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Evaluating a novel surgical risk assessment curriculum for medical students

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ABSTRACT

Purpose: Predicting surgical risk is challenging. There is no curriculum to teach risk assessment to students. We hypothesize that a risk assessment curriculum will improve medical students' confidence in and familiarity with assessing risk, and help identify barriers to assessing risk.
Methods: Third year surgery clerkship students participated in a risk-assessment workshop. Students completed pre- and post-intervention surveys assessing their familiarity with models, and confidence in predicting postoperative complications. Additionally, they completed a retention survey 12-weeks following the session.
Results: Following the session, confidence in predicting post-operative morbidity and mortality improved from <1% to 21.9% and 19.05% respectively. The majority of students continued to feel more confident mortality 12-weeks following the session. Not seeing attendings/residents use the calculator was a significant barrier to use.
Conclusions: This novel risk assessment curriculum improved student confidence towards assessing risk up to three months following the session. Additionally, this study highlights that barriers exist to using risk assessment tools clinically.

Introduction

Clinicians from a variety of specialties and levels of training find risk stratification challenging and are prone to reasoning errors.[1,2] Prior studies reveal that surgical attendings are no better at risk prediction than surgical trainees or medical students, and that surgical trainees are no better at risk prediction than internal medicine trainees.[3,4] These findings are notably concerning because preoperative decisions, including shared decision-making on the balance between the risks and benefits of operative intervention, are potentially based on erroneous risk prediction.

Risk prediction and stratification are important skills for physicians from all specialties because they facilitate appropriate and accurate conversations with patients. In fact, the Association of American Medical Colleges (AAMC) has determined that medical students should have an appropriate understanding of the risks and benefits of invasive procedures sufficient to obtain informed consent. This expectation and the importance of risk prediction is highlighted by Entrustable Professional Activity (EPA) 11 which states that graduating medical students should reach competency in obtaining consent for procedures (https://www.aamc.org/download/482208/data/epa11toolkit.pdf.)

Clinical decision making is partially learned through observation and role-modeling.[1] There is some evidence that medical students learn important clinical competencies experientially through observation and apprenticeships.[5] This learning from role-modeling of residents and attendings makes learning on clinical rotations different than in the traditional classroom. Additionally, learning on clinical rotations is different because it forces students to integrate prior knowledge, skills, and attitudes and apply them to real clinical situations, all under supervision.[6,7] This workplace learning is a crucial part of developing the competencies valued in becoming a physician.[6] As has been demonstrated with other competencies such as communications training, developing curricula for clinical decision making to incorporate into the clerkship years, improves competence.[8]

With the goals of introducing the concept of risk assessment and

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giving students the skills to make independent risk assessments, we designed a novel 1-h risk assessment workshop for medical students rotating on their surgical clerkship. We hypothesize that a risk assessment curriculum will improve medical students' confidence in and familiarity with assessing surgical risk. This workshop used learning techniques known to be successful for clinical learning such as deliberate practice,[9] clinical case-based problem solving,[10] and working in break-out groups.[11]

Methods

Study population

This was a prospective longitudinal study conducted with third-year medical students at an urban, tertiary, academic medical center. Students participated in a 1-h risk assessment workshop during their regularly scheduled didactic time during their twelve-week surgery clerkship. The session occurred during the first three weeks of their clerkship. This study was approved by the Yale Human Investigation Committee and approved by the medical student research protection committee of the Yale School of Medicine.

Curriculum

A 1-h session for surgical clerkship students was developed with these objectives:

1) Students will identify challenges in assessing surgical risk
2) Students will apply the ACS NSQIP calculator to different case-based clinical scenarios

The session was taught by a senior surgical resident and began with the distribution of two case-based presentations of a non-obstructive inguinal hernia; half of the class received Case A and the remaining half received Case B (Fig. 1). Case A presented a patient with fewer operative risk factors than Case B (Supplement 1). Individually, students were asked to rate a series of questions from 0 to 100% regarding the scenario's predicted complication risk (Table 1.)

After working through the cases individually, the class re-convened and individuals from each group shared their responses to each question. Responses were noted, paying attention to the wide variability in predictions among students. The class was then asked to share what they knew about risk prediction and how it is incorporated into the consent process, asking students to cite clinical examples. The instructor facilitated the discussion and students were prompted to think about "*gestalt*" risk assessment, a qualitative understanding of risk based on prior experience, versus quantitative risk assessment, a numerical risk score based upon validated statistical models.

Students were then introduced to the ACS NSQIP Calculator. The NSQIP calculator is an online tool developed by the ACS to quantify the likelihood of post-operative morbidity and mortality based on patient-specific pre-operative risk factors.[12,13]

Following this introduction, students divided into breakout groups. Students navigated to the ACS NSQIP risk calculator on their

Table 1
: Risk prediction questions rated from 0 to 100%.

1. What do you predict the all-cause mortality to be?
2. What do you predict the likelihood of any complication to be?
3. What do you predict the likelihood of a surgical site infection to be?
4. What do you predict the likelihood of pneumonia to be?
5. What do you predict the likelihood of a cardiac complication to be?

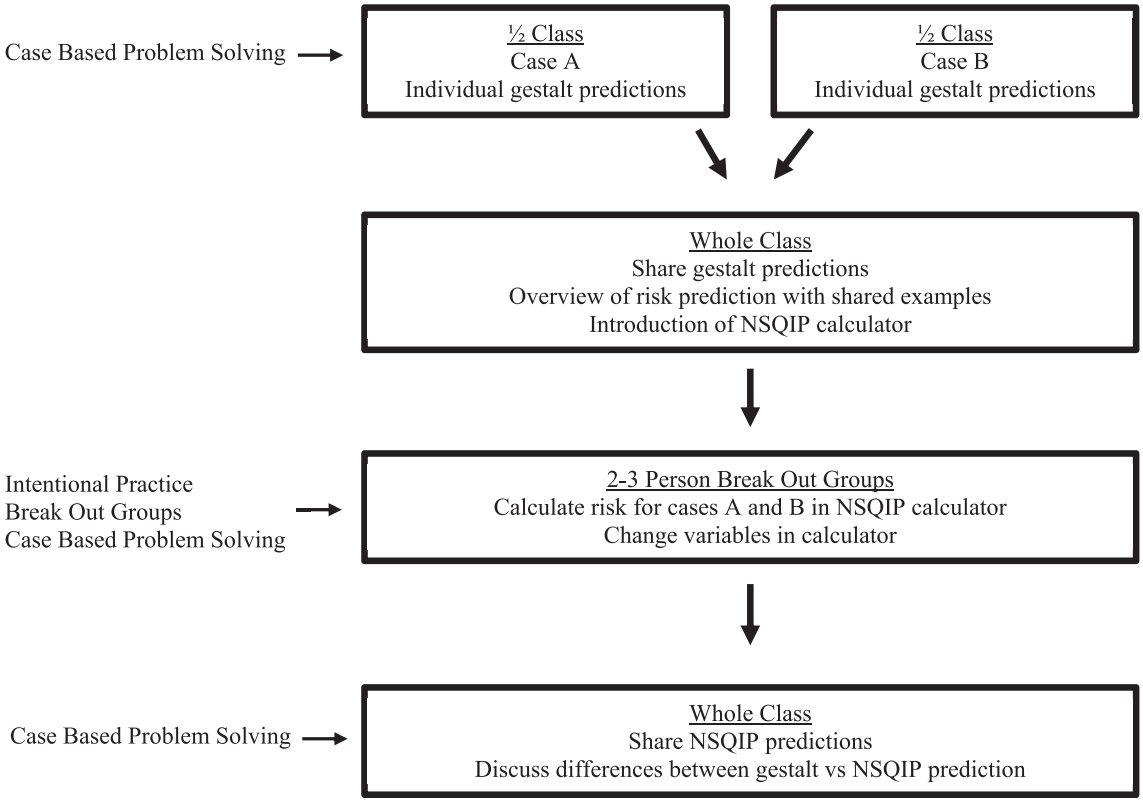

Fig. 1. Outline of curriculum.

personal mobile devices and practiced using this tool with a sample case of a reducible inguinal hernia repair (Current Procedural Technology [CPT] code 49505). Within their breakout groups, students were encouraged to discuss how their *gestalt* risk predictions compared to the calculator predictions. The students were also encouraged to change the variables within the calculator, including preoperative comorbidities and case type, and examine how the risk predictions changed. Students then re-convened to discuss their findings.

Survey instruments, data collection and outcomes

At the start of the session, students were asked to complete a survey regarding their confidence in and exposure to surgical risk assessment. At the end of the session, they were again asked about their post-session confidence in surgical risk assessment. To study the persistence of comfort with risk assessment, and the clinical applications of the session as a reflection of knowledge retention, students were given a final survey on the last day of their twelve-week clerkship.

Pre-and post-workshop survey

Students were asked six questions regarding risk prediction on a five-point Likert scale ranging from: 1- "Strongly Disagree" to 5- "Strongly Agree" (Supplement 2.) Question 7 gave the students an opportunity to leave a narrative response, asking the students to "Please share any additional thoughts you have about your preparedness to assess operative risk in your patients." On the post-workshop survey, an additional question gave the students an opportunity to "Please share any additional thoughts you have about this lecture."

Retention survey

The students were asked to rate questions regarding confidence in predicting post-operative morbidity and mortality, as well as the usefulness of a risk assessment workshop within the surgical clerkship, using a Likert scale ranging from 1- "Strongly Disagree" to 5- "Strongly Agree." Students were additionally asked how often they used the NSQIP calculator during their clerkship following the session. Students were given the opportunity to leave free response comments regarding the risk assessment session.

Statistical analysis

Descriptive statistical analysis was performed using the chi-squared test. A p-value of less than 0.05 was considered statistically significant. Analysis was performed using SAS 9.4 (Cary, NC). Additionally, narrative comments were reviewed to determine common themes among responses. This was done to iteratively improve the curriculum between clerkship blocks based on feedback received.

Results

Participant demographics

In total 105 of 152 (69.1%) clerkship students participated in the risk assessment workshop and completed the pre- and post-workshop survey. Among the 105 participating, 57 (54.3%) students completed the additional survey at the conclusion of the clerkship.

Post-workshop descriptive results

Students felt more confident predicting operative complications following the risk assessment workshop; more students selected "agree" or "strongly agree" to survey questions regarding confidence in risk prediction (pre-mean 0.95% vs. post-mean 21.90%; $p < 0.0001$), Fig. 2]. They additionally felt more confident predicting operative death (pre-mean 0.95% vs. post-mean 19.05%; $p < 0.0001$). The curriculum also improved their attitude that their patients make care decisions based on their input (pre-mean 6.67% vs. post-mean 18.10%; $p = 0.01$), their willingness to use risk-adjusted models (pre-mean 6.67% vs. post-mean 46.67%; $p < 0.0001$), and their feeling that the surgical clerkship teaches them risk assessment strategies (pre-mean 4.76% vs. post-mean 14.29%; $p = 0.02$). The curriculum did not improve their attitude regarding their ability to correctly predict surgical complications (pre-mean 1.9% vs. post-mean 6.67%; $p = 0.90$).

The one major theme predominant on thematic analysis (Supplement 3) of pre-workshop comments was that students had little or no exposure to the concept of risk assessment. Comments

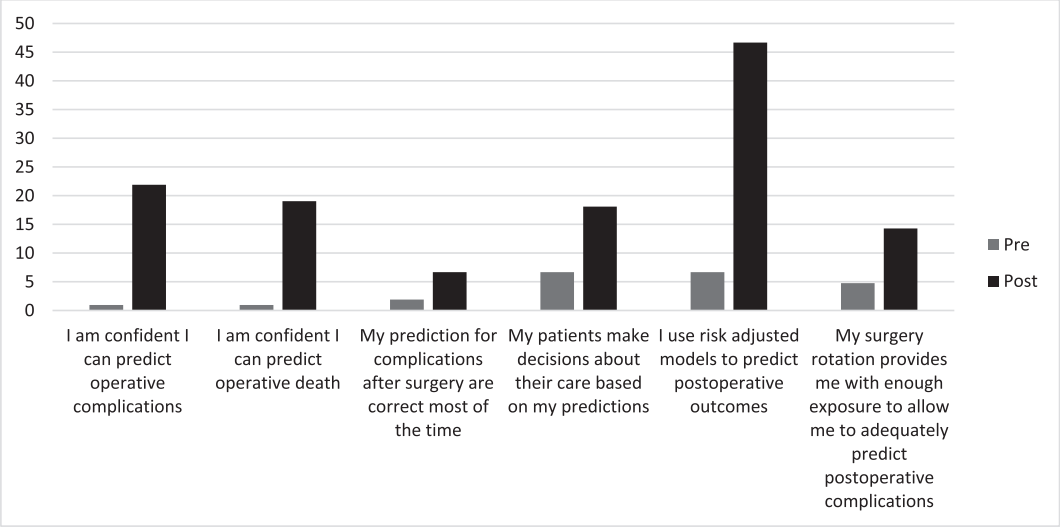

Fig. 2. Percent of students answering "agree" or "strongly agree" to pre- and post- workshop surveys.

following the workshop included: "appreciated the introduction to the calculator," with one student saying it would be difficult to use on clerkship. One student questioned the validity of the calculator.

Retention descriptive results

Overall, 71.9% (41/57) of students chose "agree" or "strongly agree" when asked if they felt more confident in predicting post-operative morbidities at the conclusion of their surgical clerkship, while 52.6% (30/57) chose "agree" or "strongly "agree" that they felt more confident in predicting post-operative mortality. Despite 80.7% (46/57) students choosing "agree" or "strongly agree" that the workshop was a useful addition to the surgical clerkship, only 29.8% (17/57) of students used the NSQIP calculator one or more times following the workshop.

The majority of comments stated that the students felt the NSQIP risk calculator had little practical value (Supplement 3). Specific barriers cited included the feeling that the calculator not accurate, residents/attendings not using it, resident/attendings not thinking it was accurate, and forgetting that the calculator was available. The fact that residents and attendings were not using the calculator seemed to be the most important, with 26% of responses to the 12-week follow up question "Please share any additional thoughts you have about the NSQIP calculator" expressing the calculator was not used for that reason. Strengths of the workshop included: it being the only place risk is addressed in the medical school curriculum, the use of clinical cases, small group work, and it leading to an increased understanding of surgical risk. Weaknesses of the session included: not introducing other risk tools and a feeling that the calculator was of little practical value.

Discussion

Third-year medical students at our institution had no prior exposure to the concept of risk assessment, or risk assessment tools. Our results demonstrate that students desire further training on risk prediction and that a 1-h risk prediction workshop to medical students resulted in increased comfort and familiarity with risk prediction models. Additionally, we demonstrated that increased confidence in risk prediction is sustained at three months following the workshop.

It is interesting to note that following the workshop, 21.9% of students felt more confident with surgical risk assessment, and following the clerkship, 71.9% felt more confident with risk assessment. This suggests that a risk assessment curriculum is not the only important component to familiarizing students with risk assessment. Other factors influencing learner confidence may include: providing real-life context during daily patient care, time to digest and further investigate the risk predictive models, and practice.

Although it is known that confidence does not necessarily correlate with competence,[14] confidence is an important, relevant part of skill acquisition and may be partially related to overall development of competency.[15,16] The goals of our workshop were to introduce risk assessment to the students, facilitate their recognition of the complexity of risk stratification, and to provide exposure to a tool that could later be used for risk-stratifying general surgery patients and thereby encourage self-directed learning.

We also recognize the importance of deliberate practice and the relevance of continued utilization in daily clinical interactions. An unexpected finding of our study was that despite the students expressing interest in the workshop and expressing that it should become a continued part of the clerkship, very few students used a risk assessment calculator following the session. Barriers to implementation of objective, risk adjusted statistical models into every day perioperative planning remain unknown. Some participants noted not feeling comfortable utilizing the risk calculator because their residents and attendings did not use it, or actively disregarded the results. Role-modeling remains a critical component to medical student and physician learning, so it is not surprising that students would be hesitant to apply a skill on the wards that they did not see their superiors using.[1,5,17] An important follow-up study will be to understand barriers to physicians and students using risk assessment tools for patient care.

There are some study limitations. We applied our curriculum to four cohorts of clerkship students at a single institution and further study of our curriculum at multiple institutions would be beneficial. Respondents who completed the retention survey might be self-selected for those who were more likely to utilize the risk calculator. We were unable to track risk predictions or evaluate if competency and accuracy improved with introduction of the curriculum.

Our curriculum was developed for medical students, but given that residents find risk prediction equally challenging, they are an important population to provide similar risk stratification education too as well.

Conclusion

A risk prediction curriculum taught to third year surgery clerkship students is feasible and improves familiarity of and confidence with surgical risk stratification. Students find the curriculum useful and confidence, an important component of skill acquisition, persists at least three months following the risk session. However, the majority of students do not use risk assessment tools following the session and further study into barriers of use needs to be conducted.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.amjsurg.2018.10.013.

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