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Prevalence and Cost of Full-Time Research Fellowships During General Surgery Residency – A National Survey

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Structured Abstract

Objective—To quantify the prevalence, outcomes, and cost of surgical resident research.

Summary Background Data—General surgery is unique among graduate medical education programs because a large percentage of residents interrupt their clinical training to spend 1-3 years performing full-time research. No comprehensive data exists on the scope of this practice.

Methods—Survey sent to all 239 program directors of general surgery residencies participating in the National Resident Matching Program.

Results—Response rate was 200/239 (84%). A total of 381 out of 1052 trainees (36%) interrupt residency to pursue full-time research. The mean research fellowship length is 1.7 years, with 72% of trainees performing basic science research. A significant association was found between fellowship length and post-residency activity, with a 14.7% increase in clinical fellowship training and a 15.2% decrease in private practice positions for each year of full-time research ($p < 0.0001$). Program directors at 31% of programs reported increased clinical duties for research fellows as a result of ACGME work hour regulations for clinical residents, while a further 10% of programs are currently considering such changes. It costs \$41.5 million to pay the 634 trainees who perform research fellowships each year, the majority of which is paid for by departmental funds (40%) and institutional training grants (24%).

Conclusions—Interrupting residency to perform a research fellowship is a common and costly practice among general surgery residents. While performing a research fellowship is associated with clinical fellowship training after residency, it is unclear to what extent this practice leads to the development of surgical investigators after post-graduate training.

Introduction

There are 4 main pathways to becoming a physician-researcher. These include extensive research training during medical school (MD/PhD), residency, fellowship or as an attending physician. Of the seven (out of 24) specialties that match greater than 1000 candidates in the National Residency Matching Program,¹ general surgery is the only one in which a sizable proportion of trainees interrupt their clinical training to perform a 1-3 year research fellowship. Since general surgery residency lasts 5 years, performing a research fellowship therefore extends post-graduate training to 6-8 years for many surgery residents. Considering the fact that greater than 70% of residents will go on to perform 1-3 year clinical fellowships after

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residency training,² this means that a substantial cohort of general surgeons will train between 7-10 years after graduating medical school prior to becoming independent practitioners.

Despite the long history of surgeons performing research in the middle of their residency training,³ there is little objective data on the utility of this practice. Although a large number of surgeons graduate with significant research experience, surgeons trail other physician-scientists in both rates of application for National Institutes of Health (NIH) grants as well as the success of those applications.⁴ This is true for career development awards as well.⁵

There is evidence that performing research during residency correlates with an academic surgical career following post-graduate training. A survey of 3 academic surgical organizations (Association of Academic Surgeons, Society of University Surgeons and American Surgical Association) showed that three-quarters of their members performed research during residency.⁶ Additionally, residents who ask to perform research fellowships during residency have been shown to be more likely to hold academic positions after residency.^{7,8} Publication as a resident has also been found to predict continued publication for attending pediatric surgeons, but simply performing a research fellowship during residency did not correlate with publications at the faculty level.⁹ We have previously shown in a single-center survey that the majority of residents who pursued a two to three year research fellowship during residency at a university medical center actively perform research as faculty members, with research currently making up 25% of their current professional effort.¹⁰ Of surgeons who performed a research fellowship during residency and then applied for independent funding after completion of training, 82% received funding, including a success rate of 72% who applied for NIH funding. However, many graduates never applied for grant support after completing their training, and a total of 41% of graduates ultimately secured independent funding while only 8% received an R01.

There is little data on the prevalence of performing a research fellowship in the middle of surgical residency. A 1994 survey of 189 attendees of a two-day "Fundamentals of Surgical Research" course aimed at residents beginning research fellowships demonstrated that half planned to spend 1 year in full-time research while half anticipated a 2-3 year research experience.¹¹ Since there were 1057 categorical general surgical residency spots available in 2007, a number that has changed less than 2% since 2001,¹ it is reasonable to assume that at least 20% (189/1057) of all surgery residents have historically pursued research fellowships in the middle of their clinical training. In contrast, a survey of New England programs showed that half of general surgery residents pursued 1-3 year research fellowships in 2000,¹² although this number may have not been representative of trainees nationwide given the heavy research emphasis of many programs in this region.

The overall lack of data relating to the prevalence of surgical residents pursuing research fellowships was summarized by a past-president of the American College of Surgeons thusly: "although young surgeons in training ... present their research findings (often excellent work and important findings) at national meetings on a regular basis, no one knows how many residents work in research programs, who they are, where they are, or what they are doing."¹³ The aim of this study was to obtain a comprehensive view of current nationwide practices of surgical research fellowships.

Methods

Participants

A list of all 250 general surgery residency programs in the United States was obtained from the website of the Accreditation Council for Graduate Medical Education (ACGME)¹⁴. Programs that did not utilize the National Resident Matching Program¹⁵ (n=11) were excluded. These included nine military programs and two newly opened civilian residencies. Electronic

and postal mailing addresses were collected for the program directors of the remaining 239 residencies from internet databases as well as individual program web pages.¹⁴⁻¹⁶

Survey

A 25-question electronic survey was sent to all program directors in 2006, and an identical hard-copy survey was subsequently sent to electronic non-responders. All recipients were asked to complete a 7-question survey covering the size, type and location of their training program, the factors which influenced their research activities, career paths of their graduates and percentage of residents who performed research fellowships. Research fellowships were defined as one continuous year or more performing research, with interruption of full-time clinical training in the middle of general surgery residency. Program directors of residencies where greater than 5% of residents performed research fellowships were asked to complete an additional 18 questions related to issues involving fellowship training. These included 6 multiple choice questions and 11 questions where a free text response was required to obtain information not readily available in a multiple choice format. An example of this is the question “how much time do your residents spend in research” where respondents had to fill in separate boxes for percentages of trainees who perform research fellowships for one year, two years or three or more years. There was also a single opinion section where program directors were queried about the utility of research fellowships using a Likert Scale. The survey was approved by the Institutional Review Board of the Human Research Protection Office at Washington University in Saint Louis.

Statistics

Data were analyzed using the statistical software program Prism 4.0 (GraphPad Software, San Diego, CA.). Comparisons of residents participating in full-time research or to mean years of research/resident to overall percentage of programs were done using ANOVA followed by TUKEY post-test. Linear regression analysis was used for all other comparisons. A p value <0.05 was considered to be statistically significant.

Results

Respondents

A total of 239 surveys were sent to program directors representing 1052 categorical general surgical residents. Responses were obtained from 200 program directors (84%). These program directors represented 905 general surgery residents (86% of all residents). When given three options to characterize their training programs, residency directors described 101 of their programs as university (50.5%), 65 as university-affiliated community (32.5%) and 34 as community (17%). Responding programs had a mean of 4.5 categorical general surgery positions annually.

Prevalence and distribution of resident research

A total of 131 programs (55%) had greater than 5% of their residents perform research fellowships. This was more common at university programs (85%) than university-affiliated community (34%) or community (4%) programs, and the percentage of eligible residents per program who pursued research fellowships ranged widely from 5% to 100% (Fig. 1A). By the conclusion of their training, 36% (381/1052) of general surgery residents extended their training a minimum of one year to perform a research fellowship. Based upon the length of time residents spend performing research (see below), there were 634 general surgery residents conducting full-time research in 2006.

Residents who pursued research fellowships did so for a mean duration of 1.7 years. Of residents who performed a research fellowship, 154 (41%) spent 1 year, 200 (52%) spent two years, and 27 (7%) spent three or more years. Mean length of research per program is shown in Fig. 1B. While the length of a research fellowship generally corresponded to resident preference, program directors reported that 5% of their residents spent less time performing research than they requested and 7% spent more time than they requested.

The majority of research residents studied basic science (72%), with the remainder performing clinical research (26%) or “other” pursuits (2%). A total of 73% of residents performing research fellowships did so in the department of surgery at their own institution, 11% worked in another department at their own institution, and 16% received research training at a different location than where they received clinical training. The vast majority of residents performed their post-doctoral fellowships after two (53%) or three (46%) years of clinical training. Residents from larger programs were more likely to start research training later (data not shown). Whether a research fellowship was started after two or three clinical years was not associated with the mean time spent performing full-time research, nor was it associated with whether a resident trained in a university or university-affiliated community program.

Forty five states and the District of Columbia have general surgery residency programs. The absolute number of residents who performed research fellowships per state is shown in Fig. 2A. Of these, 45% resided in only five states (New York, California, Texas, Pennsylvania and Massachusetts), while eight states with residency programs did not have any residents pursue a research fellowship. There was some correlation between the number of residents performing research fellowships and both the number of hospital beds/state¹⁷ and chief residents/state; however, neither of these was absolute (Fig. 2B, 2C).

Program directors were also surveyed about whether research in any form (full-time, part-time or a single project) was *required* at their programs. A total of 126 programs required research in some form while 73 did not. Since 131 programs sent at least 5% of their residents to research fellowships, this means residents in at least a small number of programs pursue full-time research even though their program does not formally require any type of research.

Productivity and moonlighting

According to their program directors, the average resident performing a research fellowship published 5.7 papers and presented at 4.2 meetings. The number of papers published was positively correlated with mean years performing full-time research (Fig. 3A) and the number of residents who conducted full-time research in a given program (Fig. 3B) but not the size of the program (Fig. 3C).

Sixty-one percent of residency programs allowed research fellows to perform external clinical duties (“moonlighting”) during their post-doctoral fellowship. Distinct from external moonlighting, 38% of programs had mandatory internal clinical responsibilities at their home institution while another 21% had optional internal clinical duties. Of note, program directors at 31% of programs reported increased clinical duties for research fellows as a result of ACGME work hour regulations for clinical residents, while a further 10% of programs are currently considering such changes. Productivity was not associated with whether trainees performed external moonlighting during their research fellowship (Fig. 3D) nor was it correlated with the requirement to perform internal clinical duties within their home training institution (data not shown).

Funding of research fellowships

The majority of residency programs (71%) which send trainees to research fellowships do not require trainees to seek or obtain external funding. However, 26% require residents to apply for funding and the remaining 3% mandate that residents obtain funding as a prerequisite for performing a research fellowship. Overall, 52% of research fellows apply for individual funding of which 57% are successful. Application for funding was significantly correlated with the number of papers published during a research fellowship (Fig. 4A); however whether or not a trainee was successful in receiving funding was not a predictor of the number of papers published (Fig. 4B).

The weighted mean salary of a third year post-graduate surgical resident in 2006 was \$46,764¹⁸ with benefits representing an additional cost of 40% of salary. The total cost to support a resident performing a research fellowship who is paid at this level is therefore \$65,470 annually, not counting support for supplies and travel costs. Since 634 surgical residents are conducting research fellowships at any given time, it costs \$41.5 million to support the salaries and benefits of general surgery residents performing full-time research in the middle of residency. This is paid for by departmental funds (40%), institutional training grants such as the NIH T32 award (24%), individual grants from the NIH or societies (17%) and other non-specified sources (19%).

Post-graduate activity

All program directors surveyed (regardless of whether their residents perform research fellowships) were asked to categorize the activities of their residents after graduation as academic practice, private practice, fellowship or other (Table 1). Greater than 90% of residents pursue fellowship training or obtain a private practice position following residency regardless of whether they train at a university, university-affiliated community, or community program. A significant association was found between mean time spent in research and choice of post-residency activity (Fig. 5). There was a 14.7% increase in a resident pursuing fellowship training and a 15.2% decrease in obtaining a private practice position for each year of full-time research performed ($p < 0.0001$).

Program directors' attitudes towards research fellowships

Program directors in residencies where at least 5% of trainees perform research fellowships were asked a number of questions regarding the utility of resident research utilizing a Likert scale (Table 2). They strongly felt that full-time research benefits residents interested in academics (87% agree or strongly agree) while a smaller majority felt that full-time research benefits residents interested in pursuing fellowship training (52% agree or strongly agree). In contrast, most did not feel that full-time research was beneficial for all residents (64% neutral, disagree or strongly disagree). There was no agreement as to whether funding constraints represent a roadblock to greater resident participation. When program directors were asked which factors determined whether a resident pursued a research fellowship, the only factor mentioned greater than 50% of the time was "resident academic goals" (Table 3A). Although the majority of program directors tracked both academic success and resident satisfaction during their research fellowship, less than a third tracked success after the fellowship (Table 3B).

The subset of program directors that sent less than 5% of their residents to postgraduate research fellowships was polled as to the reasons why. The most commonly cited reasons were lack of resident interest ($n=57$), clinical scheduling demands ($n=51$), and lack of funding ($n=29$).

Discussion

The physician-scientist has been branded an endangered species for at least half a century.¹⁹⁻²² Among the different paradigms for training physician-scientists, general surgery is unique in that the bulk of research training occurs during residency, typically 3-5 years before a trainee will become an independent practitioner. This is in sharp contrast to a more extended research experience during medical school as part of an MD/PhD program or during a fellowship that follows residency, which is much closer temporally to one's first faculty position when the techniques learned in a research fellowship are less likely to be out of date. When looking at the success of the surgery model using NIH funding as a benchmark,²³ it is difficult to make a compelling case for the superiority of current practice of performing research fellowships in the middle of residency. In 2007, interns matching into categorical general surgery resident positions made up 4.8% of the total pool (1057/21,845) of incoming interns.¹ According to the results contained herein, over one third of chief residents in general surgery perform a dedicated research fellowship, which is equal to approximately 1.5% of overall graduating trainees in the United States. However, surgical awards from the NIH have declined steadily over the past decade, and grants to surgical faculty with an MD comprise only 1-2% of all NIH grants.⁴ Thus even if an assumption is made that every NIH surgical grant comes from a resident who performs a research fellowship in the middle of residency, the ultimate "payoff" for the typical trainee extending their residency by 1-3 years is, at best, non-inferior to other paradigms of training physician-scientists. Additionally, although funding after residency was not an endpoint of this study, we found that of the 381 residents who perform a research fellowship, 41% spend 1 year and 52% spend two years, whereas our previous data found that surgeons who obtained NIH funding spent an average of 3.7 years of research before and during residency.¹⁰

It is unclear, however, whether NIH funding is the appropriate benchmark for the surgical-scientist. The surgical workload often does not lend itself to large chunks of protected time needed to succeed as a NIH-funded researcher, and the fact that research fellowships during residency do not frequently translate into NIH grants does not mean that they are not beneficial. Possible benefits to performing research fellowships include preparation for an academic career, preparation to perform research that is not funded by the NIH, increased chance of obtaining competitive clinical fellowship training after residency, and improved patient care skills secondary to improved critical thinking and assessment of the literature. We believe it is reasonable to link the length of time spent in full-time research with long-term career goals such that those interested in ultimately applying for NIH funding spend more than two years in dedicated research time while those interested in other benefits spend two years or less. The clear correlation between years spent performing full-time research and whether a trainee pursues a fellowship or goes into private practice suggests that research fellowships may impact career plans, although it is also possible that residents who pursue a research fellowship are already predisposed to pursue additional training after residency. Additionally, the data on this self-selected group cannot distinguish whether a research fellowship is undertaken as training to ultimately perform research as an attending physician or whether it is a means for some toward obtaining a fellowship after residency, since a track record of productivity is often required to match at more competitive programs. It is worth noting, however, that our previous single-center study demonstrated that the majority of surgeons who performed research fellowships in the middle of residency continued to perform research as attending physicians, with a mean percent effort of 25%¹⁰ although the generalizability of these results has been questioned because of the highly academic nature of the center surveyed.²⁴ Of note, there is a striking difference between the training surgeons receive in their research fellowship and the research they perform as attending physicians. In the nationwide survey, program directors report that 72% of their residents perform basic science research even though statistically surgeons are very unlikely to become NIH-funded basic scientists and our previous data

suggests the majority of surgeons perform clinical research¹⁰. Whether basic science training in residency is the best route to develop clinical faculty researchers is a question without a clear answer.

As might be expected, productivity increased in a near-linear fashion the longer one spent performing research, with residents who spent two years in fellowship publishing roughly twice as many papers according to their program directors as those who spent 1 year. Applying for independent funding for a research fellowship was also significantly correlated with the number of papers published. Interestingly, whether or not a trainee was successful in obtaining funding was not a predictor of publication numbers, suggesting (at least at this stage of training), the motivation to write a grant is at least as important as the quality of the grant as judged by peer review. More surprising was the relationship between program size, the number of residents per program who performed research fellowships and productivity. While the overall size of a residency program was not correlated with number of publications, there was a striking correlation between papers published and the size of a program's research fellowship cohort. Thus, a trainee in a program with four residents who all perform research fellowships is statistically likely to publish more than a trainee in an eight person program which sends only one resident to a research fellowship.

Trainees perform research in 37 out of 45 states where general surgery residencies exist. A map showing the distribution of these residents looks similar to an Electoral College map, and it is not surprising that residents performing research fellowships co-localize with the population as a whole. However, this correlation is not absolute as some highly populous states such as Florida had relatively few research fellows (n=8) while some smaller states, notably Massachusetts, had a very large number (n=56) despite the fact that the former's population is 2.7 times larger. In an attempt to normalize results, we compared research fellows to hospital bed distribution which moderated the data somewhat, but still continued to result in a wide variance. States with a high ratio of research fellows to beds were generally small with one or two institutions (in some cases the only program in the state) representing the overwhelming majority of research fellows although New York, California and Pennsylvania were notable for having a relatively high number of research fellows distributed among multiple programs. The comparison of research fellows per state normalized by the number of chief residents demonstrated how research-oriented the programs in each state were regardless of size. This produced the most heterogeneous distribution of data without the strong regional trends seen in other measures.

This study provides the first description of how much it costs to train general surgery research fellows and who pays for their training, which is especially important in an era of declining clinical revenue and relatively flat NIH budgets. Using our estimated total of \$41.5 million spent supporting resident research, from a microeconomic perspective, the cost for each manuscript produced is \$19,110 (381 research residents who average 5.7 papers each produce 2,172 papers each year). However the \$41.5 million figure actually represents an underestimate of the true cost to support research fellowships since it reflects the cost of salaries and benefits but does not take into account the price of equipment or the amount of money spent sending residents to present their findings at national meetings. We believe that simply focusing on the number of papers written is shortsighted, however, since it does not reflect the training component of a research fellowship nor its long-term benefits. These other benefits are likely why there is substantial financial support from departmental clinical revenue, the NIH, and foundations but they are more difficult to quantitate. As such, this study cannot clearly answer what the return on investment is for surgical trainees who perform research fellowships. There are a number of disparate potential benefits of a fellowship including but not limited to an increase in a) the likelihood of obtaining a competitive fellowship or faculty position, b) the likelihood of obtaining extramural grant support after residency, c) an appreciation of the

surgical (and non-surgical) literature, and d) personal time to spend with family or on outside interests, constituting “a break” in the middle of a work-intensive residency. It is reasonable to assume that different trainees enter research fellowships for different reasons and that many practicing surgeons may retrospectively view the utility of their dedicated research time differently than trainees currently entering a research fellowship. A survey comparing attitudes between current trainees and a representative cohort of surgeons who have finished their training may illuminate the relative importance of the above possible benefits of dedicated research time and whether a pre hoc view of the expected benefits is similar to a post hoc analysis of the same issue.

In addition to benefiting residents, research fellowships also have two definite benefits to departments of surgery. First, papers published by research fellows typically have surgical faculty members as senior authors. There is a clear correlation, therefore, between the productivity of a research fellow and the productivity of their faculty mentor, and papers published by surgery residents can play a major role in driving both academic success and promotion for faculty members. One less obvious benefit to surgery departments is that many research fellows are permitted to have some limited clinical responsibilities, and our data suggest that research fellows are being increasingly utilized by residency programs to offload responsibilities from clinical residents to assist in compliance with work hours mandated by the ACGME.²⁵ Unlike trainees in the majority of residency programs, a large percentage of general surgery residents previously had an average workweek that would not be compliant with current work hour restrictions. The survey results demonstrate that not only do 59% of research fellows have mandatory or optional clinical responsibilities in their home institution, but also 31% of programs have increased clinical workload on research residents to comply with ACGME work hour restrictions while another 10% are considering doing so. This does not appear to affect productivity during research fellowships as the number of publications per research fellow was similar regardless of whether a program had mandatory clinical responsibilities or optional moonlighting. However, since we do not have historical publication records from these programs, we cannot rule out the possibility that these programs were different at baseline and mandatory or optional clinical duties have a negative impact on productivity. We believe this represents the first description of a potentially unexpected consequence of work hour restrictions as well as a solution utilized by many residencies to maintain compliance.

This study has a number of limitations. An important concern is whether the 200 respondents were representative of all 239 general surgery residencies to whom the survey was sent. Using demographic data obtained from varied sources, we found that the 200 programs where the program director completed the survey were not statistically different from the 39 programs where the program director did not complete the survey in terms of program size, participation in full-time research and mean time spent in full-time research (data now shown). However, it is possible that program directors that chose not to complete the survey viewed research in a less favorable light than responders which, in turn, could mean that the program directors' views of the utility of performing research fellowships described herein are overly positive. Another important limitation of the study is that it highlights the difficulties in determining the long-term utility of surgery residents performing research fellowships. While 87% of programs track the success of residents performing research fellowships, less than a third track the success of residents after completing their research fellowships. As such, there is no way of knowing broadly whether research fellowships translate to long-term research success outside of tracking the number of NIH grants surgeons receive. The survey also does not determine whether performing basic science or clinical research is more likely to successfully prepare a fellow for a career as a surgical scientist after the conclusion of residency.

Additionally, we surveyed program directors as opposed to surgical residents. While program directors can precisely answer the vast majority of the questions asked (size of program, number of residents who perform research fellowships and for how long, etc), it is likely that at least some program directors estimated the number of publications and presentations per resident, since not all programs track the academic success of their research fellows. A separate survey of all surgery residents in a postgraduate year is an alternative approach which would yield complementary information. Additionally, the survey does not identify the quality of papers published, and it is debatable whether more publications in lower impact journals are superior to fewer publications in higher impact journals. The survey also does not distinguish whether papers were basic science or clinical nor does it distinguish between original manuscripts and review papers.

Despite these limitations, this survey shines a light on a practice that is common among general surgery residencies, but is also relatively unique to these programs. Over a third of surgical residents opt to interrupt their clinical training for 1-3 years in the middle of residency to pursue research fellowships at a cost of greater than \$40 million per year. Despite the widespread nature of this practice, it does not appear to provide a long-term benefit in obtaining NIH funding. Additional research into whether this represents the best method to develop surgical-scientists is warranted.

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Fig. 1. Percentage of residents performing full-time research and length of research fellowships
Mean number of residents/year is listed at the bottom of each column. (A) Programs which sent less than 5% of residents into research fellowships were smaller than all other groups, $p < 0.001$. (B) A residency in which half of trainees pursued a one year research fellowship and half did not perform full-time research would have a mean of 0.5 years.

Fig. 2. Geographical distribution of residents performing research fellowships
 (A) Research fellows per state. (B) Research fellows per 20,000 hospital beds. (C) Research fellows per 10 chief residents. States in white have no general surgery residencies. Not depicted are Alaska (no general surgery residencies) and Hawaii (no research fellows).

Fig. 3. Characteristics associated with research productivity

Total number of publications are associated with mean years of full-time research (A) and residents per program who perform research fellowships (B) but not with program size (C) or participation in moonlighting (D). A single box may represent more than one program.

Fig. 4. Relationship between productivity and grant support

The mean number of papers published per resident was significantly correlated with the percentage of residents in a program who applied for funding (A) but not whether or not they received funding (B).

Fig. 5. Relationship between postgraduate activities and length of research fellowship

There is a 15.2 % absolute decrease in residents going into private practice immediately for each year of full-time research (95% CI 13.7-16.8%) and an increase in fellowship participation of 14.7% per year of full-time research (95% CI 13.1-16.4%) A single box may represent more than one residency program.

Table 1
Educational or Practice Activity Immediately After Graduation from General Surgery Residency

	All Responders (n=200)	University (n=101)	University Affiliated Community (n=65)	Community (n=34)
Total Residents	905	581	225	99
Academic Practice	51 (6%)	42 (7%)	8 (4%)	1 (1%)
Private Practice	230 (25%)	116 (20%)	75 (33%)	38 (39%)
Fellowship	617 (68%)	418 (72%)	141 (63%)	59 (59%)
Other	7 (1%)	5 (1%)	1 (0%)	1 (1%)

Table 2
Program Director Opinions about Research Fellowships

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Funding constraints prevent greater resident research participation at my institution	16%	25%	16%	29%	14%
Full-time research would benefit <u>all</u> residents	11%	23%	19%	35%	12%
Full-time research would benefit residents interested in a fellowship	15%	37%	17%	25%	5%
Full-time research would benefit residents interested in academics	54%	33%	5%	7%	1%

Table 3

Table 3a Factors Influencing which Residents Pursue Research Fellowships	
Factor	Percent Citing
Resident Academic Goals	80
Resident Personal / Financial Goals	43
Funding Availability	28
Chairman Preference	18
Program Director Preference	16
None of the above, all residents conduct full-time research	15
Other	7
Table 3b Metrics Tracked by Program Directors	
Factor	Percent Citing
Academic success of residents during research fellowship	87
Academic success of residents after research fellowship	28
Resident satisfaction with research fellowship	61
None of the above	8