Safety skills training for surgeons: A half-day intervention improves knowledge, attitudes and awareness of patient safety

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Background. Education and training of health care professionals is necessary to achieve sustainable improvements in patient safety. Despite its inherently risky nature, little training specifically in safety has been conducted in the surgical disciplines. In this study we explored the effects of a safety skills training program on surgical residents’ knowledge, attitudes, and awareness of patient safety.

Methods. A half-day training program incorporating safety awareness, analysis, and improvement skills was delivered to surgical residents from 19 hospitals in London, United Kingdom. Participants were assessed in terms of safety knowledge (MCQs) and attitudes to safety (validated questionnaire; scale 1 to 5) before and after training. To determine long-term effects, 6 months after training participants identified and reported on observed safety events in their own workplace by using an observational form for data collection.

Results. A total of 27 surgeons participated in the training program. Knowledge of safety significantly improved after the course (mean pre = 45.26% vs mean post = 70.59%, \( P < .01 \)) as did attitudes to error analysis and improving safety (mean pre 3.50 vs mean post 3.97, \( P < .001 \)) and ability to influence safety (mean pre 3.22 vs mean post 3.49, \( P < .01 \)). After the course, participants reported richer, detailed sets of observations demonstrating enhanced understanding, recognition, and analysis of patient safety issues in their workplace.

Conclusion. Safety skills training with positive educational outcomes can be delivered in a half day. Such a course may allow patient safety to be integrated into any curriculum, thereby training the next generation of the healthcare workforce to maintain the safety momentum. (Surgery 2012;:.

A number of high-profile reports have pushed quality and safety higher up the health care agenda.\(^1\),\(^2\) Although there have been significant efforts in recent times, including the World Health Organization Surgical Safety Checklist,\(^3\) sustainable improvements will not be achieved without investing in the training and education of all health care professionals.\(^4\),\(^5\) This growing impetus to equip clinicians with the knowledge, skills and attitudes to improve patient safety has stimulated research efforts to develop training interventions for medical students,\(^5\),\(^6\) individuals,\(^7\),\(^8\) and multidisciplinary teams.\(^9\),\(^10\)

Most recently the concept of safety skills, ie, skills and behaviors that enhance the safe delivery of care, has emerged in the literature.\(^11\) Safety skills include nontechnical skills such as leadership, teamwork, and communication\(^12\) but go beyond these to include other behaviors and attributes, such as conscientiousness, vigilance, and humility.\(^11\) Importantly, these skills have been recognized both as crucial to patient safety and as highly trainable.\(^11\)

Current patient safety training programs have not addressed this broader spectrum of skills and typically focus instead on either incident analysis or crew resource management.\(^13\),\(^14\) Moreover, reported outcomes of such programs have been limited in that they fail to incorporate a comprehensive assessment of participants’ knowledge and attitudes and behaviors. Furthermore, many patient safety training initiatives have spanned several days, making it difficult to
integrate into current curricula or postgraduate training.\textsuperscript{15,16}

Finally, despite its inherently pressurized and risky nature, there have been few developments in patient safety training in the field of surgery.\textsuperscript{17,18} This does not mirror the significant advances made in technical skills training or assessment within the profession.\textsuperscript{19-21} Providing surgical trainees with a clear understanding of patient safety issues alongside strategies for their prevention is equally important to avoid, recognize, and respond to error.\textsuperscript{22} Although safety has begun to become incorporated into modern competency frameworks, how best to attain it remains elusive and part of the hidden curriculum.

The aims of this study were to develop and evaluate a comprehensive but pragmatic safety skills course for surgical trainees to include safety awareness skills, safety analysis skills, and safety improvement skills—alongside a robust package for its evaluation.

\section*{METHODS}

\textbf{Setting and participants.} The training took place in a London U.K. Teaching Hospital, delivered by 4 faculty members (2 surgeons and 2 patient safety experts) from the National Institute of Health Research Imperial Centre for Patient Safety and Service Quality. All General Surgery Residents (PGY3-8) from 19 hospitals in London, United Kingdom (n = 48) were invited to attend the training.

\textbf{The training program.} A 3-hour course on safety skills was developed in which we aimed to equip participants with safety awareness skills, safety analysis skills, and safety improvement skills. These 3 dimensions were chosen as the basic foundations of patient safety for improving clinical practice, reflecting the 3 broad themes of the World Health Organization (WHO) core competencies for safety.\textsuperscript{23} A description of the content of these three dimensions alongside the educational modalities used to deliver them can be found in Table I.

In the first session on safety awareness skills, participants were given a lecture on safety science and its importance to clinical practice. Then, participants were introduced to the concept of human factors and safety skills before viewing videos of poor and optimal team performance in the operating room. Faculty then discussed how these behaviors could hinder or enhance safety while participants actively reflected upon their own experiences.

The second session on safety analysis skills started with a lecture on how to identify the contributory factors for adverse events and strategies for improvements. Participants then used the validated London protocol\textsuperscript{24} in small groups to discuss and analyze actual patient safety incidents noted in their clinical practice, facilitated by faculty members. This London protocol provides a structured methodology for covering the whole process of investigation, analysis, and recommendations for action after an adverse event. The purpose of the protocol is to ensure a comprehensive and thoughtful investigation of an incident that goes beyond the more usual identification of fault and blame.\textsuperscript{24}

Finally, in the last session on safety improvement skills, participants were given a background to initiatives to improve safety in surgery such as the WHO Checklist alongside challenges to their implementation. Participants were encouraged to explore reasons as to why implementing change can be complex and strategies to overcome barriers to the adoption of safety innovations. Finally, faculty actively solicited practical strategies that participants felt that they could implement to improve safety in their own clinical practice after the course.

\textbf{Assessment of participants.} Course participants were assessed by the use of a validated multi-method approach.\textsuperscript{25} Immediate assessment was carried out before and after the course of the following:

1. Knowledge using MCQs developed by safety experts from Imperial CPSSQ. MCQs were piloted before refinement into 10 questions.
2. Attitudes using a modified version of a validated questionnaire\textsuperscript{5,26} (Table II depicts assessed categories). Participants were asked to rate their perceptions on five-point scales from 1, which indicated strongly disagree, to 5, which indicated strongly agree for items in each category.

\textbf{Long-term retention.} Immediately before the course and for 6 months after it, safety awareness was assessed qualitatively by participants completing free text observations on a safety proforma identifying any patient safety incidents. This proforma included instructions to the participant to stand back and watch a case in which they were not directly operating upon the patient on the table. A definition of a patient safety incident was provided on the proforma, and the participant was asked to write down any comments or instances of patient safety incidents noted during the case that they observed. This was conducted in the operating room of their own workplaces, allowing testing of the translational aspects, specifically patient safety awareness, of the course.
Course evaluation. A structured evaluation form gathered participants’ reactions to the training program in terms of its content, delivery, and satisfaction (using the 5-point scales and free text boxes).

Data analysis. MCQ correct answers were converted to percentages (%) for the purposes of statistical analysis. Descriptive statistics and t-tests were performed with the use of SPSS v. 17.0 to determine whether there were significant differences on knowledge and attitudes before and after training. The level of significance was set at $P < .05$. Qualitative emergent theme analysis was used to analyze the free text observations in the operating theater by two independent coders.27

RESULTS

A total of 27 surgeons (male = 17, female = 10) from 19 hospitals across London attended the training program (total population of surgical residents in the 19 hospitals = 48). All surgeons who participated were residents (PGY3-8) in the specialty of general surgery.

Knowledge. There was a significant difference in knowledge of patient safety before (mean, 45.26%; SD, 17.75%) and after the course (mean, 70.59%; SD, 14.78%), $t(34) = 4.62, P < .01$ as assessed using the MCQs.

Attitudes. Table II reports the change in attitudes after the training. From this it can be seen that there was a significant improvement in participants' subjective level of knowledge of patient safety (complementing the aforementioned MCQs analyses), attitudes to error analysis, and improving safety as well as in self-perceived ability to influence patient safety. Although personal beliefs towards safety and feelings about errors also improved, this effect was not statistically significant.

Awareness of patient safety/behaviors. Participants were much more aware of patient safety issues after the course, as evidenced from their entries into the Safety Observations Proforma. A qualitative
analysis revealed that before the attending the course, participants’ observations tended to focus around the themes of equipment problems, inexperience, and other frustrations with limited understanding of other patient safety issues. Example observations included comments such as: “Blunt scissors given to surgeon twice” (S4) or “Inexperience of assistant so case took longer” (S1).

After the safety skills training course, participants recorded an increased number of observations associated with a greater understanding, recognition, and analysis of patient safety issues. Additional themes emerged around distractions and interruptions, safety checks being incomplete and poor communication and teamwork as well as the consequences of these incidents on patient safety. Participants also expressed a greater understanding of the error cascade, and many of them commented that interventions to improve safety, such as the WHO Checklist were not being followed. Example themes and observations that emerged can be found in Table III. This result suggests that the safety skills training significantly enhanced participants awareness and appreciation of patient safety in their own immediate workplace and allowed them to apply the theoretical lessons learned from the course into their own real clinical practice.

Course evaluation. Participants’ quantitative evaluation of the course was very positive, with all ratings above the scale midpoint (3; Table IV). Upon analysis of the free-text boxes, we found that the strengths of the training were its highly engaging and interactive nature, with “permission to talk about what everyone knew but nobody said” (S3) and that “for the first time, conversations that took place in the coffee room on what went wrong could be brought out into the open…” (S12). Regarding suggestions for improvements, participants felt that it would be worthwhile “Involving other disciplines to gauge different experiences” (S3) and that the “Course should be mandatory for all surgical residents and attendings to encourage cultural change in investigating and reporting errors” (S8).

DISCUSSION

Improving quality and safety is one of the toughest problems facing medicine today. To boost safety culture in health care, it is essential that the next generation of health care professionals is adequately trained to recognize, prevent, and mitigate error. With this in mind, we developed a comprehensive but feasible package that delivers effective training in safety awareness, safety analysis, and safety improvement skills in a half-day with no special resources (such as simulation), making this highly transferable to other units. Participants particularly valued the use of case-based interactive sessions and the opportunity to discuss these issues in a frank but nonthreatening environment. Creating a psychologically safe environment to discuss the sensitive area of medical error cannot be overemphasized and itself was a key achievement of this training program.

Our training resulted in significant improvements in knowledge of safety principles and awareness of safety issues in the participants’ own work environments. This highlights that surgeons were able to translate the training received in the half-day to a real practical understanding of patient safety problems in their own clinical workplace—a key aim of our program. Coupled with the fact that participants’ attitudes about their ability to analyze errors, identify contributory factors, and improve safety significantly increased, it is possible that this training could act as a springboard for driving the development of interventions to enhance safety in surgical settings, championed by clinicians on the front-line.

Although this course was aimed at residents, such patient safety training could also be incorporated into medical student programs as well as those for more senior attending surgeons. WHO has recently developed a curriculum for the inclusion of patient safety modules in medical school curricula, but despite this, studies have indicated that junior doctors have little knowledge about safety principles, and that their experience of, and attitudes to, patient safety incident reporting are far from optimal.

Our own work has also previously reported that trainees undervalue the importance of being a patient advocate and an effective team-worker to becoming a competent surgeon. These skills are essential for patient safety and hence the drive toward delivering this safety skills training program to residents in the first instance.

It must be noted that personal beliefs about safety as well feelings about errors did not statistically improve. This could either be attributable to our limited sample size or because these constructs are so deeply embedded, a half-day training program is unlikely to affect them. Furthermore, although all general surgical residents in the North-West London region were invited, just more than one half actually attended, citing scheduling conflicts and service delivery pressures as reasons for not doing so. Making the course mandatory would have been one way of overcoming this but this would require curricula change at regional level. It is important therefore that this disparity in balancing educational activity with
service demand is addressed if we are to successfully embed patient safety into the psyche of the next generation of clinicians. It is also possible that there may have been a degree of selection bias in that the residents who did attend were more safety-conscious. Comparing results against those who did not attend (control group) would confirm the value of this training.

These limitations notwithstanding, achieving a range of positive educational outcomes in a short space of time reflects the findings from other groups who have delivered similar results when providing excellent patient safety training to medical students in 4–5 hours.\textsuperscript{5,15} Taken together with our own work, this suggests that providing an initial attempt at education and training in patient safety does not require a huge investment. Half-day training is practical, inexpensive and easily integrated into any curriculum. Moreover, in attempt to disseminate good practice, all materials for this training program (including slides, manuals, case studies and videos) are available in electronic format by contacting the authors. As such, this training program can be readily adapted to other specialties and disciplines.\textsuperscript{31} It could also be a valuable adjunct to the mandatory FLS training now being implemented across the United States.\textsuperscript{19}

Furthermore, although the course was half-day so as to minimize impact on service delivery, it could be extended to one or more days. However, this may make it less feasible for residents to attend. Follow-up sessions at 6 monthly intervals

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**Table III.** Patient safety awareness in the workplace after safety skills training

<table>
<thead>
<tr>
<th>Theme</th>
<th>Example observation</th>
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<tbody>
<tr>
<td>Distractions and interruptions</td>
<td>“Surgeon being constantly interrupted for reasons other than the procedure itself” (S8*)</td>
</tr>
<tr>
<td>Safety checks incomplete or not adequately done</td>
<td>“Patient announced latex allergy in anesthetic room. Had not been picked up at pre-assessment” (S7)</td>
</tr>
<tr>
<td>Communication and teamwork</td>
<td>“Consultant Surgeon became irritable because he had to wait for Anesthetic Consultant to come. When he arrived, it altered entire atmosphere in theatres. Theatre staff disgruntled because shouted at by surgeon” (S16)</td>
</tr>
<tr>
<td>Error Cascade</td>
<td>“Medical student scrubbed but unclear how to change gloves when gloves become dirty. Talked to scrub nurse, who then became distracted and unclear as to where things had got to in the operation. Consultant shouted at scrub nurse, who then became more confused—handed the surgeon the wrong instrument repeatedly…” (S3)</td>
</tr>
<tr>
<td>Interventions to Improve Safety</td>
<td>“Failure for all staff to fully enter into introducing each other despite checklist. Almost embarrassed doing so…” (S1)</td>
</tr>
<tr>
<td></td>
<td>“No pre-op briefing/checklist —Surgeon only checked antibiotics given halfway through case—they had not” (S4)</td>
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*Note: S = surgeon (eg, S3 = Surgeon 3).

**Table IV.** Evaluation of safety skills training

<table>
<thead>
<tr>
<th>Domain</th>
<th>Item</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content</td>
<td>1. Improved my understanding of patient safety, human factors and the systems approach to surgery</td>
<td>4.32 (0.58)</td>
</tr>
<tr>
<td></td>
<td>2. Improved my understanding of how to analyze an adverse event so as to learn from error</td>
<td>4.26 (0.65)</td>
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<tr>
<td></td>
<td>3. Improved my understanding of solutions to prevent/minimize error, including the WHO Checklist, briefing, and debriefing</td>
<td>4.16 (0.50)</td>
</tr>
<tr>
<td></td>
<td>4. Provided me with a set of strategies to enhance safety in the operating theater</td>
<td>4.16 (0.50)</td>
</tr>
<tr>
<td>Delivery</td>
<td>5. This course was well delivered and engaging</td>
<td>4.58 (0.51)</td>
</tr>
<tr>
<td></td>
<td>6. The information was provided in a way which easy to understand</td>
<td>4.58 (0.51)</td>
</tr>
<tr>
<td></td>
<td>7. Teaching and learning materials were of appropriate quality</td>
<td>4.58 (0.51)</td>
</tr>
<tr>
<td></td>
<td>8. The learning objectives were met</td>
<td>4.42 (0.51)</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>9. Overall. I was satisfied with this course</td>
<td>4.63 (0.50)</td>
</tr>
<tr>
<td></td>
<td>10. I would recommend this course to a colleague</td>
<td>4.47 (0.61)</td>
</tr>
<tr>
<td></td>
<td>11. This course should be mandatory for all members of the operating theater team</td>
<td>4.58 (0.61)</td>
</tr>
</tbody>
</table>
maybe more practical and allow for a more longitudinal analysis of safety skills as they evolve over time. It must be noted though that any long-term improvement in safety skills is likely to require a systematic approach encompassing curricular innovation as well as ongoing faculty and time commitment. However, we firmly believe that investing these resources to embed safety into current training paradigms can lead to safer clinicians, safer systems, and ultimately safer healthcare. The safety skills training program described here may form an important step towards realizing that vision.

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REFERENCES