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The Vulnerable Stage of Dedicated Research Years of General Surgery Residency

Results of a National Survey

Gloria R. Sue, MA; Emily M. Bucholz, MPH; Heather Yeo, MD; Sanziana A. Roman, MD; Andrew Jones, PhD; Richard H. Bell Jr, MD; Julie A. Sosa, MD

Objective: To characterize the demographics and attitudes of US general surgery residents performing full-time research.

Design: Cross-sectional national survey administered after the 2008 American Board of Surgery In-Service Training Examination.

Setting: Two hundred forty-eight residency programs.

Participants: General surgery residents.

Intervention: Survey administration.

Main Outcomes Measures: A third of categorical general surgery residents interrupt residency to pursue full-time research. To our knowledge, there exist no comprehensive reports on the attitudes of such residents.

Results: Four hundred fifty residents performing full-time research and 864 postgraduate year 3 (PGY-3) clinical residents completed the survey. Thirty-eight percent of research residents were female, 53% were married, 30% had children, and their mean age was 31 years. Resi-

ducing programs that were academic, large, and affiliated with fellowships had proportionally more research residents compared with other programs. Research and PGY-3 residents differed ($P < .05$) on 10 survey items. Compared with PGY-3 residents, research residents were less likely to feel they fit well in their program (86% vs 79%, respectively), that their program had support structures if they struggled (72% vs 64%), or that they could turn to faculty (71% vs 65%). They were more likely to feel training was too long (21% vs 30%) and that surgeons must be specialty trained (55% vs 63%). In multivariate analyses, research residents believed surgical training was too long (odds ratio, 1.36) and they fit in less well at their programs (odds ratio, 0.71) ($P < .05$).

Conclusions: Compared with PGY-3 residents, research residents report less satisfaction with important aspects of training, suggesting this is a vulnerable stage. Interventions could be targeted to facilitate support and better integration into the mainstream of surgical education.

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PROTECTED RESEARCH TIME during residency is resource intensive for training programs, adding 1 to 3 years to the 5-year general surgery training program. However, this practice has implications for career development. Pursuit of research during surgery residency is associated with a future

of completing postdoctoral research in the middle of residency is less prevalent in other specialties,^{2,5} where full-time research typically occurs after residency during specialty fellowship.⁶

A shortage of academic surgeons is projected for the near future.⁷ Factors inhibiting a career in academic medicine include increasing medical school debt, increased length of training⁸ and competition for funding,⁹ and divergence of basic science methods from surgical clinical practice for surgeon-scientists. It is becoming increasingly difficult for surgeons to compete for basic science funding, maintain rigorous laboratories, and stay relevant in clinical practice. Although 72% of research performed by residents is in basic science disciplines,⁴ most academic surgeons today pursue clinical

See Invited Critique at end of article

career in academic surgery,^{1,2} as well as an increased likelihood of obtaining a competitive fellowship.³ A third of all categorical general surgery residents interrupt their residency training to pursue full-time research for 1 or more years.⁴ The practice

Author Affiliations: Department of Surgery, Yale University School of Medicine, New Haven, Connecticut (Mss Sue and Bucholz and Drs Yeo, Roman, and Sosa); and American Board of Surgery, Inc, Philadelphia, Pennsylvania (Drs Jones and Bell).

research instead of basic science research. Residency is a crucial period during which surgeons learn more about the factors associated with academic careers, obtain mentors, and decide on their ultimate career goals.¹⁰ The consensus among senior-level academic surgeons remains that protected research time should be incorporated into surgical residency training to develop academic surgeons.¹ Therefore, it is important for residents not to feel isolated during this critical period. Supporting and nurturing residents doing research can cement their dedication to careers in academic surgery.

Residents may choose to take protected research time as a break from the demanding regimen of surgery training and make more time for personal or family obligations.¹¹ There appears to be a significant increase in attrition of residents during the research years, but this observation is poorly understood because of a paucity of data.¹² Previous studies characterizing general surgery research fellows have consisted only of single-institution and regional resident surveys⁵ or national surveys of surgery residency program directors.⁴ The aim of this study was to characterize the demographics of general surgery research residents in the United States, as well as their satisfaction with their training programs and plans for future career based on a national survey.

METHODS

This study used data from a national cross-sectional survey of all US categorical general surgery residents. Survey administration procedures and baseline data have been previously published.¹³ In brief, surveys were administered to all categorical general surgery residents in clinical and research years present at the American Board of Surgery In-Service Training Examination in January 2008.

The survey consisted of 46 questions that addressed motivations for pursuing surgery, views on specialization and future compensation, support from family, and current surgery experience. Questions were structured as statements with a 5-point Likert response scale, ranging from "strongly agree" to "strongly disagree." The survey also collected data on resident demographics, including age, sex, race/ethnicity, residency level, marital status, and number of children. Information on resident research status was obtained from the American Board of Surgery resident database and linked to survey responses. Residency program characteristics (number of chief residents, type of residency, geographic region, and affiliation with postresidency training fellowships) also were collected.

In these analyses, we compared survey responses of research residents (performing full-time research during their surgical residency) with those of residents in their postgraduate year 3 (PGY-3) clinical years (surgical residents in their third year of clinical training, regardless of previous research experience) to assess whether differences existed in their attitudes toward surgery training. The PGY-3 residents were selected as a comparison group because they were most similar to research residents with respect to age and level of training; according to a recent survey of program directors, 53% of residents who perform full-time research do so after PGY-2 and 47%, after PGY-3.⁴ For interpretation, questions were grouped into 8 themes, including operative experience, satisfaction with surgery training, programmatic support, perceived fit, family support, views on specialty training, views on future compensation, and other personal factors.

Descriptive characteristics for the sample were calculated by research status. Differences in individual- and program-level demographics between research and PGY-3 residents were assessed using χ^2 or Fisher exact tests for categorical variables and *t* tests for continuous variables.

Survey responses to questions on surgery experience, support, and specialty training were divided into "agree" (strongly agree and agree) and "disagree" (neutral, disagree, and strongly disagree) categories. In bivariate analyses, χ^2 tests were used to compare survey responses between research residents and PGY-3 residents. Multivariate analyses used hierarchical logistic regression models using the GLIMMIX procedure in SAS (SAS Institute, Cary, North Carolina). Variables that were significant at the $\alpha = .05$ level ($P < .05$) in descriptive analyses (sex, race, type of program, number of chief residents, and affiliation with fellowship programs) were included in the model. This study was approved by our institutional review board and human investigation committee. All statistical analyses were conducted with SAS version 9.2 (SAS Institute).

RESULTS

DEMOGRAPHICS OF RESEARCH RESIDENTS

The survey was completed by 450 (61.2%) of the 735 general surgery residents performing full-time research during residency during the 2007-2008 academic year, as reported by program directors to the American Board of Surgery national resident roster, and by 686 (62.4%) of the 1099 PGY-3 residents. Of the 450 respondents, 38.3% were female, 58.3% were white, 52.5% were married, and 29.6% had children (**Table 1**). The average age of research residents was 31 years, which was comparable with the average age of PGY-3 residents. Compared with the PGY-3 resident cohort, female, Asian, and black residents were proportionally overrepresented in the research resident cohort. Research residents and PGY-3 residents were comparable in terms of their marital status and the size of their families. However, when analyzed by sex, female research residents were more likely to have children than female PGY-3 residents (21.7% vs 11.9%; $P < .01$); no such difference was observed between male research residents and male PGY-3 residents. There was no significant difference in the attrition rates between research residents and PGY-3 residents.

With respect to program demographics, research residents differed from PGY-3 residents on most variables. While 87.6% of research residents trained at academic programs, only 10.3% of research residents were from community programs; the corresponding percentages for clinical PGY-3 residents were 66.6% and 31.1%, respectively. Research residents were more likely to come from larger programs (with more chief residents) and programs with affiliated postgraduate fellowships.

ATTITUDES REGARDING SUPPORT FROM PROGRAM

Research residents reported feeling less support from their training programs compared with PGY-3 residents (**Figure 1**). They were less likely than PGY-3 residents to feel that their programs had support structures they

Table 1. Demographic Characteristics of Research Residents

Characteristic	No. (%) ^a		P Value
	Research Residents (n=450)	PGY-3 Residents (n=864)	
Age, y			
25-29	149 (33.9)	335 (41.0)	.07
30-34	248 (56.4)	405 (49.6)	
35-39	37 (8.4)	61 (7.5)	
≥40	6 (1.4)	16 (2.0)	
Female	172 (38.3)	264 (30.7)	.006
Race/ethnicity			
White	252 (58.3)	493 (61.2)	.05
Black	25 (5.8)	38 (4.7)	
Hispanic	27 (6.3)	80 (9.9)	
Asian	99 (22.9)	143 (17.8)	
Other	29 (6.7)	51 (6.3)	
Marital status			
Married	229 (52.5)	440 (53.9)	.78
Single	99 (22.7)	188 (23.0)	
Single, in relationship	92 (21.1)	166 (20.3)	
Other	16 (3.7)	22 (2.7)	
No. of children			
0	307 (70.4)	606 (73.9)	.11
1-2	118 (27.1)	183 (22.3)	
≥3	11 (2.5)	31 (3.8)	
Geographic location			
Northeast	166 (38.1)	296 (35.1)	.17
South	77 (17.7)	176 (20.9)	
Midwest	86 (19.7)	193 (22.9)	
West	107 (37.5)	178 (21.1)	
Type of program			
Academic	382 (87.6)	561 (66.6)	<.001
Community	45 (10.3)	262 (31.1)	
Military	9 (2.1)	20 (2.4)	
No. of chief residents			
1-2	9 (2.1)	73 (8.7)	<.001
3-4	69 (15.8)	285 (33.8)	
5-6	198 (45.4)	268 (31.8)	
≥7	160 (36.7)	217 (25.7)	
Affiliated fellowship program			
Yes	354 (81.2)	512 (61.1)	<.001

Abbreviation: PGY, postgraduate year.

^aData are presented as number (percentage) of respondents (categorical variables). Percentages have been rounded and might not total to 100. Because of missing data, the number of respondents for each characteristic might be less than the total number of respondents.

could turn to when struggling (63.7% vs 71.7%; $P < .01$) and that they could turn to faculty when they had difficulties with the program (65.0% vs 71.1%; $P < .05$). They were also more likely to feel that their attending physicians would think worse of them if they asked for help when they did not know how to do a procedure (19.9% vs 15.1%; $P < .05$).

ATTITUDES TOWARD OTHER PROGRAM FACTORS

Research residents felt less positively regarding their operative experience, surgical training, and fit with their program compared with their PGY-3 counterparts (**Figure 2**). Only 77.6% of research residents believed

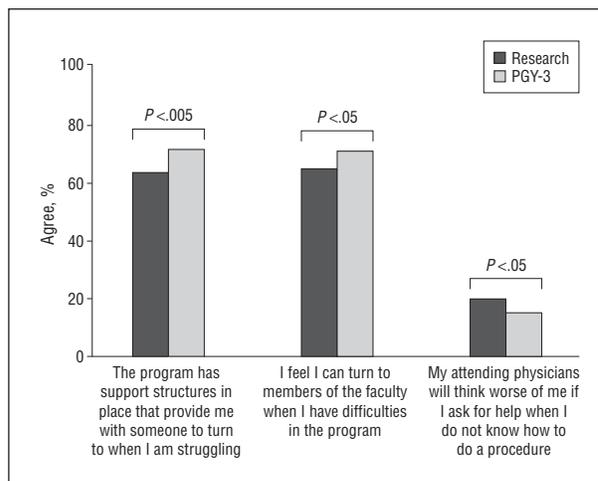


Figure 1. Perceived level of residency program support reported by research residents and postgraduate year 3 (PGY-3) residents.

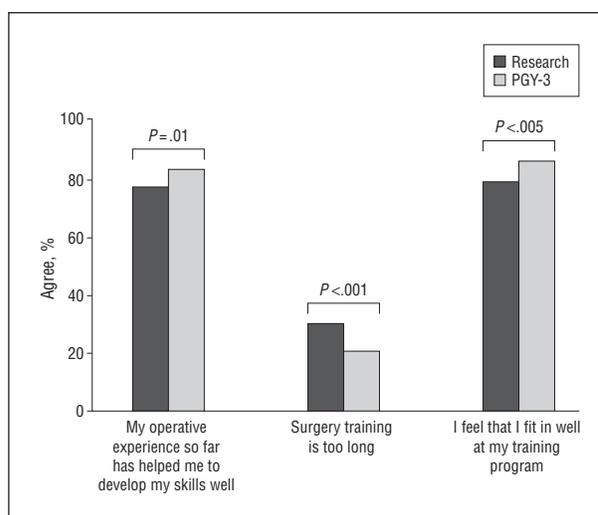


Figure 2. Perceived level of operative experience, length of training, and program fit reported by research residents and postgraduate year 3 (PGY-3) residents.

that their operative experience so far had helped them develop their skills well, compared with 83.5% of PGY-3 residents ($P = .01$). Research residents were also more likely to feel that surgery training was too long (30.3% vs 20.7%; $P < .001$) and less likely to feel that they fit in well at their training program (79.4% vs 86.2%; $P < .005$).

ATTITUDES TOWARD SPECIALTY TRAINING

Research residents valued specialty training more than PGY-3 residents (**Figure 3**). They were more likely than PGY-3 residents to feel that surgeons need to be specialty trained in order to be successful (63.1% vs 55.3%; $P < .01$) and that specialty training makes surgeons more competitive in the job market (73.6% vs 66.2%; $P < .01$). However, they were less likely to believe that they would have a better lifestyle if they completed specialty training (57.3% vs 63.9%; $P < .05$).

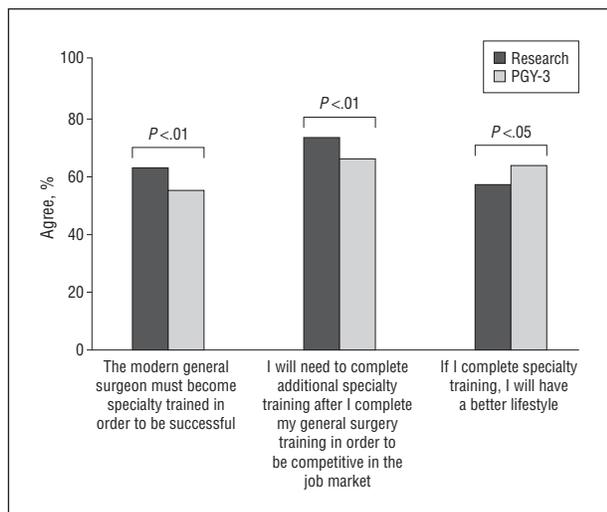


Figure 3. Attitudes toward specialty training reported by research residents and postgraduate year 3 (PGY-3) residents.

ATTITUDES TOWARD OTHER PERSONAL FACTORS

Research residents were more likely than PGY-3 residents to feel a significant amount of satisfaction when working with patients (93.4% vs 89.7%; $P < .05$).

MULTIVARIATE ANALYSES

In light of the strong association between sex, race, certain program demographics (type of program, number of chief residents, and associated fellowship programs) and the decision to pursue research fellowship, we adjusted for these factors in our multivariate logistic regression analyses (**Table 2**). Of the 10 survey items that were answered differently between research and PGY-3 residents, 2 remained significant after controlling for sex, race, and program demographics. Research residents remained more likely to believe that surgery training was too long (odds ratio, 1.36; 95% confidence interval, 1.01-1.83; $P < .05$). They also were less likely to feel that they fit well within their training program (odds ratio, 0.71; 95% confidence interval, 0.51-0.99; $P = .05$).

COMMENT

There has been a paucity of literature analyzing on a national level the demographics and attitudes of US general surgery residents who pursue protected research time. In our national survey, research residents overall had less positive attitudes compared with PGY-3 residents with regard to multiple aspects of surgery residency training. After adjusting for all demographic variables found to be statistically significant on bivariate analysis between research and PGY-3 residents, research residents were more likely than PGY-3 residents to feel that surgery training is too long and less likely to feel that they fit in well in their training program.

These findings are consistent with literature reporting that research residents have comparatively higher rates

of attrition. The resignation rates reported on the American Board of Surgery resident roster for the 2007-2008 training year were significantly different ($P < .01$), with 2.1% of all PGY-3 residents and 3.9% of research residents resigning in that year; only PGY-1 and PGY-2 residents had higher resignation rates than research residents.¹² This study documents for the first time, to our knowledge, research resident disaffection with certain aspects of training relative to PGY-3 residents and thereby helps to explain their relatively high observed attrition rate based on American Board of Surgery data. Attrition of research residents is a tremendous drain on program resources, because the cost to support the salary and benefits of a single research resident is estimated to be approximately \$65 000 per year.⁴

The primary reasons for residents to interrupt residency to conduct full-time research are to (1) establish the foundation for a future academic career, (2) improve the likelihood of obtaining a subspecialty fellowship, or (3) take a break from clinical training and make time for personal endeavors.¹⁴ Women make up 38% of the research resident cohort, compared with only 31% of the PGY-3 cohort. Women are more likely than men to cite the desire for a break from clinical training as a contributing reason for taking protected research time.¹⁴ Our finding that female research residents are almost twice as likely to have children than female PGY-3 residents suggests that female surgery residents may be taking advantage of the relative flexibility of research time to start a family or spend more time with their existing family. However, residents with children compose a minority of all research residents, with only 21.7% of female research residents having children and 34.6% of male research residents having children. These sex discrepancies demonstrate that although female residents are less likely than male residents to have children, female residents with children are proportionally overrepresented in the research resident cohort compared with the PGY-3 cohort. This suggests that a subset of female residents may be influenced by their child-rearing duties to pursue time off for full research. Program directors may need to be aware of these personal circumstances to provide better support for residents.

With respect to program demographics, the distribution of the research resident cohort was skewed toward large academic residency programs with affiliated fellowships. This may be a reflection of the stronger research emphasis, a larger critical mass of faculty and specialty fellow research and clinical mentors, available facilities, and greater number of research opportunities available at academic institutions. The practice of interrupting residency training to perform full-time research for 1 or more years is unique to general surgery^{2,15} and is uncommon in most other specialties.

In a survey of graduates of a general surgery residency program at a single institution, Thakur et al² found that 53% of residents who performed 2 or more years of research became academic surgeons, compared with only 22% of those who spent 1 year or less. In a similar study of graduates of a general surgery residency program at a different institution, Robertson et al⁵ found that not only was cumulative duration of research predictive of a future academic ca-

Table 2. Multivariate Logistic Regression Analysis

Survey Item	OR (95% CI)	P Value
Program Factors		
Support from program		
The program has support structures in place that provide me with someone to turn to when I am struggling	0.78 (0.59-1.04)	.09
I feel I can turn to members of the faculty when I have difficulties in the program	0.82 (0.62-1.07)	.14
My attending physicians will think worse of me if I ask for help when I do not know how to do a procedure	1.19 (0.86-1.66)	.29
Operative experience		
My operative experience so far has helped me to develop my skills well	0.87 (0.63-1.20)	.39
Satisfaction with surgery training		
Surgery training is too long	1.36 (1.01-1.83)	.04
Fit with program		
I feel that I fit in well at my training program	0.71 (0.51-0.99)	.05
Personal Factors		
Views on specialty training		
The modern general surgeon must become specialty trained in order to be successful	1.21 (0.92-1.59)	.17
I will need to complete additional specialty training after I complete my general surgery training in order to be competitive in the job market	1.18 (0.88-1.59)	.27
If I complete specialty training, I will have a better lifestyle	0.80 (0.62-1.04)	.10
Other personal factors		
I get a tremendous amount of satisfaction working with patients	1.97 (1.22-3.16)	.005

Abbreviations: CI, confidence interval; OR, odds ratio.

reer, but that research productivity was predictive of success in obtaining subsequent funding as a principal investigator. Those who obtained external funding authored on average 9.3 papers during residency compared with only 5.2 papers for those without external funding. A productive research experience as a resident appears to be an important prerequisite for an academic career.

Research residents are significantly more likely than PGY-3 clinical residents to feel that they need to be specialty trained in order to be successful and competitive in the job market. However, a large minority of research residents do not feel that they will have a better lifestyle if they complete specialty training, though most agree that they may have a better income. Currently, 70% of general surgery residency graduates pursue fellowship training.¹⁶ It has been reported that single residents are more likely to pursue fellowships than married residents.¹⁷ This finding is consistent with our results, in that a greater proportion of research residents in our cohort were single and felt that fellowship training was important when compared with PGY-3 residents. Many residents have decided on a field of specialization by the end of their PGY-2 or PGY-3² and already are planning for fellowship. In a national survey of general surgery program directors, Robertson et al⁴ observed a 14.7% increase in the number of residents pursuing subspecialty fellowship training and a 15.2% decrease in private practice positions for each year of full-time research pursued. While most program directors felt that performing research during residency is important to residents interested in academics, significantly fewer felt that research is of significant benefit to residents interested in fellowship.⁴ A productive research experience during residency can lead to enhanced qualifications and thereby facilitate obtaining a competitive subspecialty fellowship.

It is unclear from our survey whether the relatively negative attitudes of research residents toward their programs stem from feeling that research time was manda-

tory. Resident motivations to pursue dedicated research are diverse. Residents without a deep commitment to research but who are compelled to do mandatory research time may feel that their surgical training becomes excessively long; this may, in part, explain our findings. Another explanation could be that dissatisfied residents take time off from clinical training to reevaluate their commitment to general surgery training or focus on personal issues, such as starting families. Other factors that may play a role in research residents' negativity may include unique frustrations with the research conducted, lack of mentorship, or perceived isolation from the mainstream residency. These represent areas that merit further investigation, where programs may intervene and improve the research experience.

Our study is limited by the fact that it is based on survey self-report. There may be response bias by the survey participants in reporting negative or undesirable attitudes. Efforts were made to ensure the confidentiality of resident responses to minimize this potential bias. The PGY-3 residents were chosen as the comparison group for this study because the most common time to interrupt residency for full-time research is between PGY-2 and PGY-3. The PGY-3 resident group includes a subset of former research residents; however, we do not believe that this would significantly skew our results. The observed attrition rate among survey participants may not reflect true attrition in the larger resident pool, since a significant proportion, and perhaps the more disaffected, research residents do not take the American Board of Surgery In-Service Training Examination; therefore, our findings likely understate the differences in satisfaction.

Our data cannot clearly identify the primary reasons for which residents choose to perform full-time research. Nonetheless, research residents appeared less satisfied than their clinical peers with respect to important aspects of residency training, such as programmatic support, good fit, and operative experience. Also, they felt

that surgery training was too long. Our findings demonstrate a need for targeted residency program support for general surgery residents performing full-time research to help trainees overcome these concerns and perceived barriers to success.

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Correspondence: Sanziana A. Roman, MD, 333 Cedar St, TMP 208, Department of Surgery, Yale University School of Medicine, New Haven, CT 06520 (sanziana.roman@yale.edu).

Author Contributions: *Study concept and design:* Yeo, Roman, Bell, and Sosa. *Acquisition of data:* Yeo and Bell. *Analysis and interpretation of data:* Sue, Bucholz, Roman, Jones, Bell, and Sosa. *Drafting of the manuscript:* Sue, Bucholz, Roman, Bell, and Sosa. *Critical revision of the manuscript for important intellectual content:* Bucholz, Yeo, Roman, Jones, and Sosa. *Statistical analysis:* Bucholz and Jones. *Obtained funding:* Sue, Yeo, and Sosa. *Administrative, technical, and material support:* Yeo, Roman, and Bell. *Study supervision:* Yeo, Bell, and Sosa.

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INVITED CRITIQUE

ONLINE FIRST

General Surgery Research Residents

Apples and Oranges

Analyzing responses of PGY-3 and research residents on the 2008 American Board of Surgery In-Service Training Examination survey, Sue et al found that research residents had less positive views of residency than their PGY-3 counterparts.

As Sue et al acknowledge in their analysis, research residents fall into several different groups, which differ significantly in their motivation to do a research year. One group is dedicated to a future academic career and is strongly motivated to pursue a fellowship after completing residency. This group is likely to feel that surgery resi-

dency is too long, as it will take them 8 or 9 years before they achieve a faculty position.

A second group, those in a program with a mandatory research year or years, may also feel that residency is too long if they are not truly committed to the time they are spending outside the clinical years. These first 2 groups, however, are not likely to quit surgical residency.

As the program director in a large academic residency, I would maintain that the “vulnerable group” of research residents is a third group, those who have