Selecting Residents for Predetermined Factors Identified and Thought to be Important for Work Performance and Satisfaction: A Methodology

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OBJECTIVE: The medical profession seeks to hire and train individuals who consistently meet and/or exceed both job and cultural expectations. Resident selection is often not structured to meet this goal. The objective of this quality improvement project was to evaluate a classic unscripted interview process (OI) in conjunction with a structured, scripted interview process (SI) developed using an established hiring methodology from industry not yet utilized in health care. Qualitative questions we sought to answer: (1) Can SI be practically applied to the selection of residents? (2) Is there a significant difference in the relative position of applicants between the OI and SI rank lists? (3) Qualitatively, does SI help the evaluation/discussion of the affective domain?

METHODS: Design: Prospective qualitative comparison of OI versus SI.

Setting: Dartmouth Hitchcock Medical Center, Lebanon, NH.

Participants: Applicants were assessed by OI and SI. SI factors were selected based on a job profile. Interview scripts were created from validated behavioral and attitudinal questions. Online assessments assessed 2 important attributes - adaptability and values. Rank lists were compared for relative rank position of applicants. Feedback from faculty was obtained.

RESULTS: Fifty-two applicants. Critical attributes were self-management, integrator-synthesizer, versatility, communication, and achievement. Absolute mean difference in rank/applicant was 9.8 (standard deviation 8.9, Range 0-36) positions. Comparing the top 20 candidates of each rank list, 40% of those applicants were only on one list. Faculty felt that applicants were given a greater opportunity to show "who they are."

CONCLUSIONS: In conjunction with OI, an industry proven methodology was practically applied to define and select for high performance for the authors' specific institution. Comparing OI and SI resulted in substantial differences in rank lists. This initiative seemed to provide a structure to evaluate values and motivations that are inherently difficult to assess. Faculty felt SI in conjunction with OI gave a greater chance for applicants to show "who they are." (J Surg Ed 76:949–961. © 2019 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: Selection, education, resident, performance, metrics

COMPETENCIES: Professionalism, Interpersonal and Communication Skills, Practice-Based Learning and Improvement

INTRODUCTION

Accurate identification of orthopedic residents with the capacity for high post-training performance and satisfaction metrics remains a challenge. This remains true even though there is a great deal at stake—the health and safety of patients. Historically, resident selection has overwhelmingly relied on cognitive evaluations of candidates. This is an important component of success as it largely predicts successful passage of the American Board of Orthopedic Surgery exams but without informing success in clinical practice.[1-4] The "affective domain," which includes emotional factors such as our "personal and professional values," has long been

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viewed as an equally important factor for success as a practicing orthopedic surgeon.[5,6] For example, poor professional behavior has been cited as the most common reason for resident dismissal.[7] Porter et al.[8] reported that the 48% of programs placed 2 or more residents in remediation or probation in the prior 6 years. Forty percent had terminated a resident and 12% had terminated more than one. Bernstein et al.[6] reported that 1 in 3 resident selections were felt to be inappropriate and 1 in 12 was considered a serious mistake.

The interview process has been a cornerstone of the affective domain evaluation in orthopedics. However, unstructured interviews, letters of recommendation, and personal statements are biased, lack clear focus on job-related attributes, lack a comparison, and are unreliable in predicting performance.[7,9,10] Orthopedic surgery, as well as many other residency programs recognize these challenges and have struggled to develop a practical method of defining, assessing, and selecting for factors predictive of success.

In contrast, high performance, forward-focused organizations outside healthcare expend substantial time, effort, expertise, and resources to develop clear job expectations, performance metrics, and selection and development criteria to such an extent that an industry has developed to provide the expertise and tools to corporations.[11] Industry leaders recognize that the most important element of accurate hiring is a clear definition of critical job deliverables and performance expectations.[12] This requires understanding, documenting, and building a performance culture focused on measurable outcomes and methods. With a comprehensive and granular job description, selection, and development becomes focused on assessing candidates for specific attributes. These include job-specific and transferable capabilities, adaptability, motivations, values, and interests. The goal of any selection process is to choose applicants with the highest probability of developing into high performers and to avoid poor performers who can have devastating effects on coworkers, patients, and/or the organization, with deleterious effects on costs, culture, performance, and retention. Unlike nonhealthcare organizations, orthopedic faculty members often have individual and disparate concepts of important applicant characteristics, which may limit the mitigation of personal biases and result in the selection of applicants that resemble the faculty evaluators.[13] Moreover, this selection process often results in a mix of incomplete or wasteful assessments of candidates and difficult group discussions to create a rank list.

Residency programs clearly seek to hire and develop individuals who consistently meet and/or exceed both the job and work culture expectations. This involves both positive, productive task results and positive relationships with all its key stakeholder groups. However, job and work culture performance expectations are often unclear for both faculty and residents, making the selection, evaluation, and professional development of orthopedic professionals challenging and too often ineffective. The purpose of this quality improvement work was to answer the following questions: (1) Can scripted interview process (SI) be practically applied to the selection of residents? (2) If SI is evaluating specific attributes and not the overall application (USMLE scores, Number of Honors, Personal statements, Letters of recommendations, etc.), is there a significant difference in the relative position of applicants between the classic unscripted interview process (OI) and SI rank lists? (3) Qualitatively, does SI in conjunction with OI assist the evaluation/
discussion of the affective domain?

This is the first time this methodology has been applied in residency selection. This paper serves as a methodological introduction with largely qualitative results.

MATERIAL AND METHODS

Background For Methods

This quality improvement initiative used an established model (Hiring & Developing Winners) developed by Dr Michael O'Connor and colleagues with over 40 years of applied research in actual work environments across industries and roles.[14] This model has been validated.[15-19] The methodology specifically focuses on differentiating types of **Capabilities** and **Motivations** as they relate to applicant performance.

A. **Capabilities** describe what a person does and does not do well. It includes 3 key types of general factors, each with more specific performance-focused subfactors:
   1. **ADAPTABILITY:** Flexibility and versatility analysis which describes our willingness as well as our ability to effectively deal with change—unfavorable, difficult, new, and ambiguous situations.
   2. **TRANSFERABLE CAPABILITIES:** This involves 93 possible specific capabilities in 12 areas. These areas involve different task, relational, or mixed (task and relational) jobs-related performance strengths. This analysis identifies the level of strength for each, the level of difficulty for developing each, and length of time for doing so, i.e. decision making, problem-solving, creativity, etc.
   3. **JOB SPECIFIC CAPABILITIES:** Measures the knowledge, skills, and experience applicable only to a job. It is important to note that job-specific capabilities were not utilized in this quality improvement project.

Psychomotor testing has been evaluated in other work and did not fall into the scope of this project.[20]

B. **Motivations** describe what a person will and would not do. It includes 3 key primary types of performance factors related to performance success and/or satisfaction depending on the differing requirements of various jobs. These include:
   1. **PERSONAL WORK STYLE:** Describes what a person is naturally **motivated** to do/not do and how they act on such preferences and/or more comfortable, ingrained habits in situations. Personal work style was not evaluated in this project. A diverse work style was felt to be a component of a well-rounded department. Dr O'Connor and colleagues believe there is NO single best work/personal style since it is NOT predictive of high performance by itself.[17]
   2. **PERSONAL WORK VALUES:** Describes our personal compass about what we believe in or what we value. It explains "why" we do what we do. This values assessment is based on **empirical**, cross-cultural, and long-standing research describing the 4 types of personal values points-of-view that occur and reoccur across generations globally over time regardless of the "labels" used to describe them (e.g., Conventionalists, Millennials, Gen X, others). It is based on developmental research about the personal evolutionary path of an individual's values often transformed by either significant emotional events or socialization experiences in their work and nonwork lives. It is "systemic" in that it defines the range of personal goals, fears, lifestyles, world view, beliefs, common strengths, and development opportunities for each pattern.
   3. **PERSONAL WORK INTERESTS:** Focuses on our passions, and what most (and least) interests us. It provides insights about both our work and nonwork interests and disinterests. It identifies our own "field of interests" and its implications for different types of jobs. These often vary significantly between work and nonwork, explaining a key source of personal satisfaction based on our own "inner wiring."

The methodology for this quality improvement initiative included the following 8 steps:

It should be noted, that unlike other efforts to define attributes, this study did not start with a study of existing residents. Rather we chose to start the process from the beginning and define the job for which we are hiring a resident. In order to get to that, we had to define the job of the faculty for our specific institution—the finish line. Moreover, each residency would be unique although likely similar. For orthopedics in particular where >90% of residents are male, starting with the "job" allowed building attributes from the job profile rather than from the current residents.

Step 1: Qualitatively define a descriptive job analysis profile for faculty orthopedic surgeons and first year orthopedics residents

A job analysis profile was created by the authors by an established methodology. The initial job analysis was created for faculty. It was then modified to the role of a 1st year resident. The Job Analysis Profile consists of an in-depth analysis of any job by identifying and prioritizing the **Key Results Areas (KRAs) and Critical Tasks (CTs).** KRAs are those activities that have the greatest positive impact on performance. CTs are those tasks required to fulfill the KRAs. In general, there are only 3 KRAs and 3 CTs for any job. Each KRA and CT is then assigned an impact percentage, which is a measure of the importance or impact on success of each with regard to total performance (100%). By assigning the impact percentage, the relative importance of each result area and tasks can be evaluated and prioritized. In order to define the KRAs and CTs the following questions were asked: What is the most critical key activity required for success as an orthopedic surgeon? What is the second? What is the third? Why is each one so important? In short, it was asked of the authors what is important and why is it so important? Themes emerge. The authors iterated the results. Once these were established, the impact percentage of each KRA was assigned. The assigned percent impact should not be equal. Then each KRA was broken down into the 3 CTs that were required for success in that KRA. Each CT was assigned a portion of the percentage assigned to the respective KRA. For example, if KRA #1 is assigned 60%, then this 60% was split among its 3 CTs with none being equal for prioritization. The impact percentages were checked for comparative impact. This was performed as a group within the orthopedic department then iterated and approved by the full faculty. Only once the faculty version was finished was a first-year resident job analysis profile created. The final version of the first year resident job analysis profile was utilized in this quality improvement initiative.

Step 2: Mapping the job analysis to factors

Impact percentage of the KRAs and CTs were mapped to factors (adaptability, transferable capabilities, values and work interests) that were required for applicant performance and job satisfaction.

Step 3: Structured interview creation and implementation

A targeted, structured interview script for each of the critically and highly important factors was made from a battery of behavioral and attitudinal questions. An

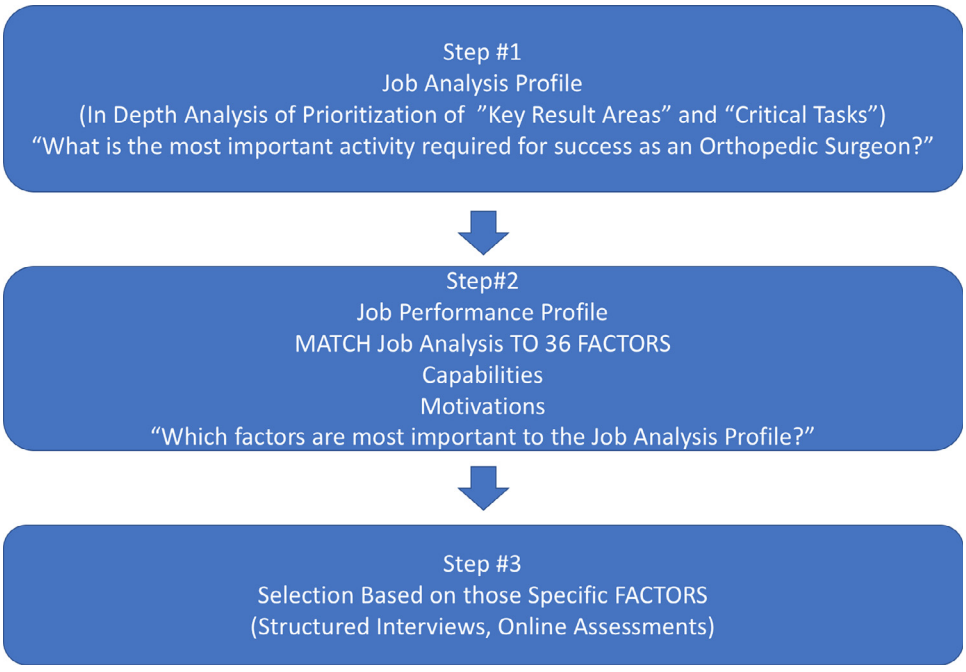


FIGURE 1. The methodology was sequenced. Step#1: First was the development of a Job Analysis Profile that prioritized the most important activities, why they are important, and what critical tasks are needed to meet the key result areas. Step #2: From this a Job Performance Profile was created by matching the Job Analysis to factors that were important to the key result areas and critical tasks. See Figure 5. Step #3: Once these factors were determined residents were then selected specifically for those factors utilizing a structured interview process and online assessments.

established scoring algorithm was created as well as an overall score for each rater for the specific factors. Each of the 4 rooms (2 interviewers/room) focused on 2 or more
factors. Generally, factors that were related were placed together. An overall score as well as a score for each factor was recorded by each interviewer.

For a graphic summary of Steps 1-3 please see Figure 1.

Step 4: Online assessments as corroborating resource

Interviewees were asked to take an online assessment of Adaptability and Personal values prior to the on-site interview. Results were NOT provided to the candidates or the interviewers prior to the structured interview.

Step 5: Development of structured rank list

Candidates were ranked based on a composite of the overall scores, critical factors scores, highly important factors scores, and online assessments. All scores except the online assessment scores were weighted to account for the variations between interviewers. A group discussion was not part of the process to make the SI rank list. Of note, a group discussion was also not part of the process for OI rank list.

Step 6: Qualitative comparisons of OI and SI

All applicants interviewed for orthopedic residency were assessed by 2 processes. (See Fig. 2) The first was OI which consisted of classic unscripted interviews as done in prior years. The assessment content and process were independently determined by each interviewer. SI was a consistently applied, structured interview process to assess only for the specific factors as well as an online assessment that was completed prior to the on-site interview. Each interview station was a total of 15 minutes. There were 7 OI interviews. One rank was given for each of these rooms. There were four SI rooms with 2 selected, trained faculty interviewers per room. For SI each faculty member was instructed to independently score each applicant. Online assessment results were not made available to the interviewers prior to the interview for practical reasons. Online assessments were assigned a weighting and incorporated into the final SI rank. Both the OI and the SI groups independently created a rank list. Both rank lists were made without a group discussion. The 2 rank lists were compared to evaluate the absolute difference and directional difference of the candidates' ranks.

Step 7: Qualitatively document final rank list discussion

As had been done in the past, the selection committee met as a group made of all those who took part in the interview process to create a final rank. A dedicated observer documented the discussion at the final rank list meeting. Notes were utilized to develop qualitative themes of the discussion.

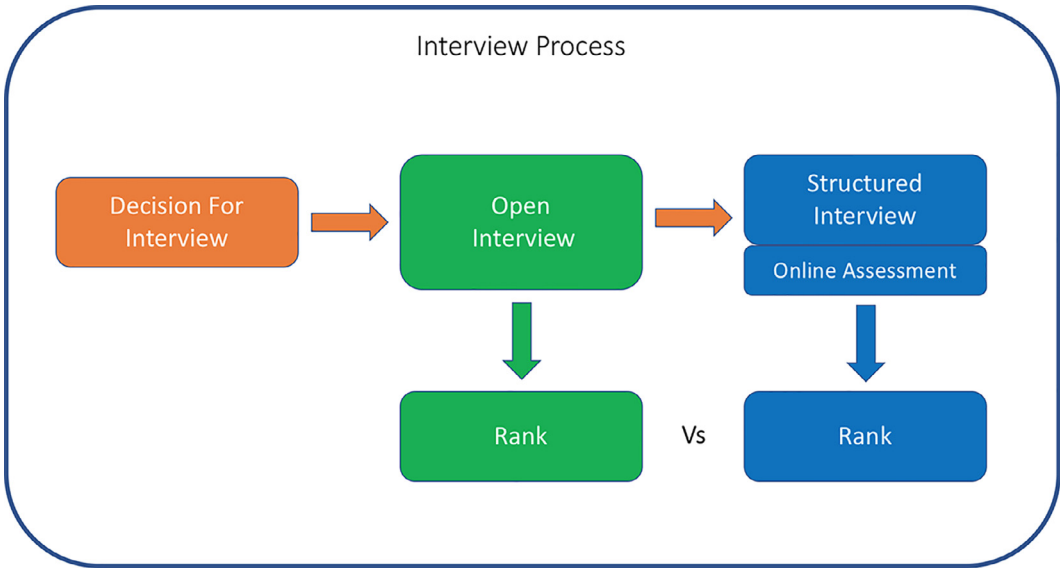


FIGURE 2. Once a decision to interview was made, all applicants were assessed by two interview processes. The first was an open process which consisted of unscripted interviews (OI). The assessment content and process were independently determined by each interviewer. The second was a consistently applied, scripted, structured interview process (SI) as well as an online assessment that was completed prior to the on-site interview. Both processes created independent rank lists which were compared for differences in rank order of applicants.

Step 8: Qualitative assessment of faculty perception of the interview processes

Faculty from both OI and SI answered a survey questionnaire, which was developed by one of the authors, both before and after the resident selection process. These results were compared from pre to post for themes.

RESULTS

Step 1: Qualitatively define a descriptive job analysis profile for faculty orthopedic surgeons and first year orthopedics residents

The authors viewed it vitally important to establish a faculty version of a job analysis profile first before attempting to define one for the resident. The key results areas in order of importance for faculty were:

1. Extraordinary patient care
2. Citizenship
3. Continuous learning.

For Residents, the impact of continuous learning was thought to be of higher priority and the wording changed to take into account development of key results expectations related to their capabilities and/or motivations. See Figure 3 for the full job analysis. See also Figure 4 for a graphic representation of the importance of each KRA for a resident and a faculty surgeon.

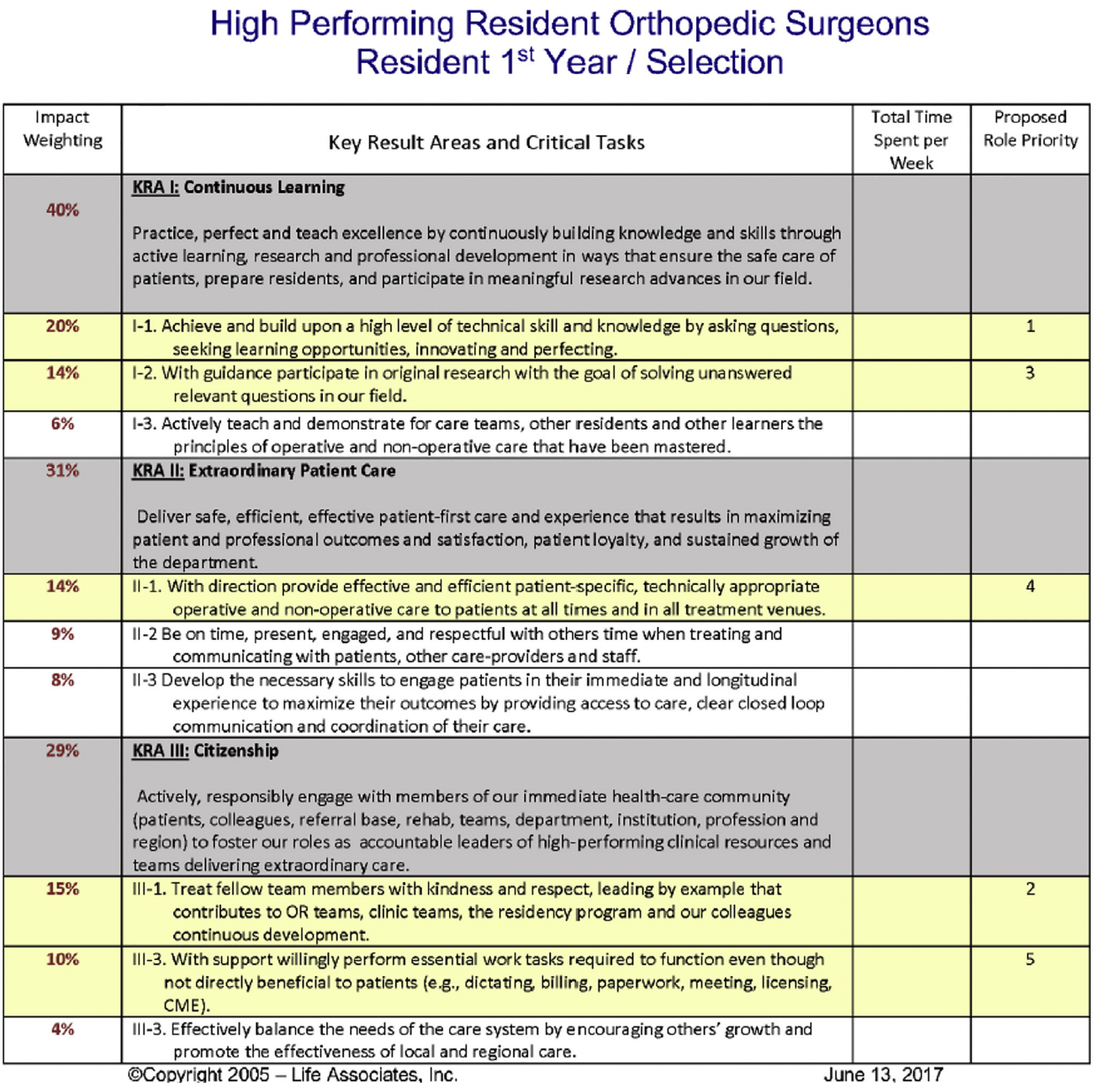
Step 2: Mapping the job analysis to factors

Based on the job analysis there were 5 critically important factors and 5 highly important factors for high performance. Each is listed here in order of importance. Listed in the parentheses is the type of factor either capability or motivation and primary type within that category. (See Fig. 5) The critically important factors were:

1. Self-management—the attitudes and practices that reflect an individual's accurate self-awareness, self-control, and self-discipline when working with people and situations.
2. Integrator synthesizer—requires working to meet responsibilities to both self and others through all-win practices; highly principled contributor in conventional ways where possible.
3. Versatility—the ability to effectively deal with changes.
4. Communication—the effective delivery, receipt, and exchange of information through various forms—including verbal, written, and listening practices.
5. Achievement—the performance practices characterized by drive, self-initiative, on-going improvement and the attainment of expectations, desired results.

The highly important factors in order of impact were:

1. Routines—work that involves repetition and practical, known activities.



High Performing Resident Orthopedic Surgeons
Resident 1st Year / Selection

Impact Weighting	Key Result Areas and Critical Tasks	Total Time Spent per Week	Proposed Role Priority
40%	**KRA I: Continuous Learning** Practice, perfect and teach excellence by continuously building knowledge and skills through active learning, research and professional development in ways that ensure the safe care of patients, prepare residents, and participate in meaningful research advances in our field.		
20%	I-1. Achieve and build upon a high level of technical skill and knowledge by asking questions, seeking learning opportunities, innovating and perfecting.		1
14%	I-2. With guidance participate in original research with the goal of solving unanswered relevant questions in our field.		3
6%	I-3. Actively teach and demonstrate for care teams, other residents and other learners the principles of operative and non-operative care that have been mastered.		
31%	**KRA II: Extraordinary Patient Care** Deliver safe, efficient, effective patient-first care and experience that results in maximizing patient and professional outcomes and satisfaction, patient loyalty, and sustained growth of the department.		
14%	II-1. With direction provide effective and efficient patient-specific, technically appropriate operative and non-operative care to patients at all times and in all treatment venues.		4
9%	II-2 Be on time, present, engaged, and respectful with others time when treating and communicating with patients, other care-providers and staff.		
8%	II-3 Develop the necessary skills to engage patients in their immediate and longitudinal experience to maximize their outcomes by providing access to care, clear closed loop communication and coordination of their care.		
29%	**KRA III: Citizenship** Actively, responsibly engage with members of our immediate health-care community (patients, colleagues, referral base, rehab, teams, department, institution, profession and region) to foster our roles as accountable leaders of high-performing clinical resources and teams delivering extraordinary care.		
15%	III-1. Treat fellow team members with kindness and respect, leading by example that contributes to OR teams, clinic teams, the residency program and our colleagues continuous development.		2
10%	III-3. With support willingly perform essential work tasks required to function even though not directly beneficial to patients (e.g., dictating, billing, paperwork, meeting, licensing, CME).		5
4%	III-3. Effectively balance the needs of the care system by encouraging others' growth and promote the effectiveness of local and regional care.		

 June 13, 2017

FIGURE 3. 1st Year Resident Job Analysis: The Key Result Areas included Continuous Learning, Extraordinary Patient Care and Citizenship. The percentage applied is the impact weighting of each Key Result area which is then subdivided into each Critical Task. The authors did not then calculate the total time spent by week but did rank the top 5.

2. Intellectual—work that involves continuous learning, research and "thinking" activities.
3. Flexibility—the willingness to effectively deal with change.
4. Helping—work that is concerned with helping or serving.
5. Problem solving—the effective gathering and evaluation of information that leads to the successful resolution of problems, conflict and management of change(s).

Step 3: Structured interview creation

A bank of behavioral and attitudinal questions from Dr O'Connor's HDW resources were used to select a series of questions for each factor, including follow-up probing questions if needed for further clarity or confir-

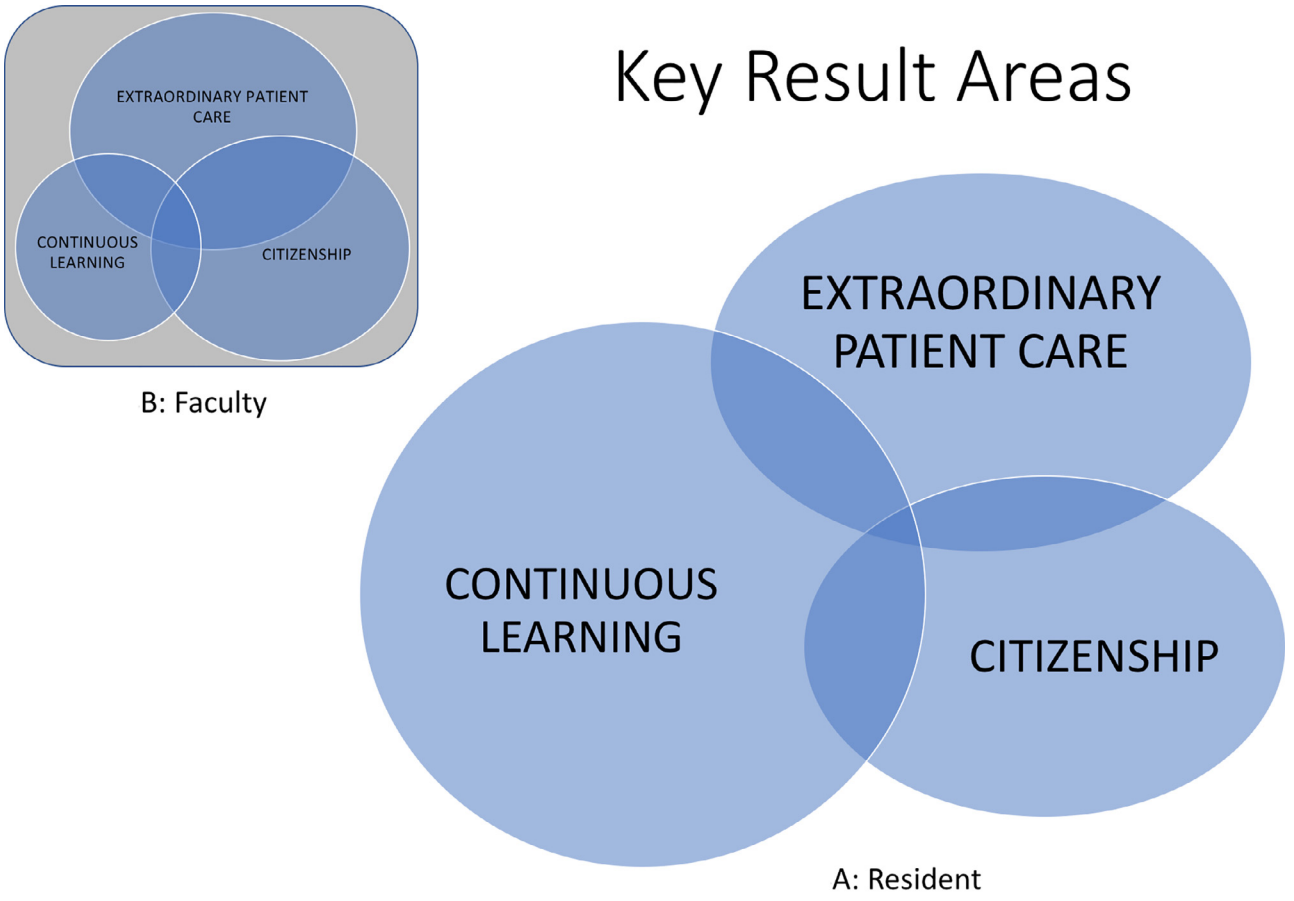


FIGURE 4. This graphically represents the relative importance of each of the Key Result Areas by the relative size of the areas. In Figure 4A, for residents, the most important KRA is continuous learning followed by extraordinary patient care then citizenship. In Figure 4B: for faculty extraordinary patient care was most important followed by citizenship and then continuous learning. This was specific to this program and may not be applicable to other institutions.

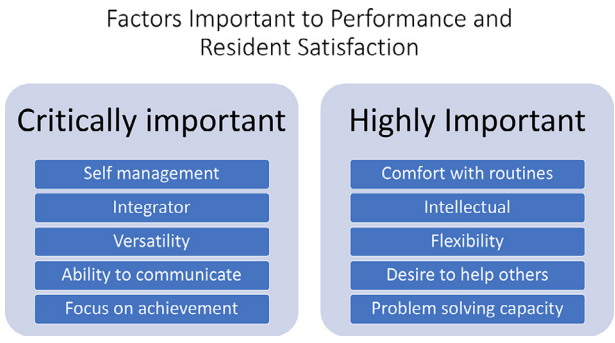


FIGURE 5. Based on the Job Performance Profile five critically important factors and five highly important factors were identified. The factors are either motivations or capabilities.

mation. Questions were either behavioral or attitudinal based. Each room had 2 interviewers assessing 2 or more factors. An overall score was independently reported for each applicant by each interviewer as well scores specific to each factor. These questions are designed to cause a "pause" and are not meant to be easy to answer. Examples of sample questions included the following:

1. Values: If you had unlimited time and resources, how would you spend them? How come? Why is that activity important to you?
2. Communication: What areas of communication would people who have worked with you or know you well say could stand improvement? Follow-up: How do you explain the fact that you have not made these improvements yet?
3. Achievement: We all get stressed. It's part of our job. When you get really stressed out is there something you are aware of that usually causes this to occur for you? Follow-up: If not disclosed than ask, what is this? How do you handle that stress?

Step 4: Online assessments as corroborating resource

The assessments evaluated work values and adaptability (versatility/flexibility) viewed as very important for

development of higher performance. Only the top 25 ranked applicants were reviewed for practical reasons. Based on the scores, applicants were ranked as Yes/Needs Development/No for each factor. This was confirmed by Dr O'Connor blinded to all other information about the applicant. A combined score was calculated. Only 5 applicants of the top 25 applicants (20%) ranked met criteria for "Yes" for all 3 factors. This is consistent with Dr O'Connor's findings that only a small percentage of employees in a given organization are high performers for a group of attributes which speaks to the need for a development plan in addition to a robust selection process.

Step 5 and 6: Magnitude and directionality of differences in the rank lists OI versus SI

Fifty-two applicants were interviewed. In the total applicant pool, the mean absolute change in rank position from one list to another was 9.8 (SD 8.9) rank positions/applicant. The range was 0-36 rank places. See Table 1 and Figure 6. 46.2% of applicants were ranked higher on SI versus OI. Only 9.6% had the same rank.

A subset of the top 20 applicants from the structured process were evaluated as the top 20 applicants represent those candidates most likely to match in this program based on historical results for the residency program. Figure 7 is a graphic summary of the substantial changes in rank position of resident candidates comparing SI versus OI for the top 20 ranked applicants from SI. The mean absolute change in rank was 10.3 (SD 8.2).

TABLE 1. Summary Resident Selection Results: This Table Summarizes the Results for All 52 Resident Candidates Interviewed and Reports the Absolute Change in Rank Position/Applicant Between Open, Unstructured and Structured Rank List. A Positive Move Means That the Candidate is More Likely to Match in the Structured Process Than the Open, Unstructured Process. Of Note the Range Was No Change to 36 Rank Positions. The Mean Was 9.8 Rank Positions and the Median Were 7.0 Rank Positions

Summary Statistics	
Candidates (n)	52
Mean ave. absolute move	9.8
Median ave. absolute move	7
Minimum rank places moved	0
Maximum rank places moved	36
Range of moves	36
Std. deviation	8.9
% candidates 'no move'	9.60%
% candidates 'move'	90.40%
Candidates with + moves	24
% candidates + moves	46.20%
Candidates with − moves	23.00%
% candidates − moves	44.20%

Positive move (+) = Ranked higher in structured process relative to open process. Negative move (−) = Ranked lower in structured process relative to open process.

The most significant finding is that when the 2 top 20 rank lists were compared (SI vs OI), 16 applicants out of the 40 (40%) were only on 1 of the 2 lists. The average change in rank for those 16 applicants that were only on 1 list was approximately 17 rank positions.

Step 7: Qualitatively document final rank list discussion

From the documented notes of the discussion a number of themes emerged. The difference in the rank lists provoked significant conversation. SI and OI were felt to be evaluating different things. SI's goal was focused and limited and application blind. This was discussed specifically around 2 applicants that performed extremely well in SI but were well below the average in terms of objective achievement on the USMLE and Number of honors. Therefore, the faculty agreed that SI was only a part of a larger process, but SI seemed helpful to moderate bias. It was agreed that in order for the whole process to be successful, other steps of the selection process need to evaluate the applicants for the objective requirements and fidelity of the application. Clear objectives for each step—the "first pass" selection for interview, OI, and SI—are necessary and are not similar.

A second theme that emerged was the importance of values. SI and the online assessment served as corroborating resources to discuss the motivations and values of applicants. Discussion of the applicant that had a thirty-six position change from one list to the other centered on the applicant's personal values. The results from the SI and the online assessments served as a way to sort through this discrepancy as a group.

Step 8: Qualitative assessment of faculty perception of the interview processes

Thirteen faculty involved in the interview process filled out the pre- and postsurvey. Overall there was no significant change in the faculty members' overall satisfaction with the process. Faculty were more satisfied with the interview process—a change from moderately to very satisfied. The attributes, interests, capabilities, and prior achievements for which applicants were being evaluated improved from somewhat disagree to somewhat agree. When asked about their clarity of personal selection criteria, faculty reported that they were slightly clearer but most faculty on the presurvey were completely or somewhat clear. Faculty either completely agreed or somewhat agreed that the SI added meaningful additional information for applicant selection. Online assessments were felt to be the least important factor in ranking applicants although on average faculty somewhat agreed that the online assessment added meaningful additional information. The most significant finding was a substantial change from somewhat disagree to completely agree as to whether the faculty felt that applicants were given adequate opportunity to show "who they are."

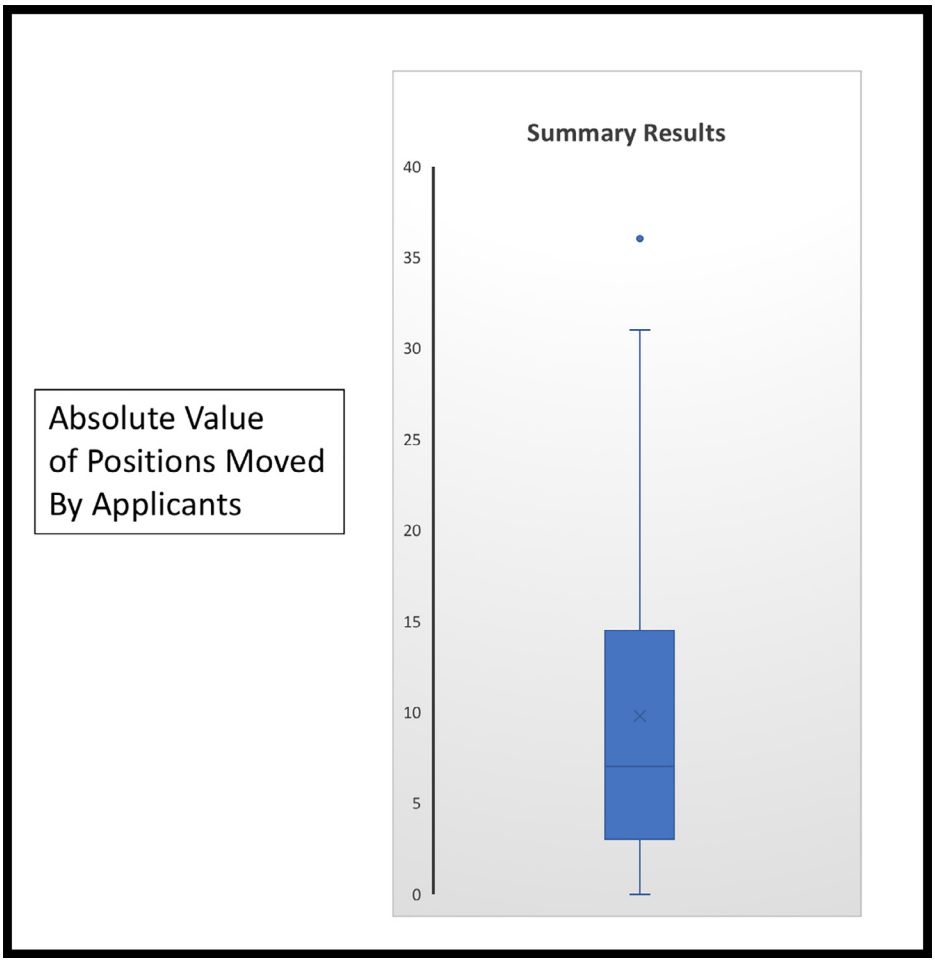


FIGURE 6. Summary of Absolute Value of Changes to Rank Position of Resident Candidates: This figure reports the mean, median, range and quartiles of the absolute change in rank position/applicant for all 52 applicants. This figure represents the data in Table 1.

DISCUSSION

This paper describes the first practical application of a well-established methodology (Hiring & Developing Winners) that defined what it means for high performance specific to our department and in conjunction with OI included SI with the goal of selecting residents based in part of specific attributes. In doing so, substantial differences in rank list order between SI and OI were found. These differences had an impact on the final rank list. Importantly, this initiative built into the selection process a structured assessment of specific factors thought to be predictive of performance and job satisfaction and focused the discussion on important factors such as applicant values and motivations that are inherently difficult to assess.

There is important literature exploring what personal attributes may be associated with resident performance. Bohm et al.[21] assessed moral reasoning skills. This included a focused interview station presenting ethical dilemmas. In this study applicants had highly variable reasoning skills with no relationship to their position or final rank or USMLE scores. In other fields moral reasoning which is cognitively based is not a significant predictor of actual behavior of people when dealing with moral choices (ethical and even other—social, economic, aesthetic, legal, and political).

Schenker et al.[22] and also Geissler et al.[23] developed an aggregate or composite scoring system for resident selection based on objective and subjective factors. Both incorporated interviews on specific factors. Schenker et al. assigned themes to rooms that included knowledge, affective domain, ethics, research, and "fit." The themes were labeled on the doors. Geissler et al. evaluated for work ethic and motivation, patient care and motor skills, career goals and suitability, ethical behavior and professionalism, and academic performance. Schenker et al. was able to predict the final rank list and found the scoring system practical and feasible. In the "Aggregate Interview Process," Geissler et al. went further and found using their aggregate method they could identify applicants who perform well

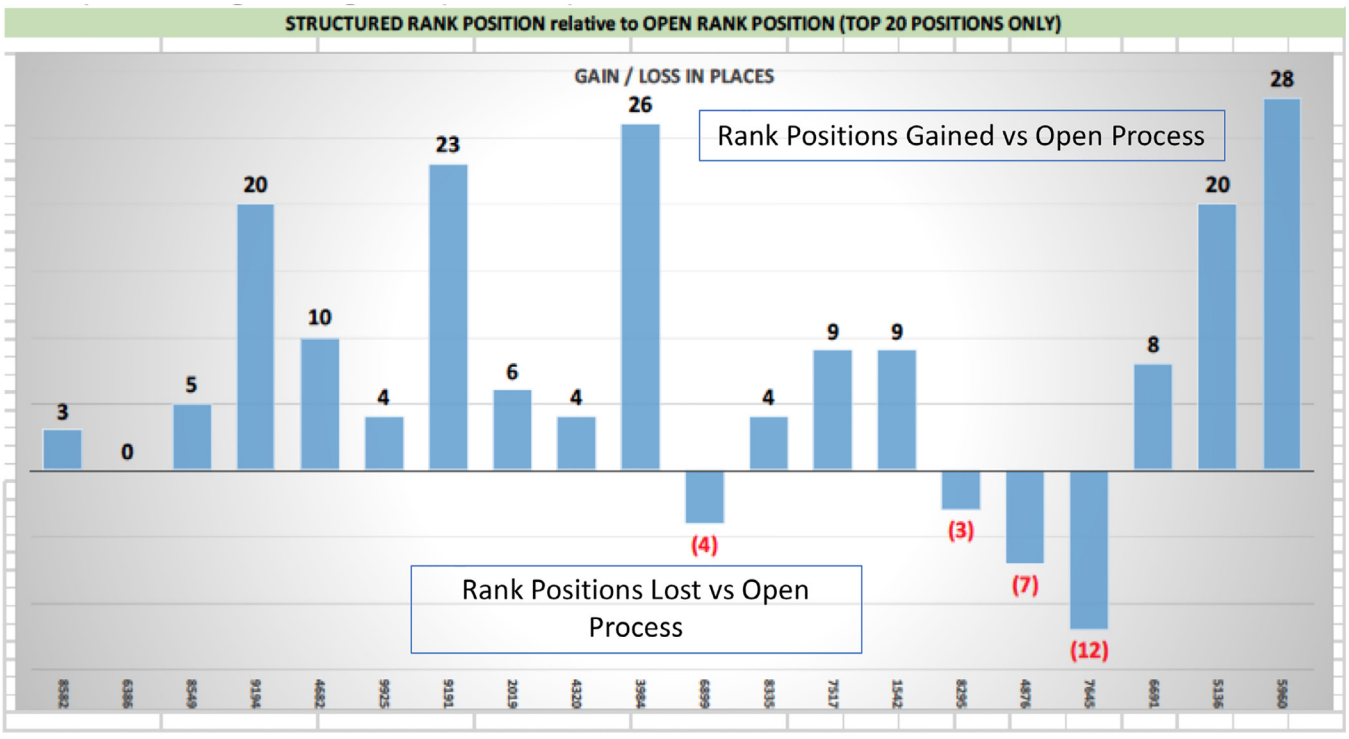


FIGURE 7. Summary of Significant Rank position changes Structured vs Open Unstructured for the top 20 ranked applicants from the structured process. Range of change 0-28 rank positions.

as residents, on the Office of Intramural Training and Education and on the American Board of Orthopedic Surgery examinations over a 10-year period. Neither study reported that they controlled the interview process with a structured or scripted interview process that might mitigate personal bias and create more uniformity of comparison.

The Hogan Personality Assessments has been utilized in multiple studies. Lubelski et al.[24] was the first to investigate the use of personality scores in the selection of neurosurgical residents. The study served as a validation study. Further study was recommended to identify what specific personality factors would predict success in a specific residency program.

Phillps et al.[10] have done significant work in this domain. The authors performed a prospective study of 12 ACGME orthopedic programs utilizing the Hogan Assessment System based on the Five Factor Model. Faculty was surveyed as to what personality factors were thought to be most important. Residents were assessed for personality factors and compared to the faculty's rank of each resident's performance. They found that there were significant differences between the personality factors that the faculty valued and thought important and those found to be present and important in the high performing residents. They also found that personality factors were useful in predicting performance among residents. Agreeableness defined as a person's tendency toward cooperation, interpersonal sensitivity, and positive temperament was most strongly and frequently found to be a predictor of performance across domains.

Phillips et al.[10] perhaps most significantly, noted that the process created a sense of self-awareness which supported and can guide development of residents. This was certainly true in the process described in our study. The process allowed for a structure that was used to discuss in a methodological way the values, motivations, interests, and capabilities of applicants but also indirectly the faculty involved. In discussing the 2 rank lists in this study, the conversation was indeed primarily about achievement and values. Using a pre- and postsurvey of faculty, the faculty had a clearer understanding of the criteria by which we were evaluating the applicants. Importantly they also felt that applicants were given a better opportunity to show who they are. In the same way, Phillips et al.[10] remarked that the process became part of the current resident and faculty's definition of who we are as a department and who we aspire to be for both residents and faculty. In other words, that these factors are important. If this process, in the end, provides nothing else, it is the opinion of the authors that doing just that is of value.

The take-home message from these studies and prior work is that the affective domain or factors such

as agreeableness defined by Hogan Assessments[10] or in this study, factors such as self-management defined by O'Connor are likely important in predicting and developing performance in residents and faculty. This study is unique in that it is the first study designed from the "ground up." This study started by defining what high performance looks like specific to the department—matched to the department's goals, culture and organizational values. A specific and structured job description was defined based on what is most important, why it is important and how it is going to be accomplished. Once defined this was mapped to 36 factors that included nontransferable capabilities, values, motivations, and work interests. Ten were found to be critically important (14%) or highly important (14%). These ten factors were then assessed through a scripted structured interview process and candidates were scored based on the presence and strength of the attributes. It is important to understand that the job analysis, important attributes, scripted interview questions are not necessarily transferable to another department. It would be necessary and an important process for another department to start at the beginning and move through a job analysis in order to match the existing or future vision of the culture and expectations of the department. ***The process is transferable and has value in itself.*** If done well it creates unity of purpose and clear objectives for both selection and development of residents and for that matter faculty. To be clear, in this work the authors made a choice as a first step to not retrospectively look at current residents/faculty in order to build a model of factors or attributes associated with high performance in the current environment. It is the authors' belief that there is a transition in healthcare from one of individual actions to one of both greater individual and group accountabilities. For example, with changes in payment models, increasing sophistication and specialization of treatment, the care of patients is moving to team based care across a continuum of care. This type of care demands attributes that the authors felt may be different than in the past. This process focuses on looking forward to hiring and developing resident and faculty that can be successful in the new and quickly changing environment.

Importantly, SI has clearly been discussed and utilized specifically to mitigate personal biases.[25] With this in mind, the authors believe that in starting from the "ground up," the process is more likely to select a group of high performing residents irrespective of what the "classic appearance" of an orthopedic surgeon is by mitigating the biases inherent in any selection process. A *Harvard Business Review* article on bias recommended abandonment of panel or group interviews and submitting assessments on consistent metrics from each interviewer prior to any group discussion.[25] These efforts as well as building the attributes prospectively seems particularly important in orthopedics where a prior model of personality attributes was developed in an orthopedic resident sample that was >90% male.[10]

There are limitations of this work. O'Connor and colleagues have validated these techniques and surveys over more than 30 years. They have evaluated the reliability and validity and this data is certainly available in their books and certification materials.[15-18] However, this methodology is a limited version of what would be recommended by Dr O'Connor and colleagues. For important positions, significantly more time would be spent for evaluation of candidates by trained and certified interviewers. It will be important to understand moving forward whether a more limited approach provides similar results in the selection of residents. The most important limitation in this study is that it provides no current correlation to resident performance in this model. However, there is a long line of evidence from industries outside and within health care, but not residency, that the correlation exists using Dr O'Connor's methodology.[10,14,17] More importantly, the development of the residents once they start is pivotal to the process. This is a small number of applicants and only one cycle of applications. The assessment did not include personal work styles.[26] Personal work styles were felt by the authors to be a development issue to be managed and not to be selected for as an independent attribute. This interview process included only 15-minute interview. Clearly the more structured and targeted interaction a selector has with the applicant the better. However, the selection process has significant opportunity costs to any practice. These costs can range into the hundreds of thousands of dollars depending on the duration and the number of the faculty involved. There are practical issues of spending this much time away from the core processes of clinical care. In short, this paper is describing our department's first attempt to apply this methodology. Included in this prospective initiative over the coming application cycles is to answer many unanswered questions about the application and utility. There remain questions around inter-rater reliability, online versus SI reliability, the objective of each stage in the selection process, whether or not applicants can "learn" and "game" the process as well as others that were not answered in this methodological paper.

This study grew organically out of one of the authors conversations with Dr O'Connor and Quinn Management Services. The questions were whether or not we could improve the quality and efficiency of the selection and development process for applicants and the faculty. From the start, the goal was to disseminate the process if it was both practical

and cost-effective. Although there is no direct monetary relationship between our institution or staff and Dr. O'Connor and Quinn Management Services, it should be noted that all materials, intellectual property and consulting were provided at no cost to the institution for this 1 year. Moving forward the goal is to repeat the selection process with small changes and start the development process.

What was learned is that SI is part of the larger selection process. It can be practically applied. The benefit of the SI is that it is application blind and designed to assess the presence and strength of specific factors. In order for this to be the case, each applicant should have already met the other pre-requisite criteria set out by the selection process—examples might include: USMLE scores, Number of honors, class rank, letters of recommendation and be acceptable from an achievement standpoint for the residency. These steps allow for SI to mitigate some of the effects of personal bias which have been shown to be present in an interview.[13]

CONCLUSIONS

Using a well-established methodology that defined high performance specific to our department and equipped with an understanding of what attributes are important, we implemented a process to rank applicants with those factors in mind. In doing so, substantial differences in rank list order were found. These differences had an impact on the final rank list. Importantly, this initiative built into the selection process a structured assessment of specific factors thoughts to be predictive of performance and job satisfaction and focused the discussion on important factors such as applicant values and motivations that are inherently difficult to assess.

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SUPPLEMENTARY INFORMATION

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