient safety teaching some time after teaching; this was designed to be delivered towards the end of the evaluation study period.

Table 2: Student evaluation tools

Focus of evaluation tool	Evaluation tool	Timing of administration
Topic 1: What is patient safety?	Pre and post topic questionnaires evaluating students self ratings of knowledge about patient safety in healthcare, attitudes and intentions	Immediately before and 1 – 2 months after the topic completion
Topic 2: What is human factors and why is it so important to patient safety?	Post topic questionnaire evaluating student reaction to teaching	Immediately after the topic completion
Topic 3: Understanding systems and the impact of complexity on patient care	Post topic questionnaire evaluating student reaction to teaching	Immediately after the topic completion
Topic 4: Being an effective team player	Post topic questionnaire evaluating student reaction to teaching	Immediately after the topic completion
Topic 5: Understanding and learning from errors	Pre and post topic questionnaires evaluating students self ratings of knowledge about error in healthcare, attitudes and intentions	Immediately before and 1 – 2 months after the topic completion
Topic 6: Understanding and managing clinical risk	Post topic questionnaire evaluating student reaction to teaching	Immediately after the topic completion
Topic 7: Introduction to quality improvement methods	Post topic questionnaire evaluating student reaction to teaching	Immediately after the topic completion
Topic 8: Engaging with patients and carers	Post topic questionnaire evaluating student reaction to teaching	Immediately after the topic completion
Topic 9: Minimizing infection through improved infection control	Pre and post topic questionnaires evaluating students' behavioural intentions with reference to this topic	Immediately before and 1 – 2 months after the topic completion
Topic 10: Patient safety and invasive procedures	Pre and post topic questionnaires evaluating students' behavioural intentions with reference to this topic	Immediately before and 1 – 2 months after the topic completion
Topic 11: Improving medication safety	Pre and post topic questionnaires evaluating students' behavioural	Immediately before and 1 – 2 months after the

	intentions with reference to this topic	topic completion
Student Evaluation of Implementation questionnaire	Questionnaire evaluating reflection of patient safety teaching overall. Designed to be completed if a focus group was not possible.	After the completion of all patient safety teaching
Focus group materials	Focus group to evaluate the students' views on patient safety teaching overall	After the completion of all patient safety teaching

It is important to note that extensive testing and validation of most of the evaluation tools was not possible in the time available from the release of the WHO Patient Safety Curriculum Guide for Medical Schools February 2009 to the start of the evaluation study in September 2009. However, the questionnaires used for Topic 1 'What is Patient Safety' and Topic 5 'Understanding and learning from errors' had both been previously developed and tested by the research team^{24,25}.

A website hosted by the University of Aberdeen was designed to accompany the evaluation tools. The evaluation tools were all available for download by the participating schools from this website. Schools were given the option of administering the various questionnaires by paper to students and tutors, or they could ask the participants to complete the questionnaires on-line by means of the website. Background information and instructions for completion of the evaluation tools were also available for download from the website.

The evaluation tools and the evaluation study plan were then submitted to the WHO secretariat to be sent for external review. Advice from the review panel prompted the development of a discussion board option in the website to allow participants from the different medical schools to discuss patient safety and their learning. Three areas were included in the discussion board. Firstly, separate sections for tutors and for students allowed discussion in a topic by topic form. Participants could also add topics if they wished. The third section, accessible by both the students and / or tutors, was for discussion of patient safety or the Curriculum Guide in general.

The external reviewers also advised that students should be invited to give permission for contact at a later date after completion of the study. This would provide an option for long term follow up of these students to further assess the impact of the patient safety teaching. Postcards were produced and offered to participating medical schools for distribution to students. The students were asked to provide a contact email address for future contact and then to return the postcard to their tutors who would forward these to the research team.

3.2 Data Analysis

The evaluation tools were analysed as follows:

Tutor data

Simple descriptive statistics were used to analyse the quantitative elements of the Tutor Immediate Evaluation questionnaire and Faculty Questionnaire. As numbers were small, non-parametric statistics were used and no formal comparative analysis was undertaken. Qualitative data from these, the focus groups and interviews with lead tutors was analysed using content analysis, where open responses were categorised into themes and these themes reported. Focus group data was summarized at the participating school and a written summary returned. Lead tutor interviews were taped, transcribed verbatim and anonymised²⁶. Analysis was data-driven. Two researchers carried out initial independent analyses, then met to compare, contrast and negotiate themes.

Student data

Again descriptive statistics were used to analyse the quantitative elements of the student questionnaires for topics 2, 3, 4, 7 and 8. Here parametric statistics were used due to sample sizes.

Topics 1, 5 used questionnaires, which had been previously developed and used. Descriptive statistics and paired *t*-tests were calculated in order to test if there were significant differences in the mean scores between schools and then between the two cohorts of students for each schools (i.e. before and after the topic had been taught). The level of significance was set at $p < 0.05$.

Topics 6, 9, 10 and 11 were questionnaires which were designed for the study using short clinical scenarios and questions based on TPB. Guidance on both questionnaire design and analysis was taken from "Constructing Questionnaires Based On The Theory Of Planned Behaviour: A Manual For Health Services Researchers" by Francis et al²⁷. Scales were calculated from student responses, based on the constructs described in the Azjen's theory of Planned Behaviour. Some sub-constructs were not appropriate for some of the scenarios and therefore were not included. The mean scores for each scale were then compared before and after the teaching using ANOVA. Statistical significance was taken as $p < 0.05$. If two scenarios were used (to gather data on two aspects of teaching) these were analysed separately. Data was analysed by school as data for topics 6, 10 and 11 were only available from one school. Topic 9 was taught by 3 schools and was analysed by school, however no significant differences were seen and therefore this is presented as aggregate data.

Summarised data from student focus groups was returned from one school. This qualitative data was analysed as described above for the qualitative data from tutors.

3.3 Evaluation Study Procedure

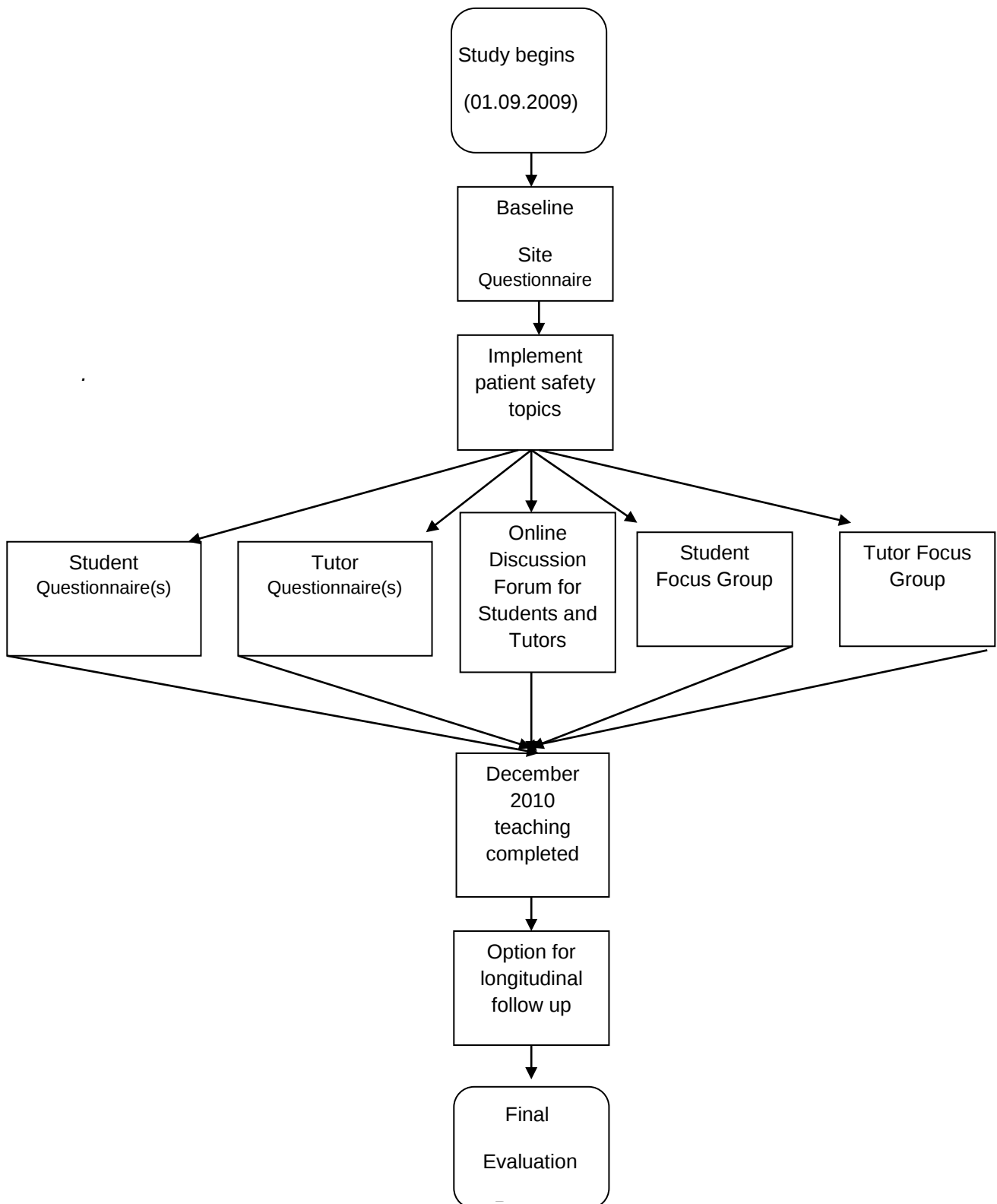
Following the external peer review process which considered the evaluation strategy, evaluation tools and research protocol, approval was obtained from the WHO Ethics Review Committee on 20th August 2009. Medical schools were recruited by the WHO Patient Safety Programme. Each school identified a lead contact person for the implementation study and contact was then made by the evaluation team. At least one school was to be recruited from each of the six WHO regions (see Table 3).

Participating schools were asked to confirm institutional ethics approval for their participation in the evaluation study. To be eligible to participate in the study, it was necessary for the schools to confirm that it would be possible for the students to complete the evaluation tools in English, as there were not facilities for translation into a range of languages. Each school was asked to provide baseline details (see Table 3) about their school (i.e. class size; undergraduate postgraduate or mixed student entry) and to implement and evaluate a minimum of four patient safety topics during a one year study period. The baseline details were gathered by the WHO Patient Safety Programme during the recruitment process by email and telephone communications. These details would be helpful for those assessing the relevance of findings from the evaluation study to their situation. Topic 1: 'What is patient safety?' was to be taught by all, but schools were at liberty to pick the three additional topics. Schools were also asked to complete one or more of the qualitative evaluation tools designed to assess student and tutor reflections on the impact and experience of the curricular interventions at the end of the year (focus group, student / tutor implementation questionnaire or participate in the on-line discussion board) (see Figure 1 below).

The on-line website facility allowed each questionnaire to be downloaded or completed online. A guide to the administration and completion of the evaluation tools and guides for running a focus group (with question guides for the student and tutor versions of the focus group) was provided for the lead contact in each participating school and further copies could be downloaded from this website. Alternatively the specific evaluation tools being used by each school could be sent by email, or paper copies of questionnaires could be provided on request to the WHO Programme. Schools chose themselves the format that they used to complete the evaluation of each topic according to local resources (i.e. paper based completion or on-line completion; focus group(s) or completion of questionnaire at the end of the study period). Contact was maintained by email and telephone between the WHO Programme, the evaluation study team in Aberdeen and the project leads in each school to clarify any questions about evaluation tool completion and return of the data. The timescale

and budget did not permit any onsite visits to be made by the research team to the participating sites to review the evaluation study processes and thus enhance the consistency of data collection.

Figure 1: Flowchart of evaluation study



3.4 Recruitment

Schools in the six WHO regions were recruited to the study. Although 13 schools were initially recruited (see Table 3) only 10 were able to both introduce patient safety teaching and submit evaluation data during the 15 month study period. The 10 schools came from nine different countries. Although all schools enrolling in the study are acknowledged at this stage of this report, each school has been randomly allocated a number and will only be referred to by this number thereafter to ensure anonymity of results as agreed in the ethics submission process.

The class (year) size of the medical schools returning data ranged from around 40 – 240 students. Two of the schools were new medical schools, one with postgraduate entry and the other with undergraduate entry. Other participating schools were either undergraduate or mixed entry. One of the schools was undergoing a major curriculum review at the time of the evaluation study. Patient safety topics were taught at all stages of the curriculum from first year to final year.

Table 3: Participating medical schools

WHO Region	Schools	School type	Class size	Study participation
AFRO	Gondar University, Ethiopia	Undergraduate entry, established curriculum	~ 80 students / year	Returned evaluation data
AFRO	University	Undergraduate entry, established curriculum	Not known	Unable to complete evaluation during study period - withdrawn
AFRO	University	Undergraduate entry, established curriculum	~ 40 students / year	Unable to complete evaluation during study period - withdrawn
AFRO	Mekelle University, Ethiopia	Undergraduate entry, established curriculum	~ 40 students / year	Returned evaluation data
AMRO / PAHO	University of Central Florida	Graduate entry, New medical school	~ 41 students / year	Returned evaluation data
AMRO / PAHO	Del Salvador University, Buenos Aires, Argentina	Undergraduate entry, established curriculum	~ 60 students / year	Returned evaluation data
AMRO / PAHO	University	Graduate entry, established curriculum	Not known	Unable to complete curriculum implementation during evaluation period - withdrawn

EMRO	King Saud bin Abdulaziz University for Health Sciences, Riyadh, Kingdom of Saudi Arabia	Graduate entry, established curriculum	~ 40 students / year	Returned evaluation data
EURO	University of Aberdeen, UK	Mixed entry, established curriculum	~ 180 students / year	Returned evaluation data
EURO	Sackler Medical School, Tel Aviv University, Israel	Graduate entry, established curriculum	~ 40 students / year	Returned evaluation data
SEARO	The Patan Academy of Health Sciences, Kathmandu, Nepal	Undergraduate entry, new medical school	~ 50 students / year	Returned evaluation data
SEARO	Maulana Azad Medical College (MAMC), New Dehli, India	Undergraduate entry, established curriculum	~ 180 students / year	Returned evaluation data
WPRO	The Sydney Medical School, University of Sydney, Australia	Graduate entry, established curriculum	~ 240 students / year	Returned evaluation data

4. RESULTS

4.1 Implementation of patient safety topics to curricula

Five of the 10 schools returning data were able to implement and perform the evaluation process for the initially requested four or more topics. All 11 patient safety topics were taught and student evaluation data returned from at least one school. Although all schools had agreed to include Topic 1, 'What is patient safety?' during the study period, only eight schools were able to submit evaluation data on this topic (see Table 4).

Table 4: Number of schools who taught and returned evaluation for each patient safety topic

Patient safety topic	No. schools returning data	No. pre-topic questionnaires returned	Estimated response rate*	No. post-topic questionnaires returned	Estimated response rate*
What is patient safety?	8	449	51%	315	36%
What is human factors and why is it	5	No pre-topic questionnaire	n/a	322	56%

important to patient safety?					
Understanding systems and the impact of complexity on patient care	1	No pre-topic questionnaire	n/a	26	65%
Being an effective team player	2	No pre-topic questionnaire	n/a	134	47%
Understanding and learning from errors	2	341	62%	163	30%
Understanding and managing clinical risk	1	159	88%	143	79%
Introduction to quality improvement methods	2	No pre-topic questionnaire	n/a	85	30%
Engaging with patients and carers	2	No pre-topic questionnaire	n/a	259	50%
Minimizing infection through improved infection control	3	93	33%	73	26%
Patient safety and invasive procedures	1	24	60%	24	60%
Improving medication safety	1	37	61%	32	53%

* These response rates were only estimated as the research team had no access to information on rates of student absence for the teaching sessions or how many students decided not to participate in the evaluation and therefore did not complete a questionnaire. The estimated response rates were calculated based on the numbers of students that each medical school reported they enrolled for each year of the course and the number of questionnaires that were correctly completed and returned.

4.2 Results from tutors – introducing patient safety teaching into curricula

The Faculty Questionnaires were completed from only one of the schools regarding the WHO Patient Safety Curriculum Guide for Medical Schools (reviewing the implementation of patient safety teaching in their school overall) and from four schools for individual Patient Safety topics. As this represents a very small sample, these results must be interpreted with caution.

Patient Safety Curriculum Guide - Faculty Questionnaire

Five tutors from one school completed the faculty questionnaire which focused on the tutor views of the patient safety curriculum as detailed in the Curriculum Guide and their teaching experience overall.

The mean time of the five tutors' experience of teaching medical students, in any setting, was 3.6 years (range of 2-4) (SD 0.894). Most of them had prior knowledge of the topics that they were teaching (as can be seen in Table 5 below). Three out of the five respondents had previously taught on courses focusing on patient safety. Three of the tutors had been recruited to teach on the course through an invitation from the head professor of paediatrics, one tutor taught as part of their role of chief of residents and the remaining tutor had been selected by the university Dean. All respondents were involved in teaching the topic to fifth year students. In a free text comment, one respondent added *"I think that it could be very useful to start teaching from the first year of the student career"*.

Table 5: Prior Knowledge of Patient Safety Topics (tutors)

Patient safety topics	No/minimal prior knowledge of the topic (no. responding)	Prior knowledge of the topic (no. responding)	Total (no. responding)
Topic1: What is patient safety?	1	4	5
Topic 2: What is human factors and why is it important to patient safety?	1	4	5
Topic 3: Understanding systems and the impact of complexity on patient care.	1	3	4
Topic 4: Being an effective team player.	0	4	4
Topic 5: Understanding and learning from errors.	0	4	4
Topic 6: Understanding and managing clinical risk.	0	4	4
Topic 7: Introduction to quality improvement methods.	0	4	4
Topic 8: Engaging with patients and carers.	1	2	3
Topic 9: Minimizing infection through improved infection control.	0	5	5
Topic 10: Patient safety and invasive procedures.	0	4	4
Topic 11: Improving medication safety.	0	3	3

A number of questions were asked about tutor training and support to deliver the teaching (see Table 6). The majority of the five tutors received specific training prior to delivering the teaching (n = 4). This was in the form of classes/discussion groups that included other teaching staff/team leader. One respondent would have liked more intensive training for the teaching.

All five of these tutors used the Curriculum Guide and found it useful in their teaching preparations. One tutor used additional slides (from the web) to supplement the materials provided in the Curriculum Guide. Answers to open questions about the guide highlighted the usefulness in how to teach the topics (e.g. *“particularly in sense of giving the lines to reach the goal”*). One respondent added that *‘the learning strategies fits with the settings selected: delivery-room, rooming-in, out-patients offices.’*

All five tutors were positive about student engagement, appropriateness of content to local context and time available to teach the content. They did not find the content difficult to teach (all found it easy [2] on a scale of 1 - 5 (1 very easy, 5 very hard)).

Table 6: Training and support to deliver patient safety teaching

Questions	Yes (no. responding)	No (no. responding)
Did you receive specific training in order to deliver Patient Safety teaching?	4	1
Did you use the WHO Teachers Guide in your preparation for teaching patient safety	5	0
Did you find the WHO Curriculum Guide useful in your preparation for this topic?	5	0
Did you use any of the other materials or references provided in the Curriculum Guide for your teaching of this topic?	1	4
Did the students seem to engage with the material?	5	0
In your opinion, was the content appropriate to your local healthcare setting?	5	0
Did you find any of the content difficult to teach?	0	5
Was enough time provided to teach the patient safety topics?	5	0
Would you change anything about the content or delivery of the topics you were involved with?	0	5

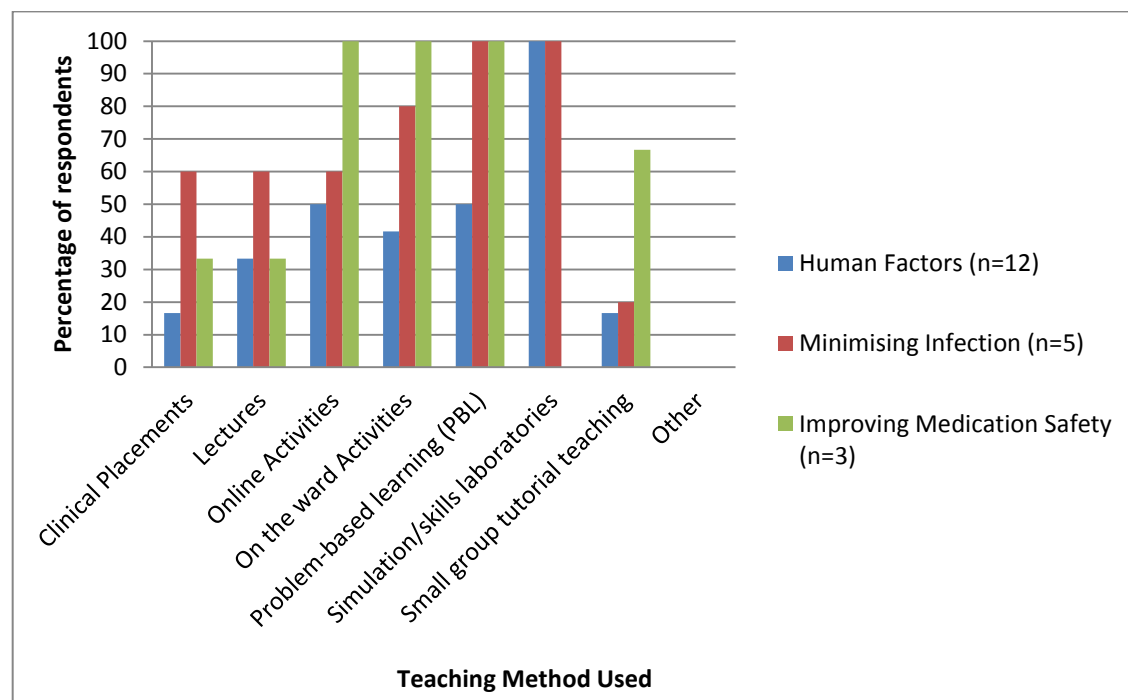
Individual patient safety topics tutor questionnaires

Questionnaires about specific topics taught were completed by several tutors from four schools. One of these was a combined response between tutors at one school (n = 7) and therefore pooled responses are used where individual responses have not been given. Responses were received on the following topics:

- Topic 2: What is human factors and why is it important to patient safety? (n = 12)
- Topic 9: Minimizing infection through improved infection control (n = 5, of which, one pooled response from 7 tutors)
- Topic 11: Improving medication safety (n = 3)

A variety of teaching methods were employed for each topic and these can be seen in Figure 2 below.

Figure 2: Teaching methods used to deliver topics



Responses from the standard set of questions can be seen in Table 7 below (Tutor Evaluation).

Table 7 - Tutor Evaluation on individual patient safety topics

Question	Topic 2: Human Factors (n=12)	Topic 9: Minimizing Infection (n=11)	Topic 11: Improving Medication Safety (n=3)
	Median (IQR)*	Median (IQR)*	Median (IQR)*
The content of the topic was new learning for me.	2 (2-3)	2 (1-2)	3 (1-4)
I had to spend a large amount of time preparing for this teaching.	3 (3-3)	2 (1-4)	4 (2-4)
I disagree with many of the facts, concepts and principles within the topic.	1 (1-2)	2(2-2)	2 (2-2)
I am likely to use some of the topic content in other teaching I do.	4 (4-4.75)	5 (4-5)	5 (4-5)
I am likely to incorporate some of the topic content into my own clinical practice (please leave blank if you have no clinical commitment).	4 (4-4); n = 9	5 (4.5-5) ; n = 9	5(5-5); n = 2
The students engaged well with the subject matter.	5 (4-5)	5 (4-5)	5 (5-5)
The mode of delivery was appropriate for the topic.	4 (4-4)	5 (4-5)	3 (3-4)
The time allocated to the topic was appropriate.	4 (4-4)	4 (3-5)	3 (3-4)
The positioning of the topic within our undergraduate curriculum was appropriate.	4 (2.25-4)	3 (2-4)	4 (4-5)

* 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5= strongly agree

Topic 2: What is human factors and why is it important to patient safety?

Of 12 respondents, seven had not taught the human factors topic before and five had taught this specific topic once or twice. Four of the tutors had taught other Patient Safety topics previously. More detailed questions about the topic can be seen in Table 7 above. In addition, five respondents added free text comments/suggestions (see Text Box 1 below). These were

around timing of the teaching (making it earlier in the curriculum), the online discussion (one of the teaching techniques) and the importance of the topic.

Text Box 1: Comments/suggestions for Topic 2, 'What is Human Factors and why is it important to patient safety?'

"I think it would have been useful earlier in final year so the students could see what they learnt in practice before graduating."
"I thought that the online discussion was a bit sterile and some students needed prompting +++"
"It's very important that people could understand how much adverse events or damage can be reduced, paying attention to the 'HUMAN FACTORS'."
"There was limited involvement by few students with the on-line article. Many students did not post any comments."
"Topic would work best at the beginning of final year I think with the various activities done throughout the year. I enjoyed the discussion with the students in the final group session and found this stimulating."

Topic 9: Minimizing Infection through improved infection control

There were four individual responses and details of seven in the joint response (n = 11 tutors). Four out of eleven had never taught this specific topic before, one had taught this specific topic once or twice, and six had taught the topic three or more times before. Four out of eleven tutors had been involved in teaching other Patient Safety topics previously. More detailed questions about the topic can be seen in Table 7 above. In addition, five free text comments were made (three from two participants in the pooled report). Three respondents added free text comments/suggestions around the importance of the topic e.g. *"Lessons learned from adverse events because of errors during control infection diseases, are extremely important to transmit"*. The other comments were around timing in the curriculum, coordination and the amount of time required for the best approach e.g. *"Teaching of this topic requires active participation of teaching faculty of microbiology, Medicine, Surgery, Anaesthesia etc; hence coordination is difficult..."* *"Small group teaching would be the best approach, but would require more time"*.

Topic 11: Improving Medication Safety

All three tutors involved in delivering the Improving Medication Safety topic had taught the material at least once or twice and all had taught other patient safety topics previously. More detailed questions about the topic can be seen in Table 7. One respondent added the

following comment *“To teach the students not to use their memory, to use all the time medication guidelines”*.

Views from Lead Tutors for Implementation – interview data

Three lead tutors responsible for the implementation of Patient Safety teaching from the medical schools chose to participate in a semi structured interview rather than completing the tutor implementation questionnaire (due to logistical issues, two were interviewed by telephone).

Overall, the interviews revealed similar positive attitudes about teaching patient safety and the Curriculum Guide materials to those reported in the tutor questionnaires. For example, Respondent Two referred to the order of the topics in the Curriculum Guide as being *“intuitive”* and Respondent One thought that the supporting materials *“teach teachers how to teach”*. Even with the range of examples and case studies included in the materials (seen as positive), participants advised that it was important to make the teaching materials context/culturally specific (e.g. with examples from their own experience), thereby *“making their own”*.

In terms of implementing the new teaching into existing medical curricula, interviewees highlighted the need for the medical school to be positive towards including new teaching. Only one medical school already had some form of Patient Safety in the curriculum and for those schools where Patient Safety was new, the critical step was determining *who* was going to lead and deliver the teaching. The right people were those with *“personal drive”* and who had already endorsed the need to teach Patient Safety e.g., *“people committed to the message and patient safety concepts”* (Respondent Three). However, this could be *“challenging because some people might think that that it doesn’t have anything to do with them”* (Respondent Two). Respondent One spoke about the need to develop champions/create role models in each specialty so patient safety teaching could flourish across the medical curriculum. Support from specialists not normally involved in the teaching of medical students was helpful for teaching some topics (e.g. risk managers and human factors experts). Human factors was noted by two of the Lead Tutors interviewed to be particularly challenging to train their tutors to facilitate the teaching. They thought that this was due to the tutors having no prior familiarity with this subject. One lead tutor reported having sought support from local human factors experts in introducing this topic and a second lead tutor spoke of plans to elicit similar support for teaching this topic a second time e.g. *“human factors....I believe that this is a very important issue, I need a psychologist to really really get profit from this issue”* (Respondent two). The third Lead Tutor who was interviewed talked of plans to get support from the university human factors scientists to help with preparation for teaching this topic in the forthcoming year. The recent experience of the research team indicates that this is also the case in the UK where medical school faculty leads have

approached Human Factors experts to provide training the trainers courses prior to introduction of this teaching to the curriculum.

Getting the timing right

In agreement with some of the questionnaire free text comments (see Text Box 1, above) interviewees mentioned the importance of timing and the challenges this can raise when introducing new teaching. Early introduction of Patient Safety was viewed as important as was integrating patient safety teaching within the wider curriculum. Even with the provision of materials, participants mentioned the time required to incorporate the patient safety teaching into the degree/to implement change and 'keep it moving'.

Discussion board

The discussion board was not used by tutors during the study period, although one tutor reported that it would be helpful to have a forum where ideas about teaching and assessing patient safety could be exchanged with others, particularly where topics were unfamiliar.

Tutor results - summary

Responses were only available from a small number of tutors from five of the participating medical schools. Overall the tutors were generally positive about both their experience of implementing patient safety teaching and the support provided by the Curriculum Guide. They highlighted the benefits of the teaching how to teach nature of the guide, the example case studies and the suggestions for ways of delivering patient safety teaching.

The tutors used a wide range of teaching techniques in the delivery of the patient safety topics and supported the integration of patient safety teaching across the whole curriculum. Even with the resource of the Curriculum Guide, the tutors highlighted the importance of sufficient time for overcoming the challenges of gaining local support, identifying and training suitable tutors and developing teaching materials for the local context.

4.3 Results from students – implementing patient safety teaching into curricula

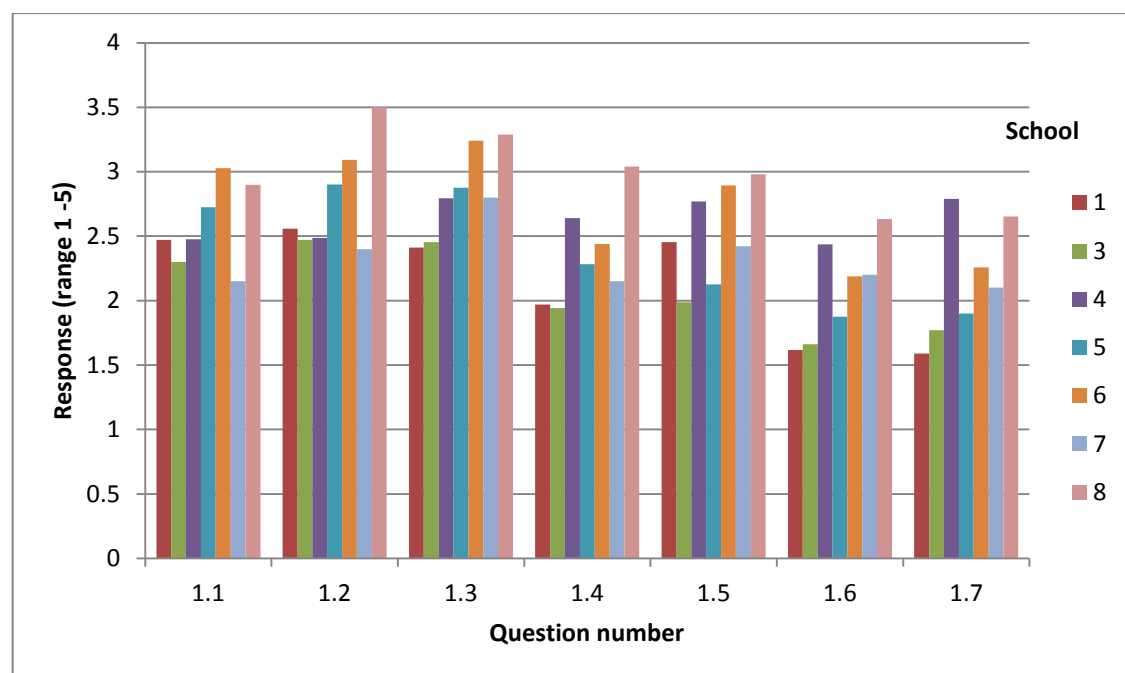
This section of the report outlines the results from medical students on a) their learning from the patient safety teaching and b) their perceptions of the teaching. Where change is being measured (i.e. the topics where before and after questionnaires were administered) the level of significance was set at $p < 0.05$.

4.3.1 Topic 1: What is patient safety?

Eight schools returned evaluation data for Topic 1 'What is patient safety?'. The topic was taught at various different stages of the curriculum: year 1 (n = 432, 56% of total), year 2 (n = 113; 15% of total) and year 5 (n = 219, 29% of total). Figure 4 illustrates the aggregated data from all student responses (n = 764) to the evaluation questionnaire for Topic 1. Students completed the questionnaire twice: once shortly before their teaching began and then again several weeks after completion of the teaching. Descriptive statistics and *t*-tests were calculated in order to test if there were significant differences in the mean scores between the cohorts of students before and after teaching.

Section one of the questionnaire (items 1.1 – 1.7) asked students for their views on their levels of knowledge of error and patient safety concepts (e.g. level of knowledge about different types of error; factors contributing to patient safety; how to report an error). For each question in this section there was a low level of knowledge reported by the students before the patient safety teaching. The students' perception of their initial level of knowledge of patient safety did vary between the school cohorts (see Figure 3 below). However, significantly increased levels of knowledge of error and patient safety were reported after the topic teaching from each of the participating schools who returned before and after questionnaires (see Figure 4).

Figure 3: Topic 1, mean (n=764) before ratings from each school (scale 1-5) for questionnaire section one



Section two of the questionnaire asked about students' views of the safety of their healthcare system (items 2.1 – 2.6). The results are more varied in this section. When students completing this section are considered as one group, their levels of agreement show that they think error and adverse events are common, and that most healthcare workers make errors. This agreement increased significantly after the teaching. Students tended to disagree with the item 'it is very unusual for patients to be given the wrong drug'. There was a significant increase in their level of disagreement with the statement after the teaching. The student responses indicate that they are predominantly neutral to the item 'In my country there is a safe system of healthcare for patients' and there was only mild agreement with the item 'healthcare staff receive training'. There was no significant change in either of these two items after teaching.

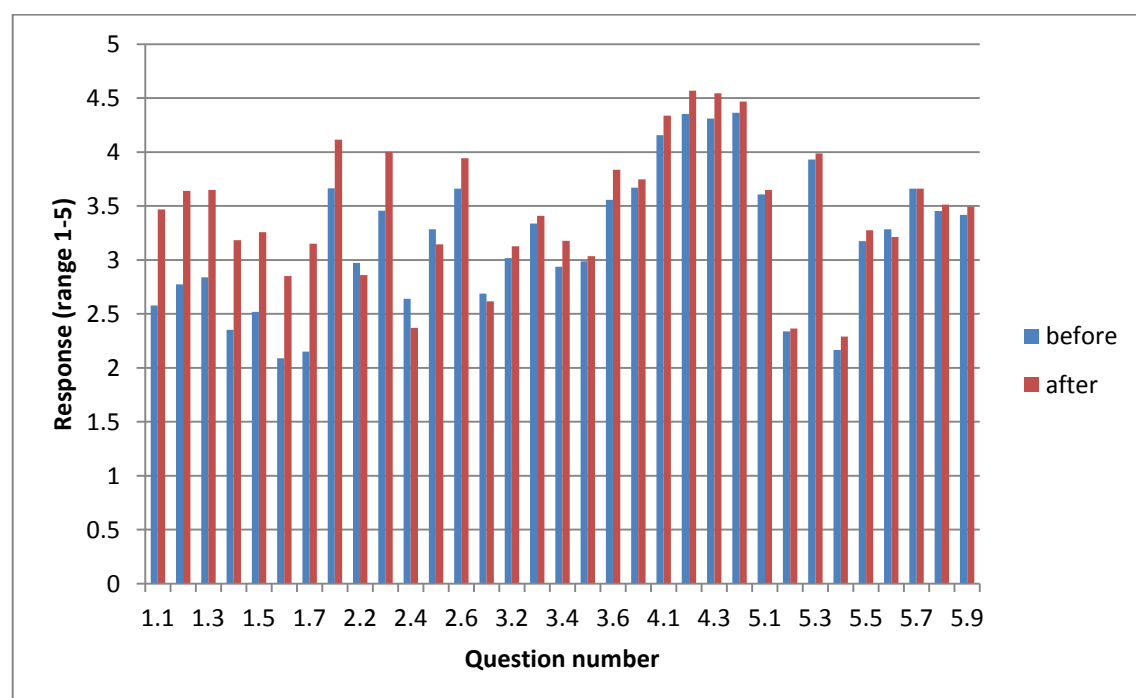
Section three investigates views on personal influence over safety (items 3.1 – 3.7). The responses suggest that students believe it would be difficult to tell others if they had made an error and that they have neutral views on the statement that 'it is easier to find someone to blame rather than focus on the cause of an error'. There was no significant change in responses to these items after the teaching. For the next five items in this section there was significant change after teaching. Students reported that they have only limited confidence in speaking to someone who is showing a lack of concern for a patient's safety both before and after teaching, however there was a statistically significant increase in the level of agreement to this item after the topic had been taught. Whereas students indicated that they did not believe that they 'know how to talk to people who make an error' or to 'ensure that patient safety is not compromised' before the patient safety teaching, they reported mild agreement with these statements afterwards and this change was statistically significant. There was limited agreement before the teaching, but a significant increase after the teaching, for the item 'I believe that filling in reporting forms will improve patient safety'. The final item in this section was 'I am able to talk about my own errors'. Contrary to the responses to item 3.1 the responses indicate agreement with this statement which increased significantly after the teaching.

The fourth section deals with personal attitudes to patient safety (items 4.1 – 4.4). Student responses in this section indicate positive attitudes to patient safety. This agreement increased significantly for the statements in items 4.1, 4.2 and 4.4 ('by concentrating on the causes of incidents I can contribute to patient safety'; 'if I keep learning from my mistakes, I can prevent incidents'; 'it is important for me to learn how best to acknowledge and deal with my errors by the end of medical school'). The level of agreement was strongly positive for item 4.3 ('acknowledging and dealing with my errors will be an important part of my job') and although this agreement increased after the topic teaching this was not significant.

Section five focuses on safety in the workplace (items 5.1 – 5.9). The results from this section show the least change following teaching with significant increase in agreement to only one

item (5.4). Responses indicated that students expect to be criticised for their mistakes by both nurses (item 5.2) and doctors (item 5.4). There was no significant change in this view with regard to nurses but after the teaching the results indicate that there was less expectation that doctors will criticise the students for their mistakes. Despite these expectations of criticism, the students showed mild agreement with the statements 'Being open and honest about the mistakes I make will be acceptable at my place of work' and 'Admitting an error I had made would lead to just and fair treatment by management'.

Figure 4: Topic 1, mean before and after ratings for each question for all schools



4.3.2 Topic 2: What is human factors and why is it important to patient safety?

This topic was taught in five of the participating schools during the study period and 322 questionnaires were completed and returned. This topic was evaluated with a questionnaire asking for students' views on the teaching immediately after the topic teaching (see table 8 below). The topic was taught to year 1 (n=12), year 2 (n=203) and year 5 students (n=107).

Table 8: Summary of responses to questionnaire evaluating student views after Topic 2: 'What is Human Factors and why is it important for patient safety?'

Question	School 1 (n=35) Mean (SD)*	School 3 (n=72) Mean (SD)*	School 4 (n=12) Mean (SD)*	School 8 (n=179) Mean (SD)*	School 9 (n=24) Mean (SD)*	All schools (n=322) Mean (SD)*
The aims of this patient safety topic were clear to me	3.94 (0.80)	3.75 (0.72)	3.75 (0.75)	3.91 (0.96)	3.58 (0.83)	3.85 (0.88)
This patient safety topic dealt with knowledge/skills I need to learn	3.89 (0.71)	3.72 (0.87)	4.08 (0.28)	4.15 (0.84)	3.71 (0.85)	3.99 (0.84)
I have improved my knowledge/skills as a result of this topic	3.85 (0.61)	3.28 (0.94)	3.83 (0.71)	3.96 (0.90)	3.63 (0.77)	3.77 (0.91)
I acquired new knowledge/skills that will be of value during my career	4.17 (0.61)	3.60 (0.95)	3.83 (0.83)	3.93 (0.90)	3.67 (0.56)	3.86 (0.88)
The teaching aids added to the session	3.64 (0.49)	3.44 (0.81)	4.09 (0.53)	4.24 (0.85)	3.48 (0.99)	3.95 (0.89)
I found the style of teaching in this topic facilitated my learning	3.74 (0.65)	3.43 (0.85)	3.75 (0.75)	4.29 (0.83)	3.78 (0.90)	3.98 (0.90)
The instructors facilitated my understanding	4.11 (0.53)	3.88 (0.74)	3.58 (0.51)	4.37 (0.82)	3.65 (1.15)	4.15 (0.84)
The time devoted to the topic was sufficient	3.31 (0.71)	3.67 (0.94)	3.17 (0.71)	4.13 (0.81)	3.79 (1.14)	3.88 (0.91)
This stage in the overall curriculum is an appropriate time for this particular topic	3.32 (0.76)	2.76 (1.05)	3.58 (0.90)	3.79 (0.96)	3.25 (0.98)	3.46 (1.05)

*5 = strongly agree, 4= agree, 3= neutral, 2 = disagree, 1 = strongly disagree

The students' responses indicate that they viewed this topic positively overall and that there was a high level of agreement that the instructors facilitated their understanding. The levels of agreement were lower for the item 'This stage in the overall curriculum is an appropriate time

for this topic'. This is influenced by one school, where the teaching occurred towards the end of the final year of the curriculum. Free text comments from this group indicated that students would value the teaching earlier in the curriculum.

4.3.3 Topic 3: Understanding systems and the impact of complexity on patient care

This topic was evaluated with a questionnaire asking for students' views immediately after the topic teaching (see Table 9). Evaluation data (n = 26) were returned by only one of the pilot schools where it was taught to year 2 students. The responses to the inclusion of this topic in the curriculum were positive overall, however there were wide standard deviations suggesting diverse student opinion. Overall there was some agreement that the aims of the topic were clear, that the topic dealt with knowledge and skills that were appropriate for their learning, these had improved after the teaching and that this would be valuable. However the views across the student group were wide ranging from positive to negative. The small number of questionnaires returned limits the conclusions that can be drawn for this topic.

Table 9: Summary of responses to questionnaire evaluating student views after Topic 3: 'Understanding systems and the impact of complexity on patient care.'

Question	Mean (SD)*
The aims of this patient safety topic were clear to me	3.65 (0.94)
This patient safety topic dealt with knowledge/skills I need to learn	3.69 (0.93)
I have improved my knowledge/skills as a result of this topic	3.50 (1.18)
I acquired new knowledge/skills that will be of value during my career	3.81 (1.06)
The teaching aids added to the session	3.77 (1.03)
I found the style of teaching in this topic facilitated my learning	3.88 (0.91)
The instructors facilitated my understanding	3.50 (1.18)
The time devoted to the topic was sufficient	4.31 (0.93)
This stage in the overall curriculum is an appropriate time for this particular topic	3.81 (1.30)

*5 = strongly agree, 4= agree, 3= neutral, 2 = disagree, 1 = strongly disagree

4.3.4 Topic 4: Being an effective team player

A total of 134 student evaluation questionnaires were returned from two of the participating schools for this topic. The topic was taught in Year 2. Again wide standard deviations suggested a range of student opinions (see Table 10). This may be reflected in the less strongly positive agreement with statements. Some differences were seen between cohorts that may indicate local variation.

Table 10: Summary of responses to questionnaire evaluating student views after Topic 4: 'Being an effective team player.'

Question	School 8 Mean (SD)*	School 9 Mean (SD)*	All Mean (SD)*
The aims of this patient safety topic were clear to me	3.55 (SD 1.09)	3.44 (0.98)	3.54 (1.07)
This patient safety topic dealt with knowledge/skills I need to learn	3.54 (1.06)	3.67 (0.97)	3.56 (1.05)
I have improved my knowledge/skills as a result of this topic	2.97 (1.11)	3.56 (1.04)	3.04 (1.12)
I acquired new knowledge/skills that will be of value during my career	3.03 (1.18)	3.22 (1.66)	3.05 (1.18)
The teaching aids added to the session	3.53 (1.26)	3.35 (0.93)	3.51 (1.23)
I found the style of teaching in this topic facilitated my learning	3.35 (1.19)	3.56 (1.04)	3.38 (1.18)
The instructors facilitated my understanding	3.51 (1.14)	3.53 (1.12)	3.51 (1.14)
The time devoted to the topic was sufficient	3.88 (1.05)	4.11 (1.13)	3.91 (1.06)
This stage in the overall curriculum is an appropriate time for this particular topic	3.56 (1.03)	3.39 (1.14)	3.54 (1.05)

*5 = strongly agree, 4= agree, 3= neutral, 2 = disagree, 1 = strongly disagree

4.3.5 Topic 5: Understanding and learning from errors.

Five schools returned data for this topic (see Table 11). A handful of responses came from students in Years 1 and 2 who were taught this topic (n=15) but the majority came from Year 3 (n=104) and Year 5 (n=385). Descriptive statistics and *t*-tests were calculated in order to test if there were significant differences in the mean scores between the before and after student cohorts.

Table 11: Stage of curriculum and number of questionnaires returned for Topic 5: understanding and learning from errors

School	Year topic taught	Number of questionnaires returned
2	Year 2	12
3	Year 5	337
4	Year 1	3
8	Year 3	104
10	Year 5	48

The first section in the questionnaire (items 1.1 – 1.7) asked students for their views on their level of knowledge regarding error in healthcare. There was a significant increase in the level of knowledge reported after the topic teaching for each item in this section (see Figure 5 below).

Section two deals with knowledge of actions to take where there is an error (items 2.1 – 2.6). Again there were significant increases of agreement for each item after the teaching, indicating that the students' perception of their own level of knowledge of actions to take related to error increased after the teaching.

The results from section three (personal influence over safety) also indicated significant differences after the teaching. This was seen in each of the seven items suggesting that there was an increase in the students' perception of their ability to influence safety after the teaching had taken place.

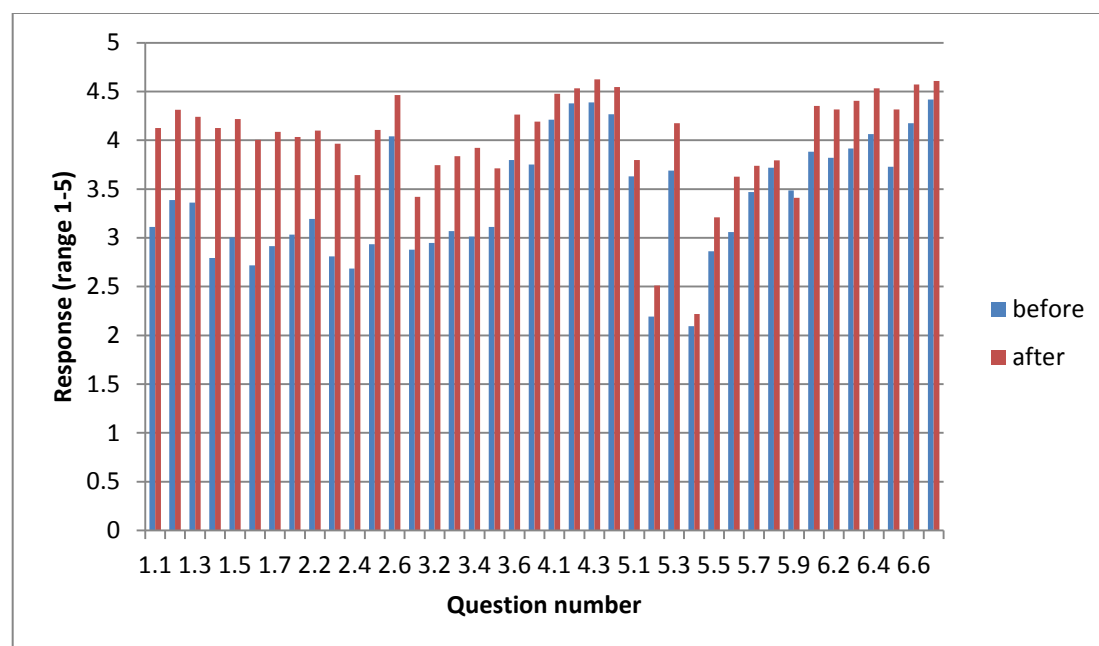
Section four dealt with personal attitudes to patient safety. The results indicate the students' positive attitudes to patient safety which increased significantly for three of the items. There was no significant change in the response to item 4.4 (it is important for me to learn how best to acknowledge and deal with my errors by the end of medical school). However this may be due to the high agreement with this statement before the teaching.

The fifth section of the questionnaire focused on student views of safety at the workplace. Results were more mixed in this section, showing significant changes in questions 5.1, 5.3, 5.4, and 5.7. However, for questions 5.2, 5.5, 5.8 and 5.9 there were no significant differences. Students disagreed with the Item 5.2 ('the nurses will not criticise me for making mistakes') and for item 5.4 ('the doctors will not criticise me for making mistakes'). Although students still tended to disagree with both of these statements after the teaching there was a significant reduction in the disagreement with respect to doctors. Students' views of management were varied with mild disagreement to item 5.5 ('managers in the healthcare

system will make it easy to report errors’) and only mild agreement to item 5.9 (‘admitting an error I had made would lead to just and fair treatment by management’). The responses indicated more agreement with statements reflecting their perceptions of management expectations of their performance e.g. 5.6 (‘managers in the healthcare system will be more interested in meeting performance targets than in patient safety’) and 5.7 (‘managers in the healthcare system will expect us to focus on patient safety’).

In the sixth and final section (‘intentions regarding patient safety’), the responses indicate that students had positive intentions with regard to patient safety both before and after the teaching. This significantly increased for all items except for item 6.7 (‘I plan to learn from the mistakes of others’). However, the level of agreement with this item was already high prior to teaching (mean response 4.4, SD 0.706).

Figure 5: Graph 3, Aggregate before and after student questionnaire data for Topic 5



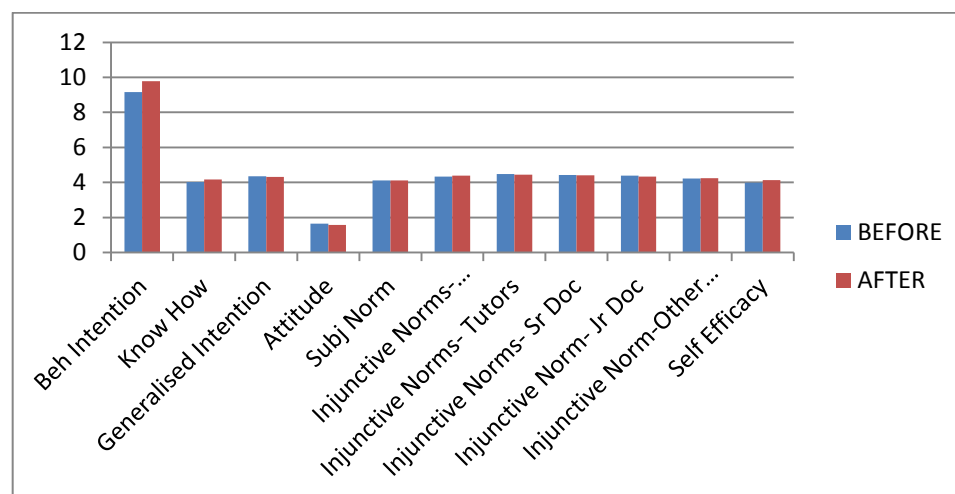
4.3.6 Topic 6: Understanding and managing clinical risk.

Topic 6 was evaluated with questionnaires which utilised the theory of planned behaviour. The four components of the theory of planned behaviour (intention, attitude, subjective norm and perceived behavioural control) were assessed before and after teaching. Two clinical scenarios directly related to the topic learning outcomes were described in the questionnaire followed by questions addressing the four components of theory of planned behaviour relating to each scenario. The questionnaire was administered immediately before and again several weeks after the teaching.

Data were returned from one school where the teaching occurred in Year 5 of the curriculum. 302 questionnaires were completed and returned; 159 before and 143 after the teaching.

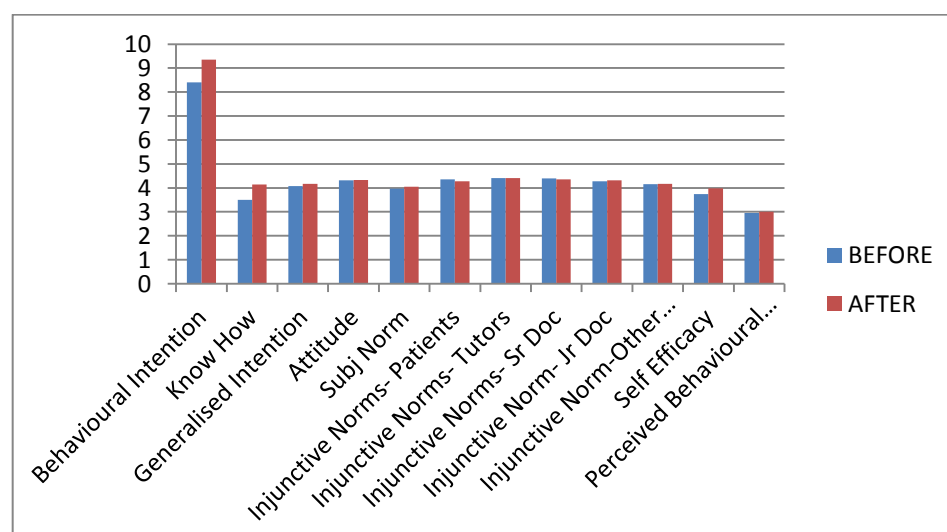
For the first scenario, measures of intention showed significant change after teaching although no other measures changed (see Figure 6 below). However, pre-teaching intentions were high which may explain the lack of an increase in the other components.

Figure 6: Topic 6, scenario one: before and after results for each component (n.b. intention is measured on a scale of 1-10; all other components are measured on a scale of 1-5)



In the second scenario (which dealt with reporting a critical incident), increases in intention, 'know how' and self-efficacy were seen suggesting that students felt more able to communicate about and report a critical incident following the teaching (see Figure 7 below).

Figure 7: Topic 6, scenario two: before and after results for each component (n.b. intention is measured on a scale of 1-10; all other components are measured on a scale of 1-5)



4.3.7 Topic 7: Introduction to quality improvement methods.

A total of 85 questionnaires were returned from two of the participating schools. The topic was taught in year 2 and year 3. Student views generally were positive. Although there were some differences between the two schools (see Table 12) these were not significant.

Table 12: Summary of responses to questionnaire evaluating student views after Topic 7: 'Introduction to quality improvement methods.'

Question	School 8 (n=69) Mean (SD)*	School 9 (n=16) Mean (SD)*	All schools (n=85) Mean (SD)*
The aims of this patient safety topic were clear to me	3.80 (1.03)	4.00 (0.81)	3.84 (1.00)
This patient safety topic dealt with knowledge/skills I need to learn	3.70 (0.84)	3.81 (0.91)	3.72 (0.85)
I have improved my knowledge/skills as a result of this topic	3.75 (0.86)	3.94 (0.92)	3.79 (0.87)
I acquired new knowledge/skills that will be of value during my career	3.71 (0.83)	4.12 (1.08)	3.79 (0.89)
The teaching aids added to the session	3.84 (0.83)	3.81 (1.04)	3.83 (0.87)
I found the style of teaching in this topic facilitated my learning	3.77 (0.89)	3.88 (0.88)	3.79 (0.88)
The instructors facilitated my understanding	3.96 (0.83)	3.87 (1.18)	3.94 (0.90)
The time devoted to the topic was sufficient	3.80 (1.07)	4.00 (1.12)	3.84 (1.10)
This stage in the overall curriculum is an appropriate time for this particular topic	3.94 (0.82)	3.75 (1.23)	3.90 (0.91)

*5 = strongly agree, 4= agree, 3= neutral, 2 = disagree, 1 = strongly disagree

4.3.8 Topic 8: Engaging with patients and carers

A total of 259 questionnaires were returned from two of the participating schools for this topic. The topic was taught in year 2 (n = 167) and year 3 (n = 92). The student views were mildly positive in both schools. Although the views were more strongly positive in School 9 this was not significant, the number of questionnaires returned was small and the range of responses wide (see Table 13).

Table 13: Summary of responses to questionnaire evaluating student views after Topic 8: 'Engaging with patients and carers.'

Question	School 8 (n= 242) Mean (SD)*	School 9 (n=17) Mean (SD)*	All schools (n=259) Mean (SD)*
The aims of this patient safety topic were clear to me	3.56 (1.01)	4.00 (0.70)	3.59 (1.00)
This patient safety topic dealt with knowledge/skills I need to learn	3.71 (0.91)	3.88 (0.78)	3.73 (0.90)
I have improved my knowledge/skills as a result of this topic	3.39 (1.01)	3.76 (1.03)	3.41 (1.02)
I acquired new knowledge/skills that will be of value during my career	3.37 (0.96)	3.71 (1.04)	3.39 (0.97)
The teaching aids added to the session	3.46 (1.04)	3.67 (1.04)	3.47 (1.04)
I found the style of teaching in this topic facilitated my learning	3.54 (1.03)	3.24 (1.03)	3.52 (1.03)
The instructors facilitated my understanding	3.65 (0.97)	3.69 (0.94)	3.65 (0.97)
The time devoted to the topic was sufficient	3.74 (0.87)	3.50 (1.09)	3.73 (0.89)
This stage in the overall curriculum is an appropriate time for this particular topic	3.70 (0.97)	3.56 (1.09)	3.69 (0.98)

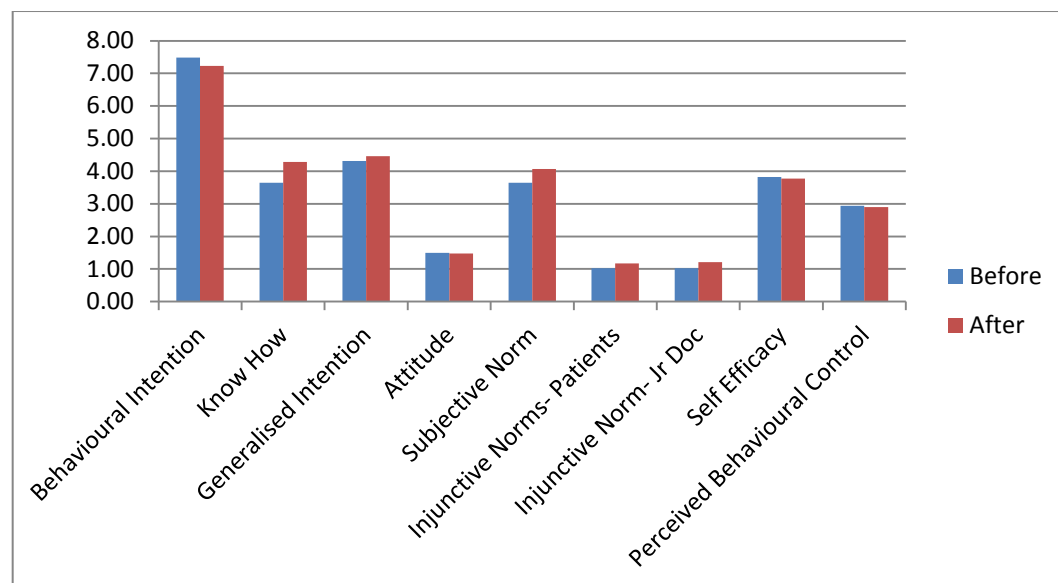
*5 = strongly agree, 4= agree, 3= neutral, 2 = disagree, 1 = strongly disagree

4.3.9 Topic 9: Minimizing infection through improved infection control.

Topic 9 was also evaluated with questionnaires which utilised the theory of planned behaviour. 166 completed questionnaires were returned by 3 schools (before n = 93; after n = 73). The topic was taught in Year 1 (n = 36), Year 2 (n = 21) and Year 5 (n = 36) of the curriculum.

Measures of intention showed no significant change after teaching, however the specific item of "knowing how" to perform appropriate actions did increase suggesting an effect of teaching on knowledge (see Figure 8). Attitude showed some improvement after teaching, as did subjective norm. The self-efficacy element of perceived behavioural control also increased. This suggests that teaching may have had an influence on beliefs which should strengthen intention, but intention did not change. However, pre-teaching intentions were high which may explain the lack of an increase. The lower control beliefs, which did not change, suggest that although students feel able to act, they do not feel that they are in control of whether or not to act.

Figure 8: Topic 9, before and after results for each component (n.b. intention is measured on a scale of 1-10; all other components are measured on a scale of 1-5)

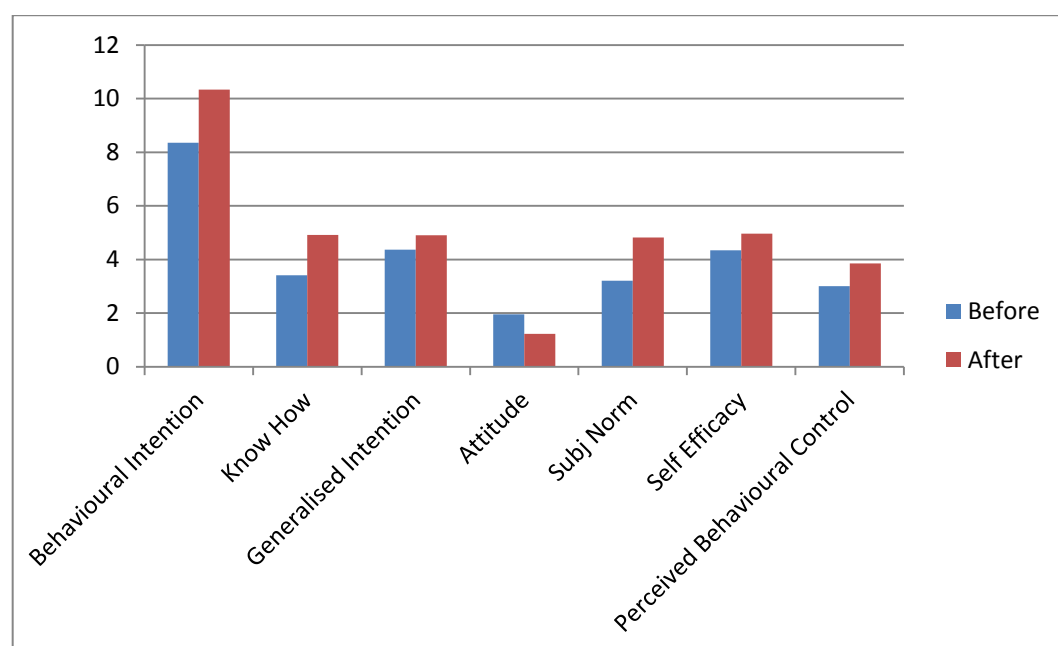


4.3.10 Topic 10: Patient safety and invasive procedures.

Topic 10 was evaluated in a similar way to topic 9. 48 questionnaires were returned from one school where the topic was taught in year 5 of the curriculum.

Statistically significant changes were observed in all measures suggesting teaching had a positive effect despite intentions scoring highly prior to teaching (see Figure 9).

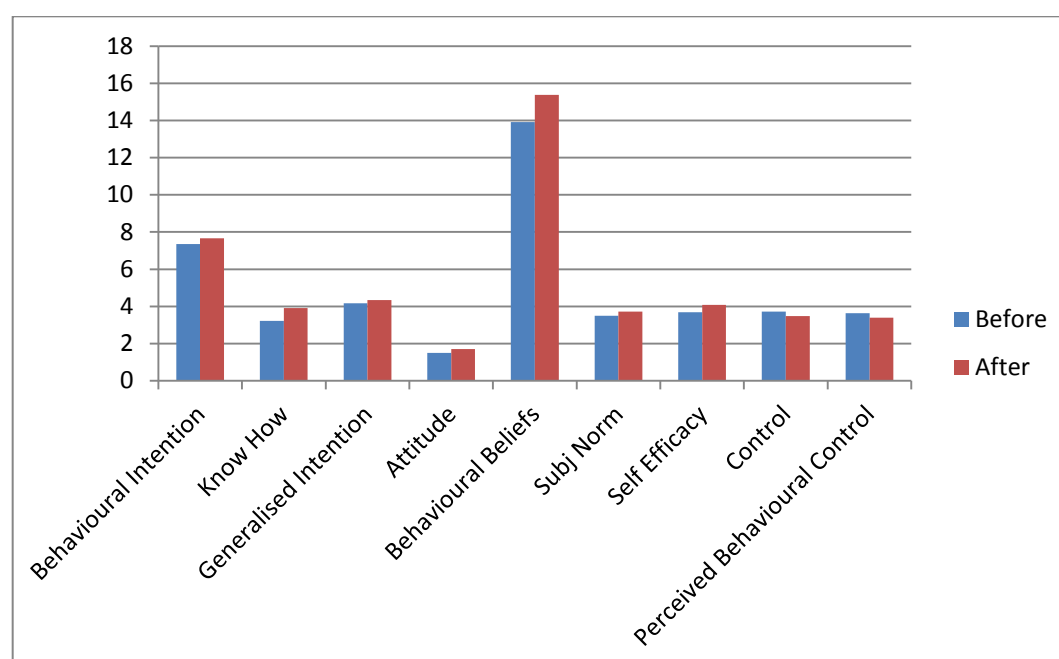
Figure 9: Topic 10, before and after results for each component (n.b. intention is measured on a scale of 1-10; all other components are measured on a scale of 1-5)



4.3.11 Topic 11: Improving medication safety.

Topic 11 was also evaluated in a similar way to topic 9. 69 questionnaires were returned from one school in which the topic was taught in Year 5. No statistically significant changes were observed in all measures except self-efficacy suggesting that teaching had minimal effect (see Figure 10). This may be because intention is already strong. The issues around perceived behaviour control are likely to be similar to topic 9 and reflect students' perceived lack of control over situations.

Figure 10: Topic 11, before and after results for each component (n.b. intention is measured on a scale of 1-10; all other components are measured on a scale of 1-18)



Student evaluation of implementation questionnaire

No data were returned for this questionnaire. The goal of the questionnaire was to gather the views of students towards the end of the student period who were able to express their views on the patient safety teaching they had experienced some months later.

Student focus group

Summarised data from a student focus group were returned from one school. The focus group was run with a group of six Year 5 students who had experienced teaching which covered four of the patient safety topics. This was the first time they had been taught about patient safety.

The students commented on their changed perceptions of the workplace since the patient safety teaching. They commented on frequently observations of clinical staff not complying

with hand hygiene policies. The students had observed staff members attending appropriate infection control training but still not following best practice. They considered that one underlying reason for this was pressure of work. The students also discussed their observations of the many verbal patient care orders given in emergency settings with limited documentation. They felt that this could also compromise patient safety.

Overall the students in the focus group agreed that safety should be included throughout the medical school curriculum, that such teaching was important for their future practice, and that although it was easy to learn about safety in theory that it was more difficult to put into practice and so this was only the beginning of their learning.

Discussion board and postcards for longer term follow up

The discussion board was not used by students during the study period and only a small number of postcards were returned from one school.

Student results - summary

Questionnaires were returned for each of the individual patient safety topics. The response rate ranged from 26% to 88%, although the number of responses from some topics was very small and they were only taught in one school.

Topic 1 was taught by eight schools. The data suggests that the level of knowledge before teaching varied across the schools, but there was a significant increase in knowledge reported by students in all schools after the teaching. This increase in the level of knowledge reported after teaching was echoed in the results from several of the topics (e.g. Topic 2 'What is human factors and why is it important for patient safety', Topic 5 'Understanding and learning from errors', Topic 9 'Minimizing infection through improved infection control'). Students reported positive attitudes and intentions to patient safety across all schools in the questionnaires evaluating many of the topics. This was echoed in the student focus group data evaluating the patient safety teaching experienced by these students overall. These students also commented on their changed perceptions in the workplace following the teaching.

5. DISCUSSION

It is impressive that within 18 months of release, the WHO Patient Safety Curriculum Guide for Medical Schools has been implemented in curricula across the world. Each school involved in this evaluation study has indicated that they plan to retain and further develop patient safety teaching as part of the core curriculum.

5.1 WHO Patient Safety Curriculum Guide for Medical Schools

The Curriculum Guide was produced with the aim of facilitating more rapid introduction of patient safety teaching to the undergraduate curriculum. The first key question this evaluation study was designed to answer was:

‘Can the WHO Patient Safety Curriculum Guide be used to support the implementation of explicit patient safety education across the six WHO regions?’

The results from both the lead tutors for implementation and the tutors who delivered patient safety teaching have confirmed that the Guide was an important support and helped them implement patient safety teaching in their curricula. The Curriculum Guide was described as intuitive and in particular the section on teaching how to teach was praised. Each of the patient safety topics was taught by at least one school during the 16 month study period.

However, despite the Curriculum Guide, reported to be a significantly helpful resource to support the development of patient safety teaching by the participants in this study, and the commitment expressed to both implement patient safety teaching and to participate in the evaluation study at high level, not all schools were able to participate within the available timescale. Three schools withdrew from the study completely whilst others could not teach the suggested four topics or complete the later part of the evaluation. This emphasises the challenges and time required for the various steps involved in major curriculum change. Qualitative data from the tutors suggests that there are several conditions required for successful implementation of patient safety into curricula, such as local support for patient safety teaching, tutor familiarity with the materials and taking change (implementation) one step at a time.

The time required to implement new teaching into the curriculum was highlighted by the lead tutors. Amongst other things leadership and commitment is required to lobby for time in the curriculum and assessment process, to develop locally suitable materials and then to train the trainers. They also reported that the clinical examples in the Curriculum Guide were useful, not necessarily to use *verbatim* in teaching, but rather as a guide to facilitate their search for examples from their own healthcare system which better fitted the local context. This also took time, but seeking support from professionals not normally involved in medical students' education (e.g. risk managers) could be helpful.

In most cases, the teaching was undertaken by either the implementation leads in each school or a small number of tutors who were given training (or time to review the Curriculum Guide) and the topics were taught in a modular fashion. When the whole Curriculum Guide is

used on a wider scale and integrated throughout the curriculum, many tutors may require training themselves in patient safety, presenting a challenge to schools' resources.

The tutors reported using a wide range of methods to teach the patient safety topics from whole group lectures to small group sessions employing simulation or clinical based activities. However data were only available from three of the participating schools, and so it is difficult to draw any conclusions about preferences for different topics or how these relate to student results.

One of the aims of this study was to recruit schools from each of the WHO regions, of different size and with a wide range of curriculum style. This would allow other medical schools to understand how the knowledge generated from this study could relate to their particular situation. Although every variation possible in the characteristics of a medical school cannot be accounted for in a sample with limited size, the significant work undertaken by the WHO Programme ensured that a wide range of schools were successfully recruited and there were participating schools from each of the WHO regions. These schools had a wide range of class (year) sizes and both graduate and undergraduate entry. Two of the schools were new medical schools, but the majority was required to negotiate time in an already established curriculum for new patient safety teaching. The two new schools, and another undergoing major curriculum review, may have found it easier to introduce new teaching.

In summary, although the sample size is small, tutors were positive about the support provided by the Curriculum Guide and the experience of teaching patient safety. There was overall agreement that patient safety teaching should be integrated across the curriculum. The tutors valued not only the patient safety content in the guide, but also the teaching suggestions and clinical examples. These were used to prompt development of appropriate local examples. Despite the support provided by the guide, the Tutors highlighted the need for time and local support to implement patient safety teaching.

5.2 The impact of patient safety teaching

The second key question the study was designed to answer was:

'What is the impact of the inclusion of patient safety teaching to the curriculum on student learning, and what are the student views on the implementation of this material to the curriculum?'

The data from both Topic 1 (What is patient safety?) and Topic 5 (Understanding and learning from errors) indicate that students from all schools perceive that they have limited knowledge

relating to patient safety before the teaching. This supports the inclusion of such teaching into the curriculum and reflects the findings of other reports in the literature^{24,25,28-31}. Although there were some differences in the level of ratings between cohorts from different schools, the ratings indicated students from all schools reported a significant increase in their knowledge after the patient safety teaching.

The attitudes and intentions of students with regard to patient safety were explored in the evaluation of several topics (Topic 1 'What is patient safety?'; Topic 5 'Understanding and learning from error'; Topic 6 'Understanding and managing clinical risk', Topic 9 'Minimizing infection through improved infection control'; Topic 10 'Patient safety and invasive procedures'; Topic 11 'Improving medication safety'). The results indicate that medical students across the WHO regions overall have positive attitudes and intentions with respect to these patient safety topics. Questionnaires were administered both before and after teaching with the intention of identifying changes. Although change was not evident after the teaching for Topic 9 and 11, the results show significant improvement in intentions after teaching for Topics 1, 5, 6 and 10.

Four questionnaires based on the Theory of Planned Behaviour were developed specifically for this evaluation study (for Topics 6, 9, 10 and 11)²⁰. The response rates for these questionnaires ranged widely from 26% to 88%, the higher response rates were for Topic 6 (response rate 88% before and 79% after). Comparing the before and after data for these topics suggests that although there was some improvement in intentions for Topic 6 and Topic 10, the teaching overall had limited impact on the cognitions being measured. This may have been due to students' positive intentions before the teaching, or to issues with the evaluation tools used. There was limited time for testing the evaluation tools prior to the study, which may not have been sufficiently sensitive to show change. The questionnaires were based on clinical scenarios which were written to reflect the outcomes for the topic detailed in the Curriculum Guide. However these scenarios may not have accurately reflected the teaching, the stage of student clinical experience or the context in each school.

The questionnaires used for Topics 1 and 5 asked students before and after teaching about some of the skills required to deal effectively with patient safety issues in the workplace ('I would know what to do if I witnessed someone more senior than me making an error'; 'I am able to talk about my own errors.'). The results indicate that students are more confident that they know how to perform these actions after teaching, but they remain aware of the difficulties that may be involved ('telling others about an error would be easy'). It is notable that the results indicate a greater increase in confidence for performing such actions after the teaching for Topic 5 (Understanding and learning from errors). It is perhaps not surprising that where more time and attention is paid to a particular topic that the effect is greater. The questionnaires used for evaluation of the teaching of these topics have been used previously^{24,25} but only one was used for before and after evaluation in one cohort of students

several years prior to this study²⁵. The before results are similar across both studies but only results for knowledge and perceived behavioural control of the students were significantly improved one year on in the earlier study. Longer term follow up of the students following teaching from the WHO Patient Safety Curriculum Guide for Medical Schools would be required to assess if the changes in knowledge, skills and attitudes are maintained. Although some students returned cards with an email address to allow contact in the future, there were only a small number from one school and so longer term follow up of the cohorts of students in this study is unlikely.

Topics 2, 3, 4, 7 and 8 were assessed with a questionnaire that was administered after the teaching had taken place. This questionnaire asked for student views on the appropriateness of the knowledge and skills addressed during the teaching, the time in the curriculum chosen to deliver the topic and the teaching materials and facilitation. Students were generally positive about whether these topics dealt with knowledge and skills that were relevant and valuable. They found the facilitation was helpful for their learning and understanding and were generally positive about the stage in the curriculum that the topic was being taught. However, it is difficult to draw conclusions regarding the student view for most of these topics as only for Topic 5 (What is human factors and why is it important to patient safety) was data returned from significant numbers of students (n=322) across a several schools (n = 5). In addition the standard deviations are wide for many of the responses, which would suggest a wide range of student opinion.

The response rates for the return of the student questionnaires on each topic ranged widely from 26% (after questionnaire for Topic 9: Minimizing infection through improved infection control) to 88% (before questionnaire for Topic 6: Understanding and managing clinical risk). Only one school was able to provide data at the end of the year indicating the student views on the implementation of patient safety teaching to the curriculum. Although it is not possible to say if these views would be more widely held, the results indicate that the students were positive about the inclusion of patient safety teaching and believe that this should be introduced more widely and earlier in the curriculum. The students reported noticing patient safety issues in their subsequent clinical attachments they had not previously considered and the results indicate that they were beginning to consider how challenging such issues were to deal with.

In summary, students reported positive attitudes and intentions towards patient safety and the inclusion of patient safety teaching to the curriculum. Students' reported their patient safety knowledge had increased after teaching. The results from the theory of planned behaviour questionnaires suggest that the student intentions to display positive patient safety behaviour also increased after the teaching of some topics. However the samples for each of these topics was small and the positive intentions of the students before teaching may have made any effect of teaching difficult to evaluate. Students were generally positive about the patient

safety teaching immediately after the topic teaching. Although data are only available from one school, students still reported positive views on their patient safety teaching several weeks later and they supported the continued inclusion and further integration of patient safety teaching to their curriculum.

5.3 Limitations

There were a number of limitations in this study, as mentioned above. The timescale that was available did not allow detailed testing of the evaluation tools prior to the study. One of the requirements for participation in the study was that the students and tutors would be able to complete the evaluation in English. This illustrates two limitations of this study. Firstly, there may have been difficulties in understanding and responding to evaluation questions due to limited understanding or differences in use of English in different countries. Secondly, the transferability of the results to schools with a different student group who are not fluent in English is limited. Response rates were variable and could only be estimated as information on the numbers of students who attended teaching, but did not participate in the study are not known.

Some topics proved more popular than others. All schools were asked to implement Topic 1 'What is patient safety?' and this is reflected in eight of the 10 schools returning data for this topic. Asking all schools to teach topic 1 could allow comparison of the teaching impact across the full range of school sizes and types. Topic 1 was chosen for the core topic as it provided both an overview and a good basis for further patient safety teaching.

Data were not collected on why schools selected other particular topics. Topic 2 (What is human factors and why is it important to patient safety?) was implemented by five schools and topic 5 (Understanding and learning from errors) by four schools. Neither of these topics has been explicitly represented in medical school curricula and they are domains within which there is limited knowledge in healthcare generally. Schools may find it useful to seek support from other professionals such as Human Factors experts when they are considering the introduction of some patient safety topics to the curriculum. All other topics were implemented by only one or two schools, which reduces the generalisability of the findings.

5.4 Conclusions

This study has confirmed that the WHO Patient Safety Curriculum Guide for Medical Schools can support the introduction of patient safety teaching to the curriculum for medical students. Tutors valued having the detail of what could constitute a patient safety curriculum with the

resources required for developing teaching materials in one place. They praised the support provided by the 'Teachers Guide' which helped them consider the ways in which to introduce topics to the curriculum and the detail provided for each of the topics helped the tutors consider how local examples could be used to illustrate patient safety teaching. Although the teaching reported in this evaluation, based on the Curriculum Guide in this first year after its publication, has generally been stand alone modules, tutors indicated a desire to work towards further integration across the curriculum

However, the tutors also highlighted the conditions and time required to successfully introduce patient safety teaching. Local support for patient safety teaching was important to allow appropriate time in the curriculum and resources for teaching. Where tutor training was required, it required time, and this may be why the patient safety teaching in many of the participating schools was delivered by the lead tutor for implementation or only one or two others. Expansion of the tutor pool to support the full integration of patient safety throughout a curriculum would require significant resource. Although the examples provided in the Curriculum Guide were praised, tutors emphasised the benefits of seeking out and incorporating local examples to support the teaching and student learning.

The results suggest that at least in the weeks immediately following teaching that students had improved knowledge of patient safety issues and in some case their attitudes and intentions had become more positive.

Given the importance of patient safety and the challenges in addressing this problem there is an ongoing need for efforts to address the difficulties in integrating effective patient safety education to the undergraduate curricula of healthcare professionals³². The students and tutors positive views of the major changes to their curricula, taking place over one academic year, supported by the WHO Patient Safety Curriculum Guide for Medical Schools are very encouraging. However questions remain on how best to integrate patient safety to the core curriculum and so the systematic evaluation of the next phase of implementation and the longer term outcomes in the healthcare workplace are now required.

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