

A RESIDENT SURVEY STUDY OF ORTHOPEDIC FELLOWSHIP SPECIALTY DECISION-MAKING AND VIEWS ON ARTHROPLASTY AS A CAREER

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ABSTRACT

A dramatic shortage of total hip and knee arthroplasty (THA/TKA) surgeons has been projected as fewer residents enter arthroplasty fellowships and the demand for THA/TKAs is rising. The purpose of this study was to ascertain the future supply of THA/TKA surgeons, to identify the criteria residents use to choose their fellowship specialty, and to assess resident perceptions of an arthroplasty career. Four-hundred and ninety-eight PGY3+ residents completed the online survey. Residents most highly prioritize intellectual factors and role models/mentors in determining their fellowship specialty. In the face of a looming patient access-to-care crisis, the data from this study supports a policy of highlighting the intellectual challenges and satisfaction of THA/TKA as a career and encouraging mentorship early in a resident's training.

INTRODUCTION

Dramatic hip and knee arthroplasty (THA/TKA) surgeon shortages may be looming. The demand for THAs and TKAs has been increasing. In the United States between 1990 and 2002: the rate of primary THAs increased by 46% (from 47.2 to 68.9 procedures per 100,000 persons); the rate of primary TKAs increased by 166% (from 51.2 to 136.0 procedures per 100,000 persons); the rate of revision THAs increased by 60% (from 9.5 to 15.2 procedures per 100,000 persons); and the rate of revision TKAs increased by 166% (from 4.7 to 12.5 procedures per 100,000 persons).[1] It has been projected

that the demand for revision THAs will double by 2026 while the demand for revision TKAs will double by 2015.[2] The supply of THA/TKA-trained surgeons is not keeping pace with the demand.

There has been a documented decline in THA/TKA specialists over time.[3] In a 2007 survey of the American Academy of Orthopaedic Surgeons (AAOS) and THA/TKA fellowship programs, THA/TKA fellowship directors reported declines in applicants. The survey revealed that 10 THA/TKA fellowship programs were discontinued over the past 5 years because of an inability to fill their positions. For the 2006-2007 academic year, only 77% (92 of 116) of the arthroplasty fellowship positions were filled; international medical graduates (IMGs) filled 20% of those positions. For the 2007-2008 academic year, only 52% (74/120) of the arthroplasty fellowship positions were filled; 27% of these were filled by IMGs.[4]

The current THA/TKA fellowship match has 115 THA/TKA fellow spots, but only 70 candidates have applied for just a THA/TKA fellowship position – the rest have applied for either a THA/TKA or a tumor position.[5] Between 2008 and 2016, Fehring et al. predicted a 34% decrease in orthopedists performing THAs and TKAs. They predicted that by 2016 there will not be enough orthopedists to fulfill 46% of the THAs and 72% of the TKAs demand, presenting a supply side crisis.[6]

There is particular concern regarding the rising demand for more challenging THA/TKA cases, namely complex primaries (e.g. developmental hip dysplasia, post-traumatic osteoarthritis, and significant leg length discrepancies), revisions, periprosthetic fractures, infections, and THA/TKAs in obese patients. Many orthopedic generalists feel comfortable performing straightforward primary total THAs and TKAs, but those other more complex arthroplasty cases present a significant challenge that generalists may defer to their fellowship-trained colleagues.[7]

The purpose of this study is to ascertain the current supply of THA/TKA surgeons and to identify what criteria U.S. residents use to choose their fellowship specialty using an online survey. We also seek to examine resident perceptions of THA/TKA as a career in an attempt to understand the recent declining enrollment in arthroplasty fellowships. Ultimately, with the data obtained from this study, the Association of Hip and Knee Surgeons (AAHKS) plans to develop targeted interventions that will most effectively recruit more orthopedic residents to an arthroplasty career in the context of an impending threat to patient access-to-care. The hypothesis of this study

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was that residents are prioritizing economics and lifestyle in their career decision-making and that the declining popularity of arthroplasty as a fellowship is due to the combination of decreasing reimbursement rates and high inpatient demands.

METHODS

The survey was designed using Dillman's Tailored Design Method (TDM). TDM is a survey research method developed to obtain survey response rates in professional populations that reach $\geq 95\%$ confidence level with $\leq 10\%$ sampling error. TDM has been found to statistically improve response rates in this population.[8] The pilot survey content was developed based on hypothesized and known resident career decision making factors as identified by AAHKS leadership members and a review of the literature.[9-13] The pilot survey was reviewed by six PGY 4 and seven PGY5 residents at the principal investigator's (PI's) institution. Based on their comment, a second pilot survey was developed and then reviewed by seven orthopedic fellows at the PI's institution. The pilot survey was then revised and finalized.

The research data collection technique was a four-staged, single mode (email), self-administered, web-based descriptive survey questionnaire conducted over a four-week period in September 2009 in collaboration with the AAOS survey research office. The first 3 stages of the data collection phase (with roughly one week between the stages) included in succession: a pre-notice email, an email containing a link to the survey web site, and a reminder email also containing the link to the survey. In the first three stages, the emails were sent to residents directly from the AAOS and contained a letter from AAHKS describing the study's purpose.

The fourth stage entailed emailing residency directors and coordinators of programs with three or more first year positions who had contact information listed in the American Medical Association (AMA) FREIDA Online database. The program directors were asked to forward the introductory letter and the survey link (exactly as it had been previously sent by AAOS directly to the residents) to their residents who were at the PGY3 level and beyond. No incentives were offered to the residents at any stage in the study in exchange for survey completion other than the satisfaction of participating in the acquisition of knowledge.

The survey was posted online using Snap survey software that allows publication of an HTML survey on the AAOS server in a hidden location. The survey was not linked to any pages on the AAOS website. Residents were emailed a link to access and complete the survey online. The Snap software forwarded their responses to the AAOS system via an email without any resident identifying information. Prior to survey analysis, Dillman's power analysis was performed to calculate how many respondents were needed to achieve a 95% confidence level for $p < 0.05$ given our sample size.[8] Completed survey data was analyzed using Statistical Package for the Social Sciences 12.0 (SPSS; Chicago, IL). A two-tailed paired t-test was

used to make comparisons between 2 groups when there were continuous variables. A Pearson Chi-square test was used to analyze contingency tables. The Fisher's exact test was used to analyze 2x2 contingency tables.

The AAHKS Research Committee approved and funded the study as part of the AAHKS health policy fellowship. The Partners (Boston, MA) Institutional Review Board (IRB) issued a Certificate of Exemption for the study as the survey did not pose any risk to the subjects and the survey collection methodology ensured anonymity of responses.

RESULTS

RESPONSE RATE

The AAOS had email addresses for 2694 orthopedic residents who were at the PGY3 level or above; 59 email addresses were found to be inactive. Based on Dillman's power analysis formula, it was calculated that a minimum of 335 respondents was needed to achieve a 95% confidence level for $p < 0.05$ with a sampling error of 5% for our sample size of 2635. 498 residents completed the online survey for a total resident response rate of 19% (498/2635).

DEMOGRAPHICS

The mean age of respondents was 31 (SD 2.6, median 30, range 25-44). Eighty-seven percent of respondents were male; 13% were female. 80% were non-Hispanic white, 9% Asian, 4% Hispanic white, and 3% Black or African-American. Other ethnic groups (each with $< 1\%$ representation) were Native American or Alaskan native, Indian, and Middle Eastern, East Indian, European, subcontinental Indian, and Persian. The rest of the respondents reported a mixed heritage. In addition to an MD, 34 had earned an MS, 8 a PhD, 7 an MPH, and 6 an MBA. Other degrees held included (number of respondents in parentheses following degree name): PT (4), MA (4), RN (1), PA (1), PharmD (1), MEd (1), OT (1), DC (1), and athletic trainer (1).

FELLOWSHIP PLANS

Sixty percent of residents were planning on enrolling in a fellowship after residency but had not yet accepted a fellowship position. Thirty-one percent had accepted a fellowship position. Of those planning on enrolling in or having already enrolled in one fellowship, 8% (37/455) were planning on enrolling in a second fellowship. Of the surveyed residents, 5% were not planning on enrolling in any fellowship, and 4% were undecided at the time of the survey. Overall, 77% felt that they were competent to practice general orthopedic surgery without additional fellowship training.

	1st Priority n(%)	2nd Priority n(%)	3rd Priority n(%)	4th Priority n(%)
Intellectual factors	190(40%)	129(27%)	74(16%)	80(17%)
Educational/ Interpersonal factors	167(35%)	133(28%)	87(18%)	87(18%)
Lifestyle factors	100(21%)	121(26%)	183(39%)	70(15%)
Economic factors	18(4%)	91(19%)	130(27%)	235(50%)

Table 1: Resident ranking of personal priorities in choosing a fellowship on a scale of 1 - 4 (1 = most important priority, 4=least important priority).

Intellectual factors	Very Important n(%)	Somewhat important n(%)	Not Important n(%)
Diversity of procedures	224(45%)	228(46%)	22(5%)
Technical challenges of the procedures	218(46%)	223(47%)	33(7%)
Challenging diagnostic problems	178(37.7%)	238(50%)	56(12%)
Ratio of operative patients to non-operative patients	159(34%)	244(52%)	70(15%)
Option in later practice to perform surgeries only in your sub-specialty	154(33%)	248(52%)	72(15)
Working with new technology	146(31%)	235(50%)	91(19)
Interest in an academic career	92(19%)	170(36%)	212(45%)
Research interest in that specialty	84(18%)	180(38%)	210(44)
Potential research and development relationships with industry	40(9%)	145(31%)	288(61%)
Insufficient exposure to that subspecialty in your residency	32(7%)	132(28%)	309(65%)
Lifestyle Factors	Very Important n(%)	Somewhat important n(%)	Not Important n(%)
Predictability of work hours in practice	180(38%)	238(50%)	56(12%)
Trauma call responsibilities in practice	131(28%)	271(57%)	72(15%)
Having a low in-patient census	118(25%)	207(44%)	149(31%)
Number of work hours in practice	117(25%)	278(59%)	78(16%)
Patient/ office call responsibilities in practice	106(22%)	295(62%)	73(15%)
Predictability of work hours during fellowship	27(6%)	153(33%)	291(62%)
Number of work hours during fellowship	21(4%)	126(27%)	327(69%)
Educational and Interpersonal Factors	Very Important n(%)	Somewhat important n(%)	Not Important n(%)
Compatibility of my personality with people in that field	263(56%)	181(39%)	26(6%)
Having a mentor/ role model in that specialty	237(50%)	189(40%)	44(9%)
Social characteristics of the patient population	101(22%)	226(48%)	143(30%)
Continuity of care	85(18%)	274(58%)	111(24%)
Timing of fellowship offer (i.e. being offered a fellowship position early)	22(5%)	97(21%)	351(75%)
Prestige	21(5%)	141(30%)	306(65%)
Ease of obtaining a fellowship in that field	15(3%)	117(25%)	338(72%)
Economic Factors	Very Important n(%)	Somewhat important n(%)	Not Important n(%)
Job marketability thereafter	211(45%)	222(47%)	38(8%)
Salary and benefits	123(26%)	273(58%)	75(16%)
Ability to do procedures with high reimbursements	89(19%)	237(50%)	145(31%)
Educational debt	75(16%)	167(36%)	228(49%)
Concerns over litigation	67(14%)	199(43%)	202(43%)
Ability to have supplemental income from owning and managing physical therapy and radiology imaging centers	55(12%)	137(29%)	279(59%)
Ability to have ownership in an ambulatory surgery center	49(10%)	142(30%)	280(60%)
Potential economic relationships with industry	27(6%)	101(21%)	343(73%)

Table 2: Resident priorities in selecting an orthopedic fellowship.

Of those who had decided on a fellowship subspecialty or had already accepted a fellowship position (355 residents): 28% chose sports, 21% hip and knee arthroplasty, 14% hand, 13% trauma, 8% pediatrics, 8% spine, 8% shoulder and elbow, 6% foot

and ankle, and 2% oncology. Twenty-seven of the respondents had indicated that they were planning on more than one fellowship. The most common subspecialty combinations (number of respondents in parentheses) were shoulder/elbow and hand (8),

Perceptions of Hip and Knee Arthroplasty Patients	Strongly Agree n(%)	Agree n(%)	Neutral n(%)	Disagree n(%)	Strongly Disagree n(%)
Arthroplasty allows me to make a positive impact on the patient's quality of life.	300(61%)	184(37%)	8(2%)	2(<1%)	2(<1%)
The arthroplasty patient population is pleasant and grateful.	111(23%)	285(58%)	78(16%)	15(3%)	1(<1%)
Arthroplasty surgeons have too many in-patients.	48(10%)	172(35%)	186(37%)	80(16%)	11(2%)
Patient/ office call responsibilities are more burdensome in arthroplasty than in most other orthopaedic subspecialties.	19(4%)	99(20%)	153(31%)	189(38%)	35(7%)
Arthroplasty patients are "too sick" (i.e. have multiple medical morbidities).	15(3%)	118(24%)	124(25%)	199(40%)	41(8%)
The high expectations of total hip and knee patients make arthroplasty as a career less appealing.	10(2%)	62(13%)	100(20%)	272(55%)	52(11%)
Technical & Intellectual Perceptions of Hip and Knee Arthroplasty	Strongly Agree n(%)	Agree n(%)	Neutral n(%)	Disagree n(%)	Strongly Disagree n(%)
I have adequate exposure to arthroplasty during my residency	230(46%)	199(40%)	32(6%)	34(7%)	2(<1%)
I enjoy using arthroplasty instrumentation	192(39%)	236(48%)	40(8%)	23(5%)	3(<1%)
I enjoy the challenge of revision total joint replacement procedures	57(12%)	120(24%)	114(23%)	134(27%)	68(14%)
I do not find arthroplasty surgery diverse enough to be interesting	54(11%)	124(25%)	112(23%)	160(32%)	47(10%)
There is interesting research in arthroplasty	50(10%)	149(30%)	210(42%)	71(14%)	16(3%)
I worry about the physical demands of arthroplasty on my health (e.g., the strain of positioning patients and dislocating/relocating hips).	16(3%)	57(12%)	64(13%)	227(46%)	129(26%)
For women: I worry about the use of cement as it pertains to reproductive health	10(4%)	20(7%)	146(53%)	58(21%)	41(15%)
Perceptions of Hip and Knee Arthroplasty Colleagues	Strongly Agree n(%)	Agree n(%)	Neutral n(%)	Disagree n(%)	Strongly Disagree n(%)
My arthroplasty attendings seem satisfied with their practice.	99(20%)	308(62%)	48(10%)	35(7%)	5(1%)
The personalities of and interactions with my arthroplasty attendings do not appeal to me.	16(3%)	57(12%)	94(19%)	221(45%)	107(22%)
Lifestyle Perceptions of Hip and Knee Arthroplasty	Strongly Agree n(%)	Agree n(%)	Neutral n(%)	Disagree n(%)	Strongly Disagree n(%)
A career in arthroplasty would place more demands on my time than most other specialties	26(5%)	140(28%)	127(26%)	186(38%)	16(3%)
Being an arthroplasty surgeon is prestigious	9(2%)	145(29%)	243(49%)	91(18%)	7(1%)
Economic Perceptions of Hip and Knee Arthroplasty	Strongly Agree n(%)	Agree n(%)	Neutral n(%)	Disagree n(%)	Strongly Disagree n(%)
There is likely to be a high demand for arthroplasty surgeons in the future	292(59%)	184(37%)	15(3%)	4(<1%)	0
Reimbursements for arthroplasty procedures and especially arthroplasty revisions are too low	211(43%)	184(37%)	76(15%)	20(4%)	5(1%)
Arthroplasty has a good job market	133(27%)	290(58%)	57(12%)	15(3%)	2(<1%)

Table 3: Resident perceptions of hip and knee arthroplasty as a career.

THA/TKA and sports (7), pediatrics and sports (4), and hand and pediatrics (3). Of those who were planning on pursuing a fellowship but had not yet decided on a subspecialty, the first choices were: sports (33%), THA/TKA (15%), trauma (14%), hand (13%), spine (7%), shoulder and elbow (6%), and pediatrics (4%). THA/TKA comprised 11% of the second choices and 25% of the third choices.

FELLOWSHIP DECISION-MAKING FACTORS

Those residents either considering a fellowship or having already accepted a fellowship were asked questions regarding their decision-making process and priorities. 12% determined what sub-specialty fellowship to pursue before residency, 1% as a PGY1 (intern), 15% as a PGY2, 49% as a PGY3, 22% as a PGY4, and 1% as a PGY5. The questions regarding decision-making in the choice of fellowship sub-specialty were divided into four categories: intellectual, educational/interpersonal, lifestyle, and economic factors. When asked to rank their top priority in choosing a fellowship, 40% cited intellectual factors, 35% educational/interpersonal, 21% lifestyle, and 4% economic. In terms of their second highest priority, 28% cited educational/interpersonal factors, 27% intellectual factors, 26% lifestyle, and 19% economic factors. Fifty percent of respondents ranked economic considerations as their lowest priority (Table 1).

The two most common factors cited as “very important” in each category, respectively, were: technical challenges of the procedures (46%), diversity of procedures (45%), predictability of work hours in practice (38%), trauma call responsibilities in practice (28%), compatibility of my personality with the people in that field (56%), having a mentor/role model in that field (50%), job marketability thereafter (45%), and salary and benefits (26%) (Table 2).

PERCEPTIONS OF HIP AND KNEE ARTHROPLASTY

All residents were asked about their perceptions of various aspects of hip and knee arthroplasty: patients, technical and intellectual aspects, colleagues, lifestyle, and economics. The strongest agreement (i.e. >60% either agreed or strongly agreed) was to the following statements: “arthroplasty allows me to make a positive impact on the patient’s quality of life” (98%), “there is likely to be a high demand for arthroplasty surgeons in the future” (96%), “I have adequate exposure to arthroplasty during my residency” (86%), “I enjoy using arthroplasty instrumentation” (87%), “arthroplasty has a good job market” (85%), “my arthroplasty attendings seem satisfied with their practice” (82%), “the arthroplasty patient population is pleasant and grateful” (81%), and “reimbursement for arthroplasty procedures and especially arthroplasty revisions are too low” (80%)(Table 3).

The strongest disagreement (i.e. >60% either disagreed or strongly disagreed) was to the following statements: “I worry about the physical demands of arthroplasty on my health (e.g., the strain of positioning patients and dislocating/relocating hips)” (72%), “the personalities of and interactions with my arthroplasty attendings do not appeal to me” (66%), and “the high expectations of total hip and knee patients make arthroplasty as a career less appealing” (65%).

	Non-TJA n(%)	TJA n(%)	p value
Primary hip arthroplasty	269 (65)	74(97)	<0.01
Primary knee arthroplasty	303(73)	76(100)	<0.01
Revision hip arthroplasty	59(14)	69(91)	<0.01
Revision knee arthroplasty	82(20)	73(96)	<0.01
Management of arthroplasty infections	90(22)	70(92)	<0.01
None of these procedures	103(25)	0(0)	<0.01

Table 4: Resident plans to perform arthroplasty procedures in future practice, stratified by (1) those who are not selecting a hip/knee arthroplasty fellowship (non-TJA group) and (2) those who are selecting a hip/knee arthroplasty fellowship (TJA group).

Overall, 76% of respondents had a clinical role model in arthroplasty whom they respected and emulated. Seventy-four percent of respondents had at least one arthroplasty attending who had taken an active interest in their education and career. Respondents were asked whether they felt confident in their ability to perform specific arthroplasty procedures upon graduating from residency. The affirmative response rate was as follows: 98% for primary TKRs, 95% for primary THRs, 36% for revision TKRs, and 24% for revision THRs.

COMPARISON OF THA/TKA-FELLOWSHIP BOUND RESIDENTS TO THEIR COUNTERPARTS

The respondents were divided into two groups: (1) the 77 respondents (15%) who have accepted or are planning on pursuing a THA/TKA fellowship (the “THA/TKA group”) and (2) the other 421 (85%) respondents (the “non-THA/TKA” group). 6% of the THA/TKA group was female as compared to 14% of the non-THA/TKA group. In their future practices, significantly more THA/TKA respondents (p values all <0.001) were planning on performing primary THAs (97% vs 65%), primary TKAs (100% vs 73%), revision THAs (91% vs 14%), revision TKAs (96% vs 20%), and management of arthroplasty infections (92% vs 22%)(Table 4). While there was a trend towards the THA/TKA group having more interest in academics, research, and leadership roles, there was no significant difference between the THA/TKA and non-THA/TKA group in terms of plans on practicing in a university or academic practice (39% vs 30%), plans on pursuing research as an attending (57% vs 48%), and plans on pursuing a leadership role in a national organization (35% vs 25%), respectively.

In terms of their top priority in selecting a fellowship field, there was no significant difference between the THA/TKA and non-THA/TKA group in terms of the following factors: intellectual (47% vs 38%), educational/interpersonal (32% vs 36%), lifestyle (16% vs 22%), and economic factors (5% vs 4%). The top ranked reasons cited FOR NOT considering a THA/TKA fellowship were: technical/intellectual reasons (49%), patient population characteristics/demographics (23%), lifestyle rea-

	% Citing the most important reason FOR pursuing TJA as a career	% Citing the most important reason FOR NOT pursuing TJA as a career
Technical/intellectual reasons	63%	49%
Patient population characteristics/demographics	17%	23%
Lifestyle reasons	12%	13%
Personalities of and interactions with colleagues	5%	4%
Economic reasons	2%	12%

Table 5: Residents' top reason for decided to pursue or not to pursue arthroplasty as a career.

Operation	Males	Females	p value between genders
Primary THA	73%	46%	<0.001
Primary TKA	81%	52%	<0.001
Revision THA	27%	19%	0.219
Revision TKA	33%	19%	0.028
Infection TJA	34%	22%	0.063
No TJAs	17%	46%	<0.001

Table 6: Resident plans to perform arthroplasty procedures in future practice, stratified by gender.

sons (13%), economic reasons (12%), and personalities of and interactions with colleagues (4%). The top reasons cited FOR considering or planning on a THA/TKA fellowship were: technical/intellectual reasons (63%), patient population characteristics/demographics (17%), lifestyle reasons (12%), personalities of and interactions with colleagues (5%), and economic reasons (2%) (Table 5).

The THA/TKA group was significantly more likely than the non-THA/TKA groups to have “at least one arthroplasty attending who has taken an active interest in my education and career”: (86% vs 72%, $p=0.01$). The THA/TKA group was significantly more likely than the non-THA/TKA groups to have “a clinical role model in arthroplasty whom I respect and wish to emulate”: (88% vs 74%, $p<0.01$).

GENDER STRATIFICATION OF ARTHROPLASTY RESPONSES

There was a trend towards fewer females than males choosing THA/TKA as a fellowship (22% vs 11%), but the difference was not significant. In considering arthroplasty as a fellowship, significantly more women (39%) than men (11%) “worry about the physical demands of arthroplasty on my health” (52% of females and 75% of males disagreed with that statement) ($p<0.001$). Eleven percent of women agreed with the statement “I worry about the use of cement as it pertains

to reproductive health,” 53% of women were neutral, and 36% disagreed with the statement. Significantly more men versus females overall (regardless of fellowship choice) were planning on performing primary THAs (73% vs 46%, $p<0.001$), primary TKAs (81% vs 52%, $p<0.001$), and revision TKAs (33% vs 19%, $p=0.03$). Significantly more females versus males were not planning on performing any THA/TKAs when in practice (46% vs 17%, $p<0.001$). There was no difference between the genders in planning on performing revision THAs (males 27%, females 19%, $p=0.219$) and treating infected THA/TKAs (males 34%, females 22%, $p=0.063$). (Table 6)

There was no difference between the genders in having a clinical role model in arthroplasty whom they respected and emulated (77% males, 71% females). There was no difference between the genders in having at least one arthroplasty attending who had taken an active interest in their education and career (74% males, 76% females).

DISCUSSION

RESPONSE RATE AND DEMOGRAPHICS

The response rate of this study yielded sufficient power for data analysis according to pre-study power analysis. This study's response rate of 19% (498 residents) exceeded the previous AAOS experience with resident direct email surveys (the last one yielding a 14% response rate in 2007). In this study, after the direct emails to residents, the response rate was just 12% (309 respondents). However, an additional 189 responses were received after the final emails sent to residents from their program directors.

Response rates amongst underrepresented minorities in orthopedic residencies were analyzed. Currently, 13% of PGY3+ orthopedic residents are women. In our study, we found the same gender distribution amongst our respondents (13% females). This reflects a trend towards an increasing proportion of female orthopedists: in 2008, 4% of active fellows and 11% of candidate members in the AAOS were female. [3] The racial distribution of our resident respondents was slightly more diverse than a 2008 AAOS survey of practicing orthopedists that found 89% non-Hispanic whites (80% in our study), 5% Asians (9% in our study), 2% African-American (3% in our study), 2% Hispanic whites (4% in our study), and <1% Native American (<1% in our study). [3]

SPECIALTY DISTRIBUTION

Our data is in concordance with a prior AAOS survey regarding fellowship enrollment. According to a 2007 AAOS survey, over 90% of graduating residents were going to pursue a fellowship. [4] We similarly found that 91% of residents have either accepted or planning on pursuing a fellowship after residency. Eight percent of those planning on enrolling in a fellowship are planning on pursuing a second fellowship as well, reflecting the current trend towards “super-specialization.”

Our survey data showed THA/TKA as the second most popular intended fellowship choice behind sports (28% sports, 21% THA/TKA) for those who have decided on their specialty. The divide between sports and THA/TKA fellowships increases, though, when looking at those who have yet to decide on a spe-

Specialty	Priority in specialty selection (in declining order)
General surgery residents [Thakur J Pediatr Surg 2001]	<ul style="list-style-type: none"> - interest in the field (80%) - surgical field prestige (53%) - presence of clinical opportunity (53%) - mentor influence (45%) - specialty research experience (38%) - income (20%) - family priorities (13%) - lifestyle (11%) - length of training (2%) - Of note: 66% of surgical residents chose the same career as their mentor
General surgery chief residents who chose a career in vascular surgery [Calligaro J Vasc Surg 2004]	<ul style="list-style-type: none"> - technical aspects of vascular surgery - positive influence of mentors - complex decision making involved in vascular surgery - the academic nature of vascular surgery
Ophthalmology residents [Gedde J Glaucoma 2007]	<ul style="list-style-type: none"> - acquisition of special skills - role models/mentors, rotation(s) in subspecialty - challenging diagnostic problems - types of patient problems - the perceived job market

Table 7: Review of resident priorities in specialty decision-making in other surgical sub-specialties.

cialty: 33% chose sports and 15% chose THA/TKA as their current top choice. Current residents are less likely choose THA/TKA as a specialty as compared to current orthopedic practitioners: 28% of current practitioners overall specialize in THA/TJA vs. 21% of those in our study who had made a specialty decision and 15% of those who had not yet decided in their specialty. In fact, there has been a recent downward trend in THA/TKA specialists amongst current practitioners: 35% ages 50-59, 29% ages 60-69, and 21% <40. Compared to the youngest practicing members of the AAOS, our survey found the same percentage of residents intending on a THA/TKA specialty (21%).[3]

PRIORITIES

Various researchers have investigated why residents decided to pursue a particular orthopedic specialty. A national survey of final-year orthopedic and plastic surgery residents revealed that residents pursued hand surgery primarily because of interest in and exposure to the field.[9] A survey of foot and ankle fellows found the top reasons for choosing a foot and ankle fellowship (in decreasing order) to be: salary/benefits, offered before other fellowships, research options, workload, location, marketability thereafter, clinical material, and mentors.[10] A Pediatric Orthopaedic Society of North America (POSNA) study identified various reasons why residents had chosen not to pursue a pediatric fellowship: they like another subspecialty better, the ratio of surgical to non-surgical cases is too small, the level of relative reimbursement is less than that in other subspecialties, they do not like caring for handicapped children, there are limited private practice opportunities, they do not like dealing with parents, and the liability is too great.[11] To our knowledge, there are no studies that look at orthopedic career decision-making in general

or that specifically investigate why orthopedic residents do or do not decide to pursue an arthroplasty fellowship.

Other surgical subspecialties have also investigated the career decision-making priorities of their residents. In reviewing that literature (Table 7) the leading priorities of surgical residents overall in choosing a fellowship field were the technical aspects of a field, their intellectual interest in the field, and having role models/mentors in that field. Overall, economics and lifestyle played a secondary role. Our survey results concurred with the literature. Intellectual factors (40%) and educational/interpersonal factors (35%) were the top priorities of our resident respondents. Fewer residents cited lifestyle (21%) and, to an even lesser extent, economics (4%) as their top priority in their career decision-making process. In fact, 50% of residents ranked economic considerations as their lowest priority.

And yet, the sentiment pervading the THA/TKA community is that fewer residents are pursuing arthroplasty as a fellowship because of declining reimbursements and impositions on one's lifestyle as compared to other specialties, namely sports. These sentiments may indeed be correct, and residents are bashful in responding honestly in surveys as they perceive the "right" answers in surgery to be de-prioritizing lifestyle and economics. Our emphasis that their responses are anonymous detracts from this theory.

The disconnect between attending and resident sentiments may be generational. The older generations historically tend to perceive themselves as harder-working than their younger colleagues. Also, physicians entering practice before the current decline in surgical reimbursements may have themselves been more motivated by income when they chose

their field than the current physician generation which entered medicine after a decline in the relative socioeconomic stature of surgeons. There must therefore be caution in projecting one's own motivational forces, assumptions and potential biases on another group.

In attempting to understand the declining percentage of THA/TKA specialization, we examined the residents' perceptions of THA/TKA patients, technical and intellectual aspects, colleagues, lifestyle, and economics. In terms of intellectual factors (which was the leading priority for residents in choosing a fellowship), only 36% enjoyed the challenge of revision THA/TKAs, and 36% did not feel that THA/TKA was diverse enough to be interesting. In terms of lifestyle, only 34% of residents felt that a career in arthroplasty would place more demands on their time than most other specialties. In terms of economics, 80% of residents felt that reimbursements for arthroplasty procedures and especially arthroplasty revisions are too low – but this should be taken in context of economics being ranked low in terms of priorities.

In comparing the two resident groups, the THA/TKA group (planning on a THA/TKA fellowship) had a trend towards prioritizing intellectual factors more than the non-THA/TKA group (47% vs 38%) and prioritizing lifestyle factors less than the non-THA/TKA group (16% vs 22%), but this difference was not significant. The THA/TKA group was (1) significantly more likely to have at least one arthroplasty attending who had taken an active interest in their education and career and (2) significantly more likely to have a clinical role model in arthroplasty whom they respected and wished to emulate. The importance of a role model and active mentor in resident decision-making is consistent with the literature in other surgical subspecialties. One study found that 66% of surgical residents chose the same career as their mentor.[12] Two other studies reported that the second most important factor in fellowship decision making was role models/mentors (the top priority being technical aspect of the field in both of those studies).[13, 14]

THA/TKA SHORTAGE

Our study confirmed the assumption that THA/TKA fellowship-trained surgeons were significantly more likely to perform THA/TKAs than those not planning on a THA/TKA fellowship. This difference was most dramatic for revision THAs (91% vs 14%), revision TKAs (96% vs 20%), and management of arthroplasty infections (92% vs 22%). Of note, 65% of non-THA/TKA fellowship respondents were planning performing primary THAs and 73% were planning on performing primary TKAs, presumably because they are comfortable with these procedures without fellowship training. It is therefore the impending explosion of complex primary and revision THA/TKA cases that is projected to most significantly compromise patient access-to-care if the number of arthroplasty fellows does not increase. The quality of care may also be compromised if surgeons less familiar with THA/TKAs perform these more challenging cases. Our survey data supports targeting recruitment efforts early in the residents' careers as 77% of

residents chose their sub-specialty at or before the PGY3 year.

When stratifying the survey results by gender, we found that fewer women than men are choosing a THA/TKA fellowship (11 vs 22%), but this difference was not significant. Women worry significantly more about the physical demands of arthroplasty, but they have there were no significant differences between the genders in terms of having an arthroplasty clinical role model or mentor. In terms of arthroplasty workforce calculations, one must note that significantly fewer females (regardless of fellowship choice) are planning on performing primary THAs, primary TKAs, and revision TKAs than their male counterparts. In fact, significantly more females than males were not planning on performing any THA/TKAs when in practice.

According to our findings, efforts to raise interest in arthroplasty as a career should target the intellectual curiosity of residents. Indeed, consistent with their overall priorities, THA/TKA residents most frequently cited technical/intellectual reasons as their top reason for deciding on THA/TKA as a career (62%). On the other hand, the most commonly cited top reason for NOT pursuing arthroplasty as a career was technical/intellectual (49%). Courses targeting young residents can highlight the intellectual challenges of THA/TKA – particularly for difficult primaries and revision THA/TKAs. Lectures and labs can demonstrate and simulate the preparation and sequence of steps needed to thoughtfully and systematically approach these cases, as younger residents deciding on their career path perhaps find these cases to be prohibitively daunting. Female arthroplasty surgeons can play a particularly significant role in helping female residents make a more informed decision about specializing in THA/TKA, specifically as it relates to the physical demands of the field. The value and effectiveness of mentorship in surgical training has been well documented.[15-19]

It has been found that musculoskeletal education is inadequate in medical school, but interest in orthopedics as a career is correlated with cognitive mastery of musculoskeletal medicine and reported clinical confidence in conducting a physical exam. Organizing medical school arthroplasty lectures, labs, and clinical clerkships may stimulate medical student interest and connect them with role models.[20, 21] Arthroplasty attendings can also be encouraged to mentor residents early in their careers, perhaps piquing their intellectual curiosity in the field. For example, at the senior author's institution, there is an annual arthroplasty research-information session/dinner targeting second-year residents. These efforts can be made on both an individual level and also on a national level with resident courses and formal mentorship and research programs.

In summary, the goal of this study was to identify resident priorities in choosing a fellowship field and to examine their perceptions of THA/TKA as a career. Our findings are consistent with the majority of the literature, finding that intellectual factors and role models/mentors are most important in determining a surgical resident's fellowship choice, not economics and lifestyle as often presumed. THA/TKA

fellowship-bound residents are significantly more likely than other residents to plan on performing primary and revision THA/TKAs as part of their practice, with the differences being most dramatic for revisions. In the face of a looming patient access-to-care crisis, the data from this study supports a policy of encouraging mentorship and highlighting the intellectual challenges and satisfaction of THA/TKA as a career early in a

resident's training as strategies to augment the declining supply of surgeons specializing in total hip and knee arthroplasty.

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