Prediction of Postoperative Surgical Risk: A Needs Assessment for a Medical Student Curriculum

Samantha L. Ahle, MD, James M. Healy, MD, MHS, and Kevin Y. Pei, MD

Yale School of Medicine, Department of Surgery, New Haven, Connecticut

OBJECTIVE: Medical students' abilities to predict postoperative complications and death are unknown. We hypothesize that medical students will lack confidence in determining surgical risk and will significantly overestimate surgical risk for post-operative morbidities and mortality.

DESIGN: Participants were invited to participate in an electronic, anonymous survey to assess their ability to predict surgical risk. The survey presented 7 complex clinical scenarios representative of a diverse general surgery practice. Participants were asked to assess the likelihood of different morbidities and mortality on a 0-100% scale, and predictions were compared to the ACS NSQIP risk calculator.

SETTING: Yale School of Medicine, New Haven, Connecticut; Tertiary medical center

PARTICIPANTS: Third year medical students on their surgery clerkship as well as general surgery residents were invited to participate.

RESULTS: Most students were not confident about predicting postoperative complications (83.3%) or mortality (70.8%). Most students did not feel that the surgery clerkship adequately prepared them to assess surgical risk (69.6%). When compared to surgical residents for most presented cases (57% of cases), students and residents similarly overestimated postoperative morbidities and mortality. Estimates varied significantly, with wide 95% confidence intervals. Only 17% of NSQIP predicted estimates fell within the 95% confidence intervals.

CONCLUSIONS: Medical students overestimate morbidity and mortality following surgery in complex patients. Additionally, they lack confidence in their ability to predict surgical complications. A formal curriculum for risk prediction is needed for medical students. (J Surg Ed 76:89−92. Published by Elsevier Inc. on behalf of Association of Program Directors in Surgery.)

KEY WORDS: risk-assessment, NSQIP, risk curriculum, risk prediction

COMPETENCIES: Patient Care, Medical Knowledge, Practice-Based Learning and Improvement

INTRODUCTION

Determining surgical risk in complex patients can be challenging, especially since patients are living longer, and often presenting with more comorbidities. In fact, even experienced surgeons tend to overestimate risk on average, particularly in medically complex patients.[1] In parts of the country, general surgery practice remains heterogeneous and surgeons must have a command of a variety of operations.[2] Additionally, patients have an increasingly sophisticated understanding of disease processes and treatment options and expect shared decision making. These factors make accurate informed consent conversations critically important.[3]

Despite the challenges involved in accurate surgical risk stratification, most physicians lack any formal training on risk assessment strategies. Instead, decision making is largely learned through observation of mentors and peers, and ultimately anecdotal based on personal experience.[4]

Similar to resident trainees, we suspect medical students garner their risk predictive skill set through observation, but there has been little attention paid to the introduction of formalized training. As clinical training and patient exposure start earlier in medical schools across the country through curriculum revamping, it is an opportune time to assess how medical students assess risk. We hypothesized that similar to residents they shadow, medical students

Correspondence: Inquiries to Kevin Y. Pei, MD, FACS, Section of General Surgery, Trauma, & Surgical Critical Care, Department of Surgery, Yale University School of Medicine, 330 Cedar Street, BB310, New Haven, Connecticut 06519; fax: (203) 785-3950; e-mail: kevin.Pei@yale.edu

will overestimate operative risk and lack confidence in their predictions.

MATERIAL AND METHODS

Following completion of their 12-week surgical clerkship, third year medical students at an urban, tertiary, academic medical center were invited to participate in an anonymous, online assessment. All study parameters were deidentified and did not affect student clerkship evaluation. This study was reviewed and exempted by the institutional review board. Students were polled a single time at the beginning of the 2016-2017 academic years.

The survey presented 7, complex clinical scenarios representative of a diverse general surgery practice including colectomy, duodenal ulcer repair, inguinal hernia repair, exploration for perforated viscus, small bowel resection, cholecystectomy, and mastectomy (Supplement Figures 1-7.) Participants were asked to predict the likelihood of any morbidity, mortality, surgical site infection, pneumonia, and cardiac complications on a 0-100% scale. Morbidity and mortality predictions were compared to the American College of Surgeons (ACS) National Surgical Quality Improvement Program (NSQIP) calculator. This calculator has been validated to provide patient-specific, high quality clinical data on preoperative risk factors that increase the likelihood of postoperative morbidities and mortality. All variables necessary for ACS NSQIP risk calculations were provided to participants.[5] The calculator undergoes updates as more patient data becomes available, thus predictions may vary based on date of use (Supplemental Figures created based on calculator input on May 20, 2018.)

To characterize their baseline comfort with risk assessment, participants were asked questions regarding confidence with risk assessment and use of risk adjusted models on a 5-point Likert scale, with 1 indicating strongly disagree and 5 indicating strongly agree. Because medical students most often observe residents during discussion of risk and shared decision making, we compare student prediction to surgery resident responses that we previously acquired. Resident data were collected over a 1-month time period through an anonymous, online survey during the 2016-2017 academic year.

Data analyses were performed using SPSS statistical software, version 22.0 (IBM Inc). Figures were created using GraphPad Prism, version 7.0 (GraphPad Software Inc). Mann-Whitney U non-parametric tests were used to determine if clerkship students and general surgery residents had statistically different risk assessments for each case. Differences in NSQIP calculator morbidity and mortality estimates were compared to medical student and resident responses, and reported as absolute percentage differences of the mean.

RESULTS

24 medical students (80% response rate) and 76 general surgery residents (64% response rate) participated in the study. Responding residents included PGY1s (28%), PGY2s (37%), PGY3s (13%), PGY4s (13%) and PGY5s (9%). The students were asked to rank their responses to specific questions related to their comfort with risk prediction, decisions to offer surgery, hospice care discussions, and code status discussions. Overall, students demonstrated a lack of confidence for all parameters. Only 8.4% agreed with the statement "I am confident in my ability to predict postoperative surgical death," and 16.7% agreed with the statement "I am confident in my ability to predict postoperative surgical complications" (Table 1). When asked whether students believed their predictions for complications were correct most of the time, only 4.2% (1/24) strongly agreed, and 4.2% (1/24) somewhat agreed, while 66.6% (16/24) disagreed with

TABLE. Percent of medical student responses to survey questions regarding confidence in risk prediction and use of risk adjusted models.

	Agree/ Strongly Agree	Neutral	Disagree/ Strongly Disagree
Confident to predict operative complications	16.7	20.8	62.5
Confident to predict operative death	8.4	20.8	70.8
My prediction for complications after surgery are correct most of the time	8.4	25	66.6
My patients make decisions about their care based on my predictions	16.7	8.3	75.0
I use risk adjusted models to predict postoperative outcome	16.7	20.8	62.5
Surgery rotation provides enough exposure to allow me to adequately predict postoperative complications	13.0	17.4	69.6

this statement. Furthermore, 75% (18/24) of students disagreed that patients make decisions about their care based on the students' predictions of risk. Students were also asked whether they believed their patients wanted to know the predicted complication and death rates before surgery, and a 54.1% majority agreed (13/24), while 20.8% disagreed. Most students did not use risk-adjusted models to predict postoperative complications (62.5% disagreed). Overall, only a minority 12.5% (3/24) of students felt the surgery clerkship provided enough exposure to allow them to adequately predict postoperative complications.

The students were then presented with 7 medically complex patients and asked to predict postoperative morbidity and mortality as well as to make a decision about offering surgery while accounting for their predicted outcomes. Estimates varied significantly, with wide 95% confidence intervals. The responses of the students were compared to the responses of the general surgery residents to the same scenarios. Both groups' responses were compared to the estimates generated from the ACS NSQIP risk calculator as described. For the majority of the presented cases (57%), medical students and general surgery residents similarly overestimated postoperative morbidities and mortality. General surgery residents of all post graduate years of training overestimated postoperative morbidities and mortality to the same degree. For 3 cases, resident estimates for morbidities and mortality were higher than medical student predictions, however both groups still significantly overestimated risk when compared to the NSQIP risk calculator.

DISCUSSION

This study serves as a needs assessment for the creation and dissemination of a formalized curriculum of risk prediction for student trainees. Not surprisingly, third year medical students at the completion of their surgery clerkship were less confident in their ability to predict operative morbidity and mortality than general surgery residents. This lack of comfort and confidence is important to acknowledge; the clinical years are an opportunity for students to gain proficiency and confidence in fundamental skills they will require as practicing physicians. Curriculum design following needs assessment is well documented; the number of times a trainee completes a task correlates with confidence in performing that task.[6] In fact, for the primary care clerkship, hands-on clinical experience is an important predictor of confidence in performing a task, and we believe this could apply to the surgical clerkship as well.[7] A successful example of this early prioritization of a newly important skill occurred in the early 2000s, when medical schools introduced communication curricula to medical students in an effort to improve clinician competence in communication skills and patient centered care, and were successfully able to do so.[8]

Additionally, the Association of American Medical Colleges now outlines entrustable professional activities (EPAs) that graduating medical students should be competent in at the time of graduation. EPA 11 states that students should be competent in obtaining informed consent for tests and/or procedures (https://www.aamc.org/download/482208/data/epa11toolkit.pdf.) A curriculum focusing on risk prediction and the use of risk assessment tools in the informed consent process, could be a vital component in helping students reach competence in EPA 11. Although students do not formally obtain informed consent in our program, we assessed their perception of their stake in preoperative decision making conversations.

This study demonstrated the lack of exposure to risk prediction which may have resulted in the trainee's lack of confidence in their predictions. Inherently, students recognize the importance of accurate predictions. Despite resident trainees being more confident, overall student estimates were similar to those of surgical residents, who also lack formal training in preoperative risk stratification. Both medical students and residents significantly overestimated operative risk when compared to risk adjusted models. Prior studies have shown that overestimation is not limited to trainees; surgical attendings and our medical colleagues similarly, significantly overestimate risk.[9] This suggests that student predictions are either random or experiential through observation.

There is no structured curriculum to teach risk prediction in surgery. Commonly, risk assessment skills in surgery are acquired via modeling by mentors.[4] There is a wide body of literature on medical decision making, especially in high risk situations. Individuals are prone to many systematic reasoning errors both in groups, and individually. They often rely on the availability heuristic, and other mental shortcuts to make judgments based on their immediate personal recall of past patients.[10] There are many ways in which physician and patient decisions can be influenced by communication techniques alone.[11] In addition, physicians are biased when assessing risk; in a study of internal medicine clinicians, they overestimated harms and benefits of most treatments.[12, 13]

Objective risk predictive models now exist, the most comprehensive is the ACS NSQIP Risk Calculator. This calculator aids not only in risk stratification, but importantly, can also aid in the informed consent process as it produces printable, patient specific information.[5] Its objectivity and ease of use afford the opportunity to introduce these important concepts to medical students

and can also foster, at an early stage, an accurate preoperative cardiac assessment.[14, 15]

This study has several limitations. We are unable to correlate individual participant responses due to strict medical student study protection policies. For example, we are unable to assess the correlation between those who used a validated risk prediction tool with their operative decision making. Additionally, we are unable to account for the effect of behavioral modeling from residents and attending surgeons on the usage of predictive models.

The early introduction of a risk-assessment curriculum would increase our students' knowledge of and comfort with understanding operative risk, as well as communicating about operative risk. This would hopefully translate to more accurate patient conversations regarding treatment risks and benefits, and lead to truly informed consent.

CONCLUSION

Students lack exposure to risk prediction training in surgery, lack confidence and comfort with the preoperative risk predictive process, and overestimate risk of complications and death. There is a need for creation of a formal risk assessment curriculum for medical students and to understand the impact of such curriculum on the students' understanding of postoperative risk.

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SUPPLEMENTARY INFORMATION

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jsurg.2018.07.011.

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