In a continuing collaboration between the American Orthopaedic Association's (AOA) Council of Orthopaedic Residency Directors (CORD) and the JBJS, the following 10 abstracts highlight the scientific research presented at AOA's virtual annual national meeting held in June 2021. These abstracts embody CORD's purpose and mission:

"The American Orthopaedic Association's Council of Orthopaedic Residency Directors (CORD) program strives to recognize best practices in orthopaedic residency education and fellowship education based on Accreditation Council for Graduate Medical Education (ACGME)-defined essential knowledge and skills in each of the residency education competency areas. CORD provides a forum for academic orthopaedic leaders to exchange ideas, discuss solutions to challenges, and find ways to teach residents in orthopaedic programs effectively."

We hope this education-related research will inspire further inquiry to advance the development of future orthopaedic surgeons.

Dawn M. LaPorte, MD, FAOA, Joshua C. Patt, MD, MPH, FAOA, on behalf of the CORD/Academics Committee

Impact of First COVID-19 Pandemic Wave on Resident Education: A Survey of Orthopaedic Surgery Program Directors

Medical education at all stages has been adversely impacted by the COVID-19 pandemic, with orthopaedic surgery programs facing significant disruptions. Few studies have characterized the impact of these educational changes from the program director point of view. Using an electronic survey distributed to all 156 program directors of US allopathic programs, we sought to characterize COVID-19 disruptions in resident education, adaptation of educational resources, and attitudes regarding the pandemic’s short-term and long-term impacts on trainee progression.

Responses were received from 69 of 156 PDs for a response rate of 44%, with 29 (42%) located in a COVID-19 “hotspot”. COVID-19 educational plans were implemented prior to the pandemic causing local impacts by 16 (23%), during the first week by 45 (65%), and during the first month by 8 (12%) programs. The highest GME pandemic stage reached varied with 5 (7%), 45 (65%), and 15 (22%) of the programs reaching stages 1, 2, and 3, respectively. The proportion of programs holding clinic visits, conferences, and sign-outs virtually increased from 12%, 39%, and 22% prior to the pandemic to 91%, 99%, and 83%.

Forty-four percent of the PDs agreed that virtual education tools are equivalent to in-person learning while 49% disagreed. The duration of restrictions on elective clinical practice was 4 to 6 weeks for 28%, 7 to 10 weeks for 38%, and >10 weeks for 35%. Most PDs viewed short-term impact on resident training to be moderately (55%) or severely negative (36%) but rated long-term impact on residents “once they are in practice” to be neutral (52%) or moderately negative (38%). Ninety percent of the PDs rated missed clinical time due to COVID-19 from March to June 2020 as equivalent to a short leave of absence (i.e., medical and parental) while 10% felt that additional training time would be needed.

The average level of concern for trainee surgical skill progression for all residents was 4.2 of 10, with PGY-3 (5.2) and PGY-4 (5.0) rated significantly higher than PGY-1 and PGY-2 (3.8 and 3.9).

Disclosure: The Disclosure of Potential Conflicts of Interest forms are provided with the online version of the article (http://links.lww.com/JBJSOA/A138).

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Impact of COVID-19 Pandemic on Orthopaedic Surgical Training: A National Survey Exploring the Perceptions Among Orthopaedic Surgery Residents

Background: During the beginning of the COVID-19 pandemic, orthopaedic surgery residents were required to spend their clinical time doing something other than providing direct musculoskeletal care. Without this direct patient care experience, residents adapted to new, mostly virtual, methods of progressing their surgical training. Most of these adaptations and changes occurred at their own discretion, requiring residents to prioritize not only their time but also what educational modality they prioritized most. This article represents the results of a survey of orthopaedic surgery residents within the United States and their perceptions of how taking a leave of absence has affected their surgical training and how their surgical educational values have changed during this time.

Methods: An anonymous web-based survey was distributed to all publicly available orthopaedic surgery residency program directors from June 2, 2020, to July 9, 2020, to recruit orthopaedic surgery residents for participation. The survey was split into the following categories: demographics, perceived long-term implications surrounding surgical training, and perceived value of various educational platforms which were evaluated both before and after the leave of absence. Perceptions of value were measured on a scale of 1 to 10, with 10 being most valuable.

Results: A total of 507 residents completed the survey. An average of 6 weeks missed was reported concerning orthopaedic clinical time. For PGY-1’s, the relative importance from before and after the leave of absence of operative time and clinic time saw decreases while outside lectures saw increases. For PGY-2’s and PGY-3’s, the relative importance from before and after the leave of absence observed drops in operative and clinic times, with increases in research, independent study, and outside lectures. For PGY-4’s and PGY-5’s, the relative importance from before and after the leave of absence observed decreases in the value of operative and clinic times, didactics, independent question review, and outside lectures.

Conclusion: Taking a leave of absence has impacted how orthopaedic surgery residents have continued their surgical education and the perceived importance of different educational activities. Operative case volume significantly decreased during their leave, but residents paradoxically perceived time in the operating room to be less important during their leave compared to before the leave of absence, suggesting that a more diverse education is preferred over a heavy operative experience. This average 6-week leave of absence during the COVID-19 pandemic could serve as a surrogate marker for a medical leave of absence, with no need for additional time in training.

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Resident Selection in the Wake of USMLE Step 1 Transition to Pass/Fail Scoring

Background: The numeric score for the US Medical Licensing Examination Step 1 was one of the only universal, objective, scaled criteria for comparing the many students who apply to orthopaedic surgery residency. However, on January 26, 2022, Step 1 transitioned to pass/fail scoring. The purpose of this study was to (1) determine the most important factors that will be used for interview and resident selection following this change and (2) assess how these factors have changed compared with a previous report on resident selection.
Methods: A survey was distributed to the program directors (PDs) of all 179 orthopaedic surgery programs accredited by the Accreditation Council for Graduate Medical Education. Questions focused on resident selection practices before the score change and the impact of the Step 1 score transition on expected future practices.

Results: A total of 78 PDs (44%) responded to the survey. Over half of the PDs (59%) responded that US Medical Licensing Examination Step 2 Clinical Knowledge (CK) score is the factor that will increase most in importance following the transition of Step 1 to pass/fail, and 90% will encourage applicants to include their Step 2 CK scores on their applications. The factors rated most important in resident selection from 0 to 10 were subinternship performance (9.05), various aspects of interview performance (7.49-9.01), rank in medical school (7.95), letters of recommendation (7.90), and Step 2 CK score (7.27). Compared with a 2002 report, performance on manual skills testing, subinternship performance, published research, letters of recommendation, and telephone call on applicants’ behalf showed significant increases in importance.

Discussion: As Step 2 CK is expected to become more important in the residency application process, applicants’ stress surrounding Step 1 numeric scores may simply move to Step 2 CK scores. Performance on subinternships will remain a critical aspect of residency application, as it was viewed as the most important resident selection factor and has grown in importance compared with a previous report.

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The Unmentionable Intangible Traits in Surgeons: Are They the Key to Career Happiness and Success?

Background: Demographic differences among surgical trainees regarding intrapersonal traits, such as imposter syndrome and assertiveness, have become widely acknowledged. However, many of these characteristics have not been examined in tandem, nor among both trainees and surgeons in practice. This study aimed to (1) assess the prevalence and scale of 5 intrapersonal traits among surgical residents and practicing surgeons and (2) identify potential associations between the presence of these traits and demographic factors such as self-identified sex, age, and time in practice.

Methods: This was an International Review Board-approved study consisting of an anonymous, voluntary RedCap survey including validated measures of (1) self-efficacy, (2) impostor syndrome, (3) assertiveness, (4) perfectionism, and (5) self-rated likeability. A multimodal recruitment strategy was used, and surgeons across all subspecialties (resident, fellow and attending level) were eligible for inclusion. The individual assessments were shown without a title or label, and thus, respondents were not made aware of which traits were being analyzed until the completion of the survey, at which time their scores and an interpretation were also provided.

Results: A total of 296 participants were included, with 54% identifying as female (n = 161) and 72% between the ages of 25 and 40 years (n = 212). Imposter syndrome, assertiveness, and perfectionism scales were normally distributed; self-efficacy and self-rated likeability scales demonstrated slight negative skew. Self-identified male sex was associated with less impostor syndrome (p < 0.001) and perfectionism (p = 0.035) and higher assertiveness (p < 0.001). Imposter syndrome was less common among older age groups (p = 0.001). No significant differences were observed in any of the 5 traits when comparing surgeons in practice and those in training (p > 0.05).

Conclusions: Surgeons are a self-efficacious group of perfectionists with widespread variability in impostor syndrome and assertiveness. Female sex and younger age were associated with more impostor syndrome and less assertiveness, highlighting an opportunity for early career coaching and individualized education.

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Empathy Among Orthopaedic Surgery Trainees

Background: It has been postulated that the process of (and stresses associated with) medical training results in a loss of empathy of trainees. We sought to assess the empathy of orthopaedic surgery trainees over the course of residency.

Methods: We electronically distributed an anonymous Qualtrics survey to trainees in 23 ACGME orthopaedic surgery residency programs via the Collaborative Orthopaedic
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Education Research Group (COERG), which included questions comprising the validated Short-Form 8-Item Empathy Quotient (EQ-8), as well as single-item measures of emotional exhaustion and depersonalization derived from the Maslach Burnout Index. In total, 438 of 605 residents (72.4%) completed the survey. Responses were imported from Qualtrics into SPSS Statistics, version 26.0 (IBM Corp), for analysis. EQ-8 scores were tabulated for respondents. Scores were compared via one-way analysis of variance (ANOVA), with Bonferroni correction and Tukey post hoc testing. Statistical significance was defined as α = 0.05.

Results: The mean EQ-8 score among all respondents was 11.3 (SD = 3.5). Female respondents scored higher (mean = 12.2, SD = 2.8) than male respondents (mean = 11.2, SD = 3.3). Trainees planning on a career in academic medicine scored significantly (p<0.009) higher (mean = 12.0, SD = 2.9) than those intending on private practice (mean = 10.9, SD = 3.3) or those with a military commitment (mean = 10.4, SD = 3.4). There was a significant difference in empathy with respect to single-item Maslach Burnout Index measures in both depersonalization (p = 0.002) and emotional exhaustion (p = 0.005). There was no significant difference in EQ-8 scores across years in training, program location, primary training setting, and intended fellowship or with respect to relationship status or having children.

Conclusions: There was no evidence of duration in training resulting in a loss of empathy. Among our respondents, female trainees and those intending on a career in academic medicine demonstrated significantly higher levels of empathy. There was a significant relationship between burnout and empathy—trainees who demonstrated higher levels of emotional exhaustion and depersonalization also demonstrated lower levels of empathy. A future longitudinal study may shed additional light on the effects of training on empathy.

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Racial Discrimination and Noninclusive Work Environments in Orthopaedic Residency: Results of a Survey of 310 Black Orthopaedic Surgeons

Background: Orthopaedic surgery is the least diverse medical specialty in terms of gender, race, and ethnicity. The impact that lack of diversity has on Black orthopaedic residents has never been evaluated. This study aims to describe the magnitude of racial discrimination and noninclusive work environments experienced by current and former Black orthopaedic residents in the United States.

Methods: An anonymous survey was administered between July 1 and September 1, 2020, to 455 Black orthopaedic surgeons in practice and 140 Black orthopaedic residents/fellows. Respondents reported on frequencies of microaggressions and receiving derogatory or devaluing statements ostensibly motivated by race that were quantified through descriptive analysis and compared by sex. They were also asked to complete the modified Perceived Occupational Discrimination Scale (PODS).

Results: The response rate was 52% (n=310/595) and included 243 of the 455 practicing surgeons (53%) and 67 of the 140 current residents/fellows (48%) surveyed. On the PODS, 96.1% of the respondents (n=309) felt that Black orthopaedic residents face workplace discrimination, the majority of whom perceived “a lot discrimination” (78.3%), followed by “some discrimination” (17.8%). Black women had a significantly higher mean PODS score than Black men (p = 0.009). Racial microaggressions experienced in residency were common, including “microinsults” such as being confused for a nonphysician medical staff (nurse/PA) (87%) or nonmedical staff (janitorial or dietary services) (81%). Overt discriminatory statements received during residency training (“microassaults”) were reported by 61% of the respondents. These were perpetrated most often by patients (49%) and attending faculty (38%). Black women reported significantly higher perception of noninclusive, derogatory remarks, the majority of which (67-100%) were perceived to be racially biased. The statements that were most frequently perceived as racially biased were “You matched at your program to fulfill a diversity quota” (100%) and “You demonstrate inferior bedside manners compared to your peers” (100%), followed by “You do not “fit in” at your program/do not match the “culture” of your program” (98%).

Conclusion: The prevalence of racial microaggressions toward Black orthopaedic surgeons during residency training is high, particularly among Black women. To better understand barriers to successful recruitment and retention of Blacks in orthopaedics, the high prevalence of noninclusive culture in residency training needs to be intentionally addressed and mitigated.

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The Gladden Society Honor Roll: A Ranking of Orthopaedic Surgery Residency Programs by Percentage of Black Residents

The mission of the J. Robert Gladden Orthopaedic Society (JRGOS) is to improve the diversity of the orthopaedic workforce and promote the highest quality musculoskeletal care for all people. Commensurate with this mission, the JRGOS set out to define which orthopaedic surgery residency programs were...
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succeeding in recruiting a more racially diverse class of resident physicians. Using the JRGOS diversity database, which includes the largest collection of Black orthopaedic surgeons in the United States, the authors identified all Black residents who were currently training between the 2019 to 2020 and 2020 to 2021 academic years. Using the results of this query, a ranking list of the top 20 programs was created, per academic year, based on the percentage of Black orthopaedic residents present at each program.

Programs ranking in the top 20 for the percentage of Black orthopaedic residents present for both academic years included Howard University, Tulane University, Kingsbrook Medical Center, New York University-HJD, Stanford University, University of Southern California, University of Cincinnati, Yale University, Carolinas Medical Center, University of Arizona-Phoenix, University of Pittsburgh, and University of Missouri at Columbia. Unfortunately, our data showed that during the 2019 to 2020 academic year, there were 107 orthopaedic residency programs (66%) with no Black residents, and during the 2020 to 2021 academic year, there were 96 programs (60%) with no Black residents.

While the field of orthopaedic surgery has a diversity problem, this study shows that not all residency programs are struggling with increasing the diversity of their residency classes. The JRGOS believes that a problem cannot be fixed unless the magnitude of the problem is first measured. This Gladden Society Honor Roll is the first step to provide the data needed to increase the diversity of the orthopaedic surgical workforce.

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Testing the Validity of a Novel Simulator for Training Pediatric Supracondylar Elbow Fractures

Background: Supracondylar distal humerus fractures are the most common pediatric fracture treated surgically worldwide. Precise pin placement is critical to maintaining fracture reduction achieved during surgical intervention. We developed an augmented reality simulator to help train orthopaedic residents in pinning a pediatric elbow, building on a previously developed and validated simulator used to train wire navigation of hip fractures. This study aimed to assess the construct validity of the simulator—its ability to distinguish surgical expertise.

Materials and Methods: The simulator in this study uses a camera system to track a wire and generate pseudofluoroscopic images on a laptop. The model consists of a pediatric humerus sawbone with a pediatric soft-tissue model surrounding the bone. In this study, 4 first-year residents, 6 third-year residents, and 4 staff surgeons were recruited to participate. Residents were given literature to review prior to the exercise, so they understood the clinical goals of creating a diverging pin construct. After the introduction, participants placed their pin configuration on the same simulated patient with identical fracture patterns. Performance was graded based on pin spread, number of fluoroscopic images, and a composite score. All participants answered survey questions related to the simulation’s face validity.

Results: Staff surgeons pin spread averaged 61% (standard deviation, SD, 13%) of the fracture line in the AP plane, used an average of 32 (SD 4.5) images to place the wires, and had a composite score of 0.71 (SD 0.38) on a scale of −1.5 to 1.5. Third-year and first-year residents pin spread covered 40% (SD 8%) and 26% (SD 5%), respectively, of the fracture line in the AP plane, used an average of 41 (SD 14) and 43 (SD 13) images, and had a composite score was 0.10 (SD 0.56) for the first-year residents and −0.67 (SD 0.24) for the third-year residents. There was a significant difference between the 3 groups on the fracture coverage in the AP plane and in the total score metric (p <0.01 and p = 0.01, respectively). All residents felt that practice on the simulator would improve their performance in the operating room.

Conclusions: Pinning pediatric elbow fractures can be a stressful procedure for novice and intermediate-level residents. Previously, there were very few options for learning this skill. This study demonstrates that by utilizing an existing wire navigation simulation platform extended for pediatric elbow pinning, we can distinguish between multiple levels of orthopaedic surgical experience.

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In 2020, Are We Still Interviewing Orthopaedic Surgery Candidates with Illegal Questions?

Introduction: The National Resident Matching Program (NRMP) has a code of communication aimed at residency programs and applicants to ensure that the matching process is as ethical as possible. Despite this, the literature shows that up to 90% of applicants are asked “illegal” questions during interviews. The purpose of this study was to determine what proportion of orthopaedic surgery applicants are asked illegal questions and whether certain demographics are more likely to receive these questions than others.

Methods: A survey was developed to determine whether applicants were being asked illegal questions, which was then pilot tested with current residents who applied to the University of Louisville via ERAS between 2014 to 2019. It was then sent to this same cohort for the 2019 to 2020 application cycle. Responses underwent a statistical analysis via SPSS 2.0.

Results: The overwhelming majority of respondents received at least 1 question during the interview season that would be considered illegal by the NRMP, at 99.5% (379/381). There was no statistically significant difference between the genders in receiving illegal questions. Male applicants predominately received questions regarding away rotations or previous interview locations; female applicants received these questions in similar proportions and had a statistically significant higher proportion of questions regarding gender/marital status/children (p = 0.001) and family planning (p = 0.023) than their male counterparts.

Conclusion: This study demonstrated that essentially all orthopaedic surgery residency candidates are asked illegal questions during the interview process, but a significantly larger proportion of female applicants are asked questions regarding gender, familial status, and marital status. Thus far, no studies have exclusively polled orthopaedic surgery applicants, which is significant as this specialty has one of the highest rates of gender divide. It is possible that even while the prevalence of illegal questions decreases overall across all specialties, women applying to orthopaedics are subjected to higher rates of illegal questions during the interview process than their male counterparts. It is imperative for faculty to be aware of what types of questions are considered illegal, as their programs may be subject to investigation and penalties if reported. It is also crucial to recognize the implicit biases that still exist when interviewing female candidates, as other studies have shown that female candidates may be less likely than male candidates to pursue a career in orthopaedics at least partially due to negative interactions they face in the field based on their gender.

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Race/Ethnicity, But Not Gender, Influence An Applicant’s Enrollment Into Orthopaedic Surgery Residency

Orthopaedic surgery is one of the most competitive but least diverse surgical specialties, with ever-increasing academic achievements. Prior research shows that White applicants had higher US Medical Licensing Exam (USMLE) Step 1 and Step 2 scores as well as higher odds of Alpha Omega Alpha (AOA) status compared with Black, Hispanic, and other applicant groups. Yet, it still remains unknown whether differences in application metrics by race/ethnicity sufficiently explain the underrepresentation of certain racial or minority groups in orthopaedic residency programs.

In this study, we sought to determine (1) the relative weight of academic variables for admission into orthopaedic residency and (2) whether race and gender are independently associated with admission into an orthopaedic residency.

The Electronic Residency Application System (ERAS) data from the Association of American Medical Colleges (AAMC) and the National Board of Medical Examiners (NBME) of first-time MD applicants (n = 8,966) for orthopaedic surgery residency positions in the United States and of admitted orthopaedic residents (n = 6,218) from 2005 to 2014 were reviewed. Academic metrics were analyzed using hierarchical logistic regression models.

When only academic variables were analyzed, AOA status (odds ratio 2.12 [95% CI 1.80-2.50]; p < 0.001), USMLE Step 1 score (OR 1.04 [95% CI 1.03-1.04]; p < 0.001), USMLE Step 2 Clinical Knowledge score (OR 1.01 [95% CI 1.01-1.02]; p < 0.001), publication count (OR 1.04 [95% CI 1.03-1.05]; p < 0.001), and volunteer experience (OR 1.03 [95% CI 1.01-1.04]; p < 0.001) were associated with admissions into orthopaedics while work and research experience were not. In a second model where race and gender were added to the academic variables, applicant race, but not gender, is associated with admissions into orthopaedic residency. Applicants from Asian (OR 0.78 [95% CI 0.67-0.92]), Black (OR 0.63 [95% CI 0.51-0.77]), Hispanic (OR 0.48 [95% CI 0.36-0.65]), or other (OR 0.65 [95% CI 0.55-0.77]) race groups had lower odds of admission into residency compared with White applicants.

Minority applicants, but not women, have lower odds of admission into orthopaedic surgery residency, even when accounting for academic performance metrics. To mitigate this, changes in the residency selection processes can include increasing the diversity of the selection committee, bias training, blinding applications before review, and removal of metrics with a history of racial disparities from an interviewer’s candidate profile before an interview.

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