

# The Science of Selection: Using Best Practices From Industry to Improve Success in Surgery Training

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**BACKGROUND:** The selection of high-quality applicants is critical to the future of surgery. However, it is unclear if current practices meet industry criteria of a successful selection system, as measured by administrative efficiency and performance and attrition of those selected.

**METHODS:** We performed a modified systematic review process to gain an understanding of current selection processes, remediation practices, and attrition rates in surgery residency training programs in the United States. We also conducted semistructured interviews with local residency program directors and coordinators to obtain a specific snapshot of the amount of time and resources dedicated to these activities in various sized programs. The associated financial costs of these activities are also presented.

**RESULTS:** The administrative costs for current residency selection processes are substantial, ranging from \$45,000 to \$148,000 for each program per year. Approximately 30% of residents require at least 1 remediation intervention, costing programs \$3400 to \$5300 per episode, and typically involve concerns around nontechnical skills. Attrition rates range from 20% to 40%.

**CONCLUSIONS:** This review suggests that additional methodologies may allow surgery residency programs to identify best-fit candidates more efficiently and effectively, while also decreasing remediation and attrition rates. Possible solutions include incorporation of structured interviews, personality inventories, and situational judgment tests. Resources dedicated to current interview practices, remediation efforts, and attrition management can be redirected to support these methodologies. By applying the science of selection and assessment to the

recruitment process, programs may be able to make more data-driven decisions to identify candidates who will be successful at their institution. (J Surg Ed ■■■■-■■■. © 2017 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

**KEY WORDS:** selection, recruitment, cost, applicants, attrition, remediation

**COMPETENCIES:** Systems-Based Practice, Practice Based Learning & Improvement

## INTRODUCTION

Modern surgery residency training requires efficiency. New technologies, evolving techniques, duty-hour restrictions, changes in team dynamics, and increased administrative demands for both faculty and residents have intensified burdens placed upon training programs. These factors require that residents rapidly adapt to their chosen training environment, quickly develop skills to work independently, and avoid delays in their training because of remediation or performance issues. One way to identify those most likely to succeed is to create a robust and validated selection process. In fact, the Royal Colleges of Surgeons in Canada, Australia, New Zealand, England, Ireland, and Scotland have all identified better selection of surgery trainees as a key initiative integral to improving surgical residency.<sup>1</sup> Unfortunately, surgery residency directors may be unaware of the science of selection commonly used in industry, instead relying on ad hoc interview and selection processes that can result in remediation and attrition rates higher than those accepted in nonmedical fields.

This report defines the current paradigm of surgery resident selection and compares it to metrics used in industry to determine the return on investment (ROI) of a selection system: administrative efficiency, performance of those selected, and attrition rates. Through data collected from empirical review and semistructured interviews, we also provide the monetary and nonmonetary costs associated with current selection processes.

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Finally, we propose that additional methodologies and assessment strategies may allow programs to identify best-fit candidates more efficiently and effectively, while decreasing remediation and attrition rates and improving resident satisfaction, thus increasing the ROI of our current selection system.

## METHODS

We performed a modified systematic review process, the Systematic Rapid Evidence Assessment or Rapid Review, which uses a variety of methods that incorporate the principles of systematic review technology but modifies the methods used to complete work within a specified time or on a multitude of topics, to gain an understanding of the current selection, remediation, and attrition management processes in surgery residency training programs in the United States. Because of the variety of research questions being addressed in this review and the variety of research designs and methods, a synthesis approach such as a meta-analysis could not be adopted. Online databases, including the Cochrane Library, Ovid MEDLINE, and PubMed, were used to search for terms associated with residents (education, medical, graduate/or internship and residency/or education, medical) and then selection (select, selection, interview, screening, recruitment, application, onboarding, mini multiple interviews, references, personal statements, USMLE, academic records, personal statements), remediation (remediation, problem, concerns, intervention, probation, performance improvement, high-risk, deficits), and attrition (attrition, turnover, dismissal, termination, fire). Findings from each of these searches are presented under the core topic areas.

Next, we performed semistructured interviews with local residency program directors and coordinators to obtain a specific snapshot of the amount of time and resources dedicated to these activities in various sized programs. Specifically, individuals were asked to describe their current screening process beginning with

receipt of applicants through the Electronic Residency Applicant Service (ERAS) system. The interview guide included questions for each work activity including (1) purpose, (2) who (role and number of individuals) was involved, (3) amount of hours involved, (4) if any preparatory work was need for that task to occur, and (5) frequency of recurrence. Program Directors and Coordinators were also asked to think about 1 remediation intervention for professionalism, technical skills, and problem solving that had occurred in the recent past. For each scenario, individuals were asked to (1) describe the situation in a deidentified manner, (2) discuss how and when program administration got involved, (3) specific actions taken by administration, (4) what preparation or development was needed to lead up to those actions and by whom, (4) if anyone outside the department was involved, (5) recurrence of activities, (6) amount of hours involved for each task, (7) amount of resident time involved, and (8) length of intervention.

These data are presented along the ROI framework offered by aforementioned selection scientists. Specifically, we report results of these methods along the topics of (1) recruitment/selection efficiency, (2) candidate performance, and (3) candidate retention. We note the monetary and nonmonetary expenses of each of these phenomena in turn. Finally, we conclude with a summary of alternative selection methodologies that have proven successful in other industries and may have value for the screening process in surgery.

## RESULTS

### Costs of Current Processes

#### Monetary Costs of Interviews

Table 1 provides a case illustration of the typical selection methodology<sup>2</sup> and associated staff and faculty hours from both author's institutions, representing a larger ( $N = 13$

**TABLE 1.** Cost of Interview Process for a Large and Small Residency Programs

	Total Staff Hours	Total Faculty Hours	Total PGY Hours	Total
Review and invite applicants				
Small	71	30	0	263
Large	104.5	30	0	134.5
Prepare and conduct interviews				
Small	80	200	100	380
Large	75	400	120	595
Final ranking				
Small	8	19	0	27
Large	9	80	18	107
Total hours				
Small	163	249	100	512
Large	188.5	510	138	836.5
Total cost				
Small	\$4107.60	\$45,269.00	\$2,850	<b>\$52,227</b>
Large	\$4750.20	\$103,530.00	\$4,140	<b>\$112,420</b>

Note: Small program: staff cost:  $\$25.20/\text{h} \times 163 \text{ h} = \$4107.60$ ; faculty cost:  $\$203/\text{h} \times 249 \text{ h} = \$45,269.00$ ; PGY cost:  $\$30/\text{h} \times 95 \text{ h} = \$2850.00$ . Large program: staff cost:  $\$25.20/\text{h} \times 188.5 \text{ h} = \$4750.20$ ; faculty cost:  $\$203/\text{h} \times 510 \text{ h} = \$103,530.00$ ; PGY cost:  $\$30/\text{h} \times 138 \text{ h} = \$4140.00$ . PGY, postgraduate year; Total Costs are in Bold.

categorical positions per year) and smaller ( $N = 5$  categorical positions per year) program, respectively. The various activities and associated number of hours spent for the selection process by Program Directors ( $N = 3$ ) and Program Coordinator ( $N = 3$ ) teams at each institution during the previous match cycle were logged. Time estimates do not take into account social activities that were provided for interviewees. This process involves obtaining applications from the electronic residency application service (ERAS), an initial screening of the applications with predefined criteria (i.e., USMLE scores, grades, and letters of recommendation) and initiating the invitation/scheduling process. Administrative staff and resident values reflect mean hourly wages. Faculty values reflect opportunity costs, capturing the loss of potential gain from other activities (clinic care, performing surgery, research, administrative duties, etc.). These values are based on reported average hourly rates for both surgeons in training and in practice.<sup>3,4</sup>

Table 1 displays this process for the large program inviting 200 applicants over the course of 5 interview days to fill 13 resident slots and a smaller program receiving 750 applications and interviewing 60 applicants over 4 separate interview days to fill 5 resident slots. As shown, these conservative values range from \$52,227 to \$112,420. Reports from Program Director surveys in other specialties estimate that median values of this process per program are closer to \$148,000 per program.<sup>5</sup>

### Monetary Costs of Remediation

Table 2 illustrates case time and costs associated with remediation methods for three hypothetical residents with professionalism, decision making, and technical skills deficiencies as informed by responses from the semistructured interviews. Each estimate takes into account 2 meetings with the program director, as surgical educators have noted that most residents begin remediation after repetitive concerns have been noted in evaluations/ratings.<sup>6</sup> The resident's issues are then reviewed by a review committee (i.e., Clinical Competency Committee) and an improvement plan is created. The first example is for a resident with professionalism concerns. The remediation plan occurs over 3 months and includes monthly meetings with a faculty advisor and a final review again conducted by the review committee. The decision making and technical skills remediation plans involve similar pathways for improvement. As shown in Table 1, these fairly conservative remediation practices range from \$3,400 to \$5,000 per

resident per episode. Thus, a program graduating six chief residents per year and remediating 30% of its trainees just one time across five clinical years of training will spend between \$6700 and \$10,500 per year on remediation.

The prevalence of these remediation practices are informed by literature reviews examining resident remediation in surgery programs. For example, Sanfey et al.<sup>7</sup> revealed that the predominant issues exhibited by struggling trainees involve the nontechnical competencies, such as knowledge, interpersonal skills, and professionalism.<sup>7</sup> Unfortunately, these nontechnical areas are those in which program directors report the most uncertainty regarding how to implement remediation protocols.<sup>6</sup> Additionally, a recent retrospective analysis of 348 categorical general surgery residents at six West Coast programs found that 31% of residents required remediation for issues related to medical knowledge, interpersonal skills, and communication abilities, and that 27% of these residents required more than one remediation intervention.<sup>8</sup> Another study conducted at a single institution noted a 22% rate of serious performance problems among general surgery trainees.<sup>9</sup> Bergen et al.<sup>10</sup> similarly found that 20.8% of surgery residents at a single institution were high-risk or problem residents, most of whom exhibited deficiencies in interpersonal behavior.

### Monetary Costs of Attrition

Although zero percent attrition is not realistic (and likely not healthy), turnover rates greater than 15% are considered unhealthy and a cause for alarm in industry.<sup>11</sup> Current attrition rates are extremely costly for programs. Direct medical education costs alone are \$80,000 per trainee, per year, and do not include costs associated with interviewing, onboarding/training, supervisory time dedicated to on-the-job training, and the losses incurred for re-filling a position.<sup>12-14</sup> Thus, a significant monetary loss is incurred when a resident leaves a program after one, two, or three years of training and the program is unable to fill the position.

The rate of attrition from general surgery programs appears to be four to five times higher than that in other surgical subspecialties.<sup>15</sup> A 20-year study of Yale residents by Longo et al.<sup>16</sup> revealed that 30% of categorical general surgery residents at their institution failed to complete the general surgery program. Of note, most of these trainees (77%) left before beginning their third year. Although the reasons for dismissals were multifaceted, the authors pointed to behavioral issues (inappropriate behavior, dishonesty,

**TABLE 2.** Time and Costs Associated With Remediation Plans for Professionalism, Decision Making, and Technical Skills

Remediation Area	Staff Hours	Faculty Hours	PGY Hours	Attorney Hours	Total Cost
Professionalism	2	15.65	5.66	0	\$3397.15
Decision making	5	20.68	11.66	2	\$5413.84
Technical skills	2	16.28	26.6	0	\$4155.04

Note: Staff cost: \$25.20/h; faculty cost: \$203/h; PGY cost: \$30/h; attorney cost: \$370/h. PGY = postgraduate year.

etc.) as reasons for leaving. The authors concluded: “although programs recruit residents primarily on cognitive factors, such as grades on clinical rotations and standardized board scores, it is the vital noncognitive issues that are associated with failure.” Attrition rates reported from other institutions are varied, but typically range between 18% and 26%.<sup>17-22</sup> Some have reported rates as high as 40% to reflect how many trainees began surgical residency but did not finish in either general surgery or a surgical subspecialty.<sup>23</sup>

### Nonmonetary Costs of Attrition

**Reputation.** Unfortunately, an inefficient selection system can have widespread effects on a program’s reputation. Applicants judge the likelihood of future organizational behavior based on the extent to which the organization has performed the activity in the past.<sup>24</sup> Thus, for departments that have experienced increased attrition in the past, applicants are likely to surmise that similar levels of attrition will continue to occur, influencing their perceptions of the program’s reputation. Work outside of medical education has demonstrated that high levels of attrition have a negative effect on organizational reputation.<sup>25,26</sup> Furthermore, this relationship is intensified for organizations who previously experienced the strongest reputations.<sup>27</sup> This “the higher they are, the harder they fall” phenomenon suggests that when institutions with traditionally positive reputations began experiencing high levels of attrition, observers interpret it as a sign of weakness in the system.

**Morale.** Increased levels of remediation practices and attrition resulting from ineffective selection systems can also have a substantial effect on trainee attitudes and morale. As noted by Longo,<sup>28</sup> experiencing attrition can negatively affect the morale of surgery residents remaining in the program. Unexpected labor shortages can stress the system as well as compromise the extent to which the remaining residents acquire necessary skills. Longitudinal studies have shown that continuously working in these types of environments can increase perceptions of job insecurity and its related effects. Thus, even when residents remain in a program, witnessing their colleagues leave deepens feelings of job insecurity, which has been associated with intensified psychological stress, burnout, and withdrawal.<sup>29-32</sup> Work investigating the “survivors of attrition” have demonstrated that those who remain in a department enveloped with attrition experience poorer psychological health than those who actually left.<sup>33</sup> This process is extremely concerning given the baseline prevalence of stress, burnout, and career dissatisfaction among American surgeons.<sup>34-36</sup>

## DISCUSSION

These data reveal that the current selection process for general surgery residents is a costly endeavor, and there may

be opportunities to expand the ROI (as measured by efficiency, remediation, and attrition rates). Programs are spending \$50,000 to over \$100,000 annually on the current selection process. Unfortunately, these costs do not end after recruitment. Estimates suggest that programs must remediate approximately one-third of residents during their time in training,<sup>8</sup> and the cost of each remediation episode per resident is around \$4,000. Perhaps even more concerning are the attrition rates in surgery. Recent reviews of attrition in general surgery suggest that 20% to 30% of trainees do not complete their training.<sup>37</sup> Programs who are unable to fill these positions experience sunk costs of at least \$80,000 per year.

Fortunately, organizational researchers and practitioners can provide helpful insight into common selection methodologies and assessment strategies that may have value for the residency selection process. What follows is a description of common selection methodologies used in industry, with examples of how they might be implemented into surgery.

### Structured Interviews

As noted earlier, decisions about residency selection are highly based on an unstructured interview process.<sup>2</sup> Unfortunately, using unstructured, “get-acquainted” interviews in surgery results in subjective, global evaluations that are often of little value and even illegal.<sup>38</sup> In fact, studies have found that when applicants who have been initially rejected admission based on unstructured interviews join a medical class, there are no differences between initially rejected and initially accepted students in terms of attrition, academic performance, clinical performance, or honors earned after medical school and 1 postgraduate year later.<sup>39</sup> Several other studies have provided similar examples of the disconcertingly poor validity of unstructured interviews for screening decisions.<sup>40,41</sup>

In contrast, structured interviews rely on more objective evaluation procedures, such as consistently asking only job-related questions, providing training on interviewing skills, and rating on established scoring formats.<sup>42</sup> This standardization and reliance on systematically evaluating knowledge, skills, and abilities related to performance has been found to improve the quality of selection decisions compared to unstructured interviews.<sup>43,44</sup> Across 3 separate meta-analyses, researchers have demonstrated that the predictive validity of structured interviews is twice that of unstructured interviews.<sup>43-45</sup> Further comparison of these techniques has revealed that it requires a minimum of 4 interviewers for unstructured interviews to achieve the levels of reliability and predictive validity that 1 interviewer using structured interview techniques would attain.<sup>46</sup> Despite the fact that interviewers continue to have ample confidence in their ability to select the best candidates using unstructured interviews,<sup>47</sup> empirical work in surgery has shown that



faculty have little interrater agreement during the interview process.<sup>48</sup>

Fortunately, curricula have been developed using frame-of-reference training and case reviews as a foundation to ensure faculty interviewers are aware of structured interview basics, are using rating forms in the same manner, and are aware of how to avoid inappropriate questions.<sup>48</sup> Given the finding that applicants to surgical programs experience the highest number of inappropriate interview questions,<sup>38</sup> implementing programs designed to inform and train faculty on how to avoid these questions may be an ideal starting point.

## Personality Assessment

The appeal of including interviews in the selection process stems from the acknowledgment that factors besides cognitive abilities are necessary for trainees to be successful in surgical programs. Thus, interviews are used to assess elements such as personality and fit with a program. However, these characteristics can be assessed most efficiently and objectively with personality tests. Because the relationship between personality characteristics and job performance has been well-established across a variety of occupations,<sup>49,50</sup> including personality testing during the screening process is extremely common outside of surgery. Approximately two-thirds of medium to large organizations use some type of personality and aptitude testing in job applicant screening.<sup>51</sup> Additionally, more than 40% of Fortune 100 companies in the United States report using personality tests for assessing some level of job applicant from front line workers to the CEO.<sup>52</sup> In fact, every one of the Top 100 companies in Great Britain has reported using personality tests as part of their hiring procedure.<sup>53</sup> Implementing such testing has been found to reduce turnover rates by as much as 20%,<sup>54</sup> 30%,<sup>55</sup> 40%,<sup>56</sup> and even 70%.<sup>57</sup> Given the high level of attrition previously discussed (industry standards strive for attrition rates well below 15%<sup>11</sup>), these studies suggest that general surgery programs can benefit from such prescreening of applicants. Including this form of assessment can be quite feasible for surgical training programs. For example, after meeting eligibility and other critical criteria, applicants could be directed to an online assessment platform in which they complete a timed, personality assessment. Programs could screen these results to identify any potential outliers in personality characteristics deemed valuable (conscientiousness, industriousness, etc.), thus narrowing down the applicant pool before on-site interviews. Inclusion of this type of assessment could increase the amount of standardized and job-related data available to administrators, while also enhancing the efficiency of on-site interviews.

## Situational Judgment Tests

As noted earlier, decision making is often cited as a primary reason why surgical trainees are dismissed from programs. Thus,

implementing screening processes to measure judgment would be of substantial value to the surgical community. Situational judgment tests (SJTs) are a measurement method designed to assess judgment in work-relevant situations. These “low fidelity” simulations use written vignettes of common workplace scenarios to present applicants with challenging situations likely to be encountered on the job. Candidates must make judgments about possible responses under a certain degree of uncertainty (Appendix).<sup>47</sup> Applicants are scored against a predetermined key defined by subject matter experts. The value of these tests lies in their ability to measure a wide array of professional attributes (leadership, interpersonal skills, crisis management, etc.) and that they are customized to identify desirable qualities within a particular organization. Thus, SJTs can provide unique value to surgical training programs because they can be customized to assess competencies that a program cares about.

Meta-analyses have demonstrated that SJTs are able to predict job performance, and offer incremental validity over other selection measures, such as biographical data, structured interviews, and assessment centers.<sup>58,59</sup> Organizational consultants have noted that using SJT methods for screening applicants provide a realistic job preview, giving the applicant common scenarios in which they would be placed on a frequent basis. This process encourages applicants to consider their fit within the organization, resulting in up to 25% self-selecting out after realizing a misfit. Additionally, implementation of this process has been shown to reduce the interview burden by approximately 33%.<sup>60</sup> For these and other reasons, SJTs are already a natural component of selection of medical trainees in the United Kingdom, Belgium, Canada, Israel, Singapore, and Australia.<sup>61</sup> Additionally, the Association of American Medical Colleges (AAMC) is undergoing preliminary work to incorporate SJTs into medical student selection.<sup>62</sup> Given the substantial amount of data demonstrating the predictive validity surrounding use of SJTs, that they are cost-effective to develop and administer, and that there is convincing data regarding their use in surgery,<sup>63</sup> their use in selection of surgical trainees should be seriously considered.

## CONCLUSION

As shown, surgery residency programs dedicate significant resources to the current selection process, revealing that program leaders place great value on the ability to successfully identify candidates who will be able to thrive in their training environment. However, the quality of this decision-making process is dependent upon the quality of the data behind it and, unfortunately, selection methods adopted by most residency programs are not capturing critical data points for the desired competencies. This may account for the burgeoning remediation and attrition rates seen in general surgery residency training today. Defined competencies, valid assessments, and efficient processes should

form the foundation of the resident selection system. Given the steady increase in the applicant pool for General Surgery over the last 5 years,<sup>64</sup> now may be the most ideal time to implement new processes so that Program Directors can identify high-quality applicants that fit best into their particular training program in the most efficient manner possible.<sup>65,66</sup> As shown, any costs incurred by a residency program investing in a more efficient selection process will be more than made up for by less money spent on remediation and attrition with the invaluable additional benefit of enhanced reputation and morale.

## APPENDIX

Sample situational judgment test question for general surgery residency applicant.

**Please respond to the following item, ranking each possible response from most to least appropriate.**

You are a junior resident rotating on a service that frequently interacts with Emergency Department residents and attendings. Unfortunately, the Emergency Medicine (EM) department and Surgery house staff have a history of confrontation. As a result, you find that your actions are constantly being scrutinized and questioned by Emergency Department faculty and residents. Your attending has received multiple complaints about your interpersonal behavior, although you are certain they are unfounded. Which of the following actions should you take, from most to least appropriate?

- (A) Tell your attending the complaints are without merit.
- (B) Talk to your colleagues to see if they are having similar experiences on this rotation.
- (C) Speak with the EM faculty to inquire more about how your behavior is being perceived.
- (D) Apologize to EM faculty and residents and monitor your behavior closely.
- (E) Do nothing, and keep to yourself until the rotation is over.
- (F) Speak with the Program Director about these issues.

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