Predictors of Radiation Oncology Resident Research Productivity

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Purpose: Academic research is an essential part of residency training, yet resident productivity in research seems to be highly variable. The aim of this study was to determine the factors, both individual and institutional, that contribute to research output among radiation oncology residents.

Methods: Newly practicing radiation oncologists and current senior residents were identified and invited via e-mail to complete a web-based survey. The survey addressed demographic factors, previous academic accomplishments, and residency program structure. The end point, research productivity, was defined as the number of first-author papers produced or research grants awarded on the basis of work initiated during residency.

Results: Ninety-seven of the 232 senior residents and recently graduated radiation oncologists surveyed responded (a 42% response rate). The median number of publications produced on the basis of work during residency was 3 (range, 0-7). Twenty-one respondents indicated that they had received 1 or more grants. Forty-four respondents completed <6 months of research, while 53 completed ≥6 months of research. Univariate analysis revealed that a scientific college major and the amount of designated research time were positively correlated ($P < .05$) with first-author publications. Entering with a PhD, presenting research at an international meeting before residency, participation in the Holman Research Pathway, female gender, publications before residency, and the amount of designated research time were positively correlated ($P < .05$) with receiving a research grant. On multivariate regression analysis, the amount of designated research time was the sole determinant of first-author papers ($P < .007$), while participation in the Holman Pathway was the only surveyed factor that was correlated with research grants awarded ($P < .001$).

Conclusions: The amount of designated research time during residency training is the sole independent predictor of research productivity as measured by publications. Participation in the Holman Pathway is the sole detected item shown to be an independent predictor of achieving a peer-reviewed grant. Residency program structure has a major impact on the productivity of residents.

Key Words: Resident training, medical education, research productivity

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INTRODUCTION

The performance of medical research by residents is considered an important element of training, vital to the growth and development of the individual trainee. It is strongly endorsed by the ACGME, helping facilitate the 6 core competencies: patient care, medical knowledge, practice-based learning, systems-based learning, encouraging interpersonal and communication skills, and fostering professionalism. Furthermore, resident-performed research contributes to the academic growth of the field of radiation oncology.

Anecdotally, there seems to be much variability in the productivity of radiation oncology residents [1]. A study based on the number of published papers of radiation oncology residents cited on PubMed reported a range of 0 to 9 papers published per resident over the course of 4 years of residency training, with an overall average of 1 paper. However, the factors that contribute to this variability remain undefined. We hypothesized that the structure of a residency training program plays a greater role in research productivity than previous individual accomplishments or values among residents. To test this hypothesis, we per-

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Table 1. Contents of questionnaire	
Individual Factors/Accomplishments/Values	**Residency Factors**
1. Major in college	1. Participation in Holman Research Pathway during residency
2. Medical school ranking	2. Number of residents in training program
3. PhD before beginning residency	3. Average number of histories and physical examinations completed per week while on service
4. Presented research before residency	4. Number of months spent "on service" during residency
5. Ranked residency programs on the basis of ability to succeed in research	5. Number of months dedicated to research during residency
6. First-author publications accepted/submitted to journals before residency	6. Rewarded by being sent to national/international meetings for research
7. Practice setting in 5 years' time	7. Assigned a formal research mentor
8. Gende	8. Did the program have a formal research director?
9. Number of children on last day of residency	9. Number of faculty members who initiated their own clinical trials
10. Current position (academic/private/academic affiliate)	10. Hours per week dedicated to research forums and journals

formed a survey of current senior residents and recently graduated radiation oncologists. Our long-term goal is to produce evidence that can be used to improve the residency training experience.

METHODS

Resident Identification

We identified newly practicing radiation oncologists by consulting the 2009 and 2010 editions of the Association of Residents in Radiation Oncology annual directory. In addition, we searched individual residency program's Web sites to identify current senior residents. Thus, our cohort consisted of those who completed resident training in 2010 and 2011 as well as senior residents who will complete training in 2012.

Survey Construction

We designed a web-based survey consisting of 26 questions. Ten questions explored the structure of respondents' residency training programs, and 10 questions addressed respondents' past experiences, accomplishments, and values (Table 1). Questions were designed specifically for binary comparison. Research productivity on the basis of research completed during residency was assessed by two outcomes: (1) the number of first-author papers based on work during residency (published or submitted, even after the completion of residency), and (2) the number of peer-reviewed grants received during residency or based on research completed during residency. Research productivity was not independently confirmed from reported publication (PubMed, Scopus, etc) or grant records. The remaining 4 questions addressed demographic information. Participants were invited via e-mail to complete the online survey questionnaire using SurveyMonkey software (SurveyMonkey, Menlo Park, California).

To further understand the research structure of the ACGME-accredited residency programs, a secondary question was distributed to quantify the amount of dedicated research time available to residents. Programs were contacted through the residency program coordinators or current chief residents or through examination of the programs' Web sites. Data regarding protected research time during residency were acquired from 74 of the 85 residency training programs.

Analysis

To facilitate statistical analysis, the various categorical variables were converted into arbitrary scores. Statistical analysis was performed in Excel version 12.3 (Microsoft Corporation, Redmond, Washington) and Stata version 11.1 (StataCorp LP, College Station, Texas). Statistical techniques included Pearson's chi-square test, Student's t-test, and multivariate regression as appropriate. An a priori non-Bonferroni-corrected α value of 0.05 was used as a threshold for statistical significance in this exploratory analysis.

RESULTS

A total of 232 radiation oncologists who had completed training in either 2010 or 2011 or were identified as senior residents in 2011 and 2012 were contacted. Forty-two percent of eligible participants (97 of 232) responded to the survey; 75% of the respondents were women. The average age of respondents was 33 years (range, 29-44 years). Seventy-eight respondents were science undergraduate majors; 14 (15%) had PhDs upon entry to residency. Over the course of their training, 41 had no children, 26 had 1 child, and 26 had ≥ 2 children.

Twenty-three percent of respondents had dedicated research directors, 16% were assigned formal mentors, and 68% had ≥ 2 staff physicians who had conducted investigator-initiated trials. Forty percent had ≤ 1 hour of dedicated time allotted for research forums or journal clubs per week. Twenty-nine percent, 49%, and 22% of respondents spent at most 36, 37 to 42, or ≥ 43 months of formal clinical training, respectively. Thirty percent stated that they performed >10 new consults per week. The median number of residents per training program was 8 (range, 4-28). Fifty-six percent trained at programs with ≥ 8 residents, and 37% had ≤ 6 residents. Fifty-five percent had ≥ 6 months of dedicated research time, and