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Factors contributing to University of Tennessee obstetrics and gynecology resident research publications

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INTRODUCTION

The *Accreditation Council for Graduate Medical Education (ACGME)* requires residents to participate in scholarly projects during residency training. The ACGME encourages residency programs in advancing residents' knowledge of research principles (1). Many residency programs, therefore, require residents to complete a research project. Some educators also promote residents' research as a way to increase number of academic clinicians (2). In studying factors that contribute to urology resident research publication in, the research publication was associated with entering fellowship training (3). Protected research time seemed to contribute to radiation oncology residents' research productivity (4). In a survey of internal medicine directors, a study identified lack of mentor and resident research interests as the major barriers to the resident scholarship (5). Another study among surgical residents identified clinical topic as more common than was basic science projects (6). In another surgery program, residents published an average of one paper during their training period (7).

The University of Tennessee obstetrics and gynecology residency requires not only the completion of the resident's research but also presentation of the research. We initiated this residency research program in 2000 with a defined timetable of research completion. Our residents are encouraged to find a research project in their intern year with an attending mentor. The research is expected to be completed at the end of the third year of residency. Residents received no protected research time, although they have 5-6 weeks of elective time. An annual Resident Research Day is organized with presentation of the resident research, critique by an academic panel, and ending with an awards banquet. We wished to study factors contributing to the peer review publication of resident research.

METHODS

We retrospectively reviewed the research projects of the University of Tennessee's obstetrics and gynecology residents from 2000 to 2013. We defined the successful research project as having the research publication listed at Pubmed.gov. The research project was defined as the project started and finished during residency. We excluded publication from fellowship if the residents eventually took further fellowship training. All resident research projects were listed in the program booklet which was published yearly and distributed freely to all faculty, residents and any other interested parties. The resident research publication data were obtained by PubMed query with multiple search terms: full name, last name plus first and middle initial, and last name plus first initial. We analyzed the association between successful research publication with potential contributing factors (the residents' demographics, study design, and mentor's demographics). Demographic data were obtained from public web sites (Health Grades, Vitals.com and Google). Our study was exempted by the Institutional Review Board of the University of Tennessee Health Science Center (13-02515-XM).

Medical school of origin was defined as from the United States vs. foreign medical graduate. Research type was defined as basic science (laboratory-based), clinical (related to clinical practice), and resident education (related to teaching methods). Research subjects were defined as related to obstetrics and gynecology subspecialty. Research designs were divided into prospective (cohort, case control, randomized trial) vs. retrospective (cohort, case control). Residents who were categorized as applying for fellowship were defined as residents who applied and subsequently were accepted to an American Board of Obstetrics & Gynecology approved subspecialty fellowship. Faculty/mentor first-author publication was defined as the mentor being first author on the paper. High number of faculty publication was defined as having at least one Pub Med publication yearly.

Various potential contributing factors to research publications were analyzed using univariable logistic regression models, which formed the basis for the final multiple logistic regression models. Then, the likelihood of having PubMed publication was modeled, and the results were provided in terms of

odds ratios comparing different levels of fellow and mentor characteristics. SAS Version 9.3 was used for data preparation and analysis. P value <0.05 was defined as statistically significant.

RESULTS

One hundred thirteen resident research projects were reviewed. Most of the research topics were clinical ($n=99$) with six in basic science and eight in education research. Resident's ethnicity was 71Caucasian, 22 African American, 9 East Indian, 6 Asian, 2 Hispanic, 2 Iranian, and 1 Filipino. Seventy-five (66.4%) residents were females. Twenty-three residents (20.2%) published their research with those applying for fellowship achieved a 27.3% publication rate ($P=0.02$). Residents who applied for fellowship had 4 times better odds of publishing than did residents who did not (odds ratio 4.18 with confidence interval of 1.25 and 14.02)

On univariable logistic regression models (Table 1), resident research publication was not associated with the resident's race ($P=0.1$), age ($P=0.18$), gender ($P=0.11$), origin of medical school ($P=0.58$), mentor's gender ($P=0.12$), or mentor's age ($P=0.63$). Resident research publication was marginally associated with foreign vs. US graduate ($P=0.076$), research design ($P=0.053$), where US graduates and those working with retrospective research designs had less likelihood of publication. Odds of having publication was higher for gynecologic oncology research topic ($P=0.0004$) vs. general gynecology, professor vs. assistant professor mentor ($P=0.0062$), mentor's high number of publications ($P=0.0001$), mentor's first-author publication ($P=0.0001$), and mentor of Asian ethnicity ($P=0.0017$).

Considering the above univariable results as our base, we constructed multivariable logistic regression models to describe the joint association of multiple predictors with PubMed publication status (Table 2). Only two predictors had significant association with the likelihood of PubMed publication and thus remained in our final model: resident research publication was associated with the first-author publication of their mentors ($P=0.0001$) and with mentor of Asian ethnicity ($P=0.04$). Every one additional first-author publication of the attending faculty increased the odds of PubMed publication for the resident by 27%, keeping faculty race fixed. Residents/Fellows working with Asian attending faculty had more than 5 times higher odds of publishing in PubMed compared to those working with Caucasian faculty, keeping the number of the first-author publications by the attending fixed.

Mentors' demographic are found in Table 3 and the entire faculty of obstetrics and Gynecology demographic in Table 4.

DISCUSSION

ACGME encourages residents to pursue scholarly activities. However, ACGME does not specify how to do so. Thus, there are a variety of interpretations by residency programs to fulfill this requirement, from simply doing some research to abstract submission to peer-review publication (3,5,7).

In our institution, we define residents' research publication as having a publication listed in pubmed.gov. We admit that publication is not necessarily a reflection of good research. However, a peer review publication does teach residents to take their research from an idea to project completion and to share their research results. Other institutions may differ from ours in requiring for publication, and we respect the difference.

Our study reflects the common perception that having research publication is valued highly by residents who plan to apply for fellowship. Research publication is so desirable that some fellowship candidates were suspected of lying in their fellowship application about having published research papers (8). Our study showed an increased rate of research publication in fellowship candidates, as was found in another study (3). Our study showed residents applying for fellowship, indeed, were more successful in publishing their research.

Our university residency program encourages research. However, we do not have a specific departmental research resource dedicated to helping residents, except the standard IRB, electronic access to medical journals, and exposure to faculty with research interests. These facts may explain our low rate of resident research publications. Other institutions have suggested various ways to improve resident publication rate. First, a surgery residency program was able to increase the number of peer-reviewed resident publications from 6 to 53 in over 4 years by adding a dedicated medical editor assisting resident research (9). Second, a few other studies concluded that protected resident research time and future fellowship training and academic careers correlate with increased resident publication (10, 13-18).

However, dedicated research time is expensive. A survey of 200 surgical residency programs showed that 381 out of 1052 trainees (36%) interrupted their residency to pursue full-time research. The mean research fellowship length was 1.7 years, with 72% of trainees performing basic science research. This protected research time was highly associated 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 ($P < 0.0001$). 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%) (14). Our current departmental budget does not have the financial reserve to allow for protected research time.

We reported the importance of mentor selection in contributing to resident research publications. Mentors with a high publication history seemed to help residents publish their research. Our university in Memphis, TN, where half of the population is African American. However, the number of African American mentors at our university seems to be markedly underrepresented. We need to look internally of our department in ways to increase this representation.

Our study has several limitations. First, we may give perception that having peer-reviewed publication is more important than just having research. We are certain that important research has not been published, but we believe that, in our current era, this situation is probably unusual. The primary reason for publication is to share with others ideas and research results and is highly encouraged in most intellectual fields, including medicine. Thus, research publication is probably an important lesson we should teach our young physicians-in-training. Second, not all peer-reviewed journals have high academic quality. We initially considered adding quality of publication, such as the H index, to our analysis. A study suggested that the H index may have better predictive power than total citation count or paper count in predicting future scientific achievement (15). However, with the small number of residents published in our study, this quality analysis would be meaningless. Furthermore, even the H index's validity is debated (16). Nevertheless, we do keep our database ongoing with the hope of doing a follow-up study. Third, there are differences in the degree of paper authorship in resident research publications. We did not analyze our database, because the small sample size would result in weak statistical associations. Fourth, our definition of residents who applied for fellowship did not include residents who did not get into a fellowship. We defined this category strictly, since we were unable to document clearly how many residents were really interested in applying for a fellowship but decided not to pursue it further. In our experience working with residents, interests going for a subspecialty fellowship vary among residents, postgraduate level, or even at time of year. Fifth, our study was based only on a single institution and may not applied to residency programs with different faculty composition. The fact that Asian faculty seems to be a more successful mentor may be a reflection of this faculty's publishable experience rather than race. However, our study has too few Asian faculty to discern this differences. Finally, being listed in pubmed.gov may exclude other publications such as those in open-access publications. We picked PubMed listing since the National Library of Medicine uses an NIH-chartered committee, the Literature Selection Technical Review Committee, to review all new biomedical and health journal titles and recommend those to be indexed for MEDLINE. Indeed, there are

many more journals than those listed in PubMed/MEDLINE, but those were not selected by this NIH committee. The committee selected the journals based on the quality of the scientific content, including originality and the importance of the content for the MEDLINE audience throughout the world. Overall, about 20% to 25% of the titles reviewed are selected for indexing to MEDLINE (17). Thus, although it is not a perfect criterion, PubMed listing serves as an acceptable cutoff point. Another study used PubMed publication as its criterion for resident research publication as well (18).

In summary, we have reported our 13 years of resident research and factors contributing to publications. We believe that research training is an important component of residency training, because it teaches skills to critically evaluate the results of published studies and to use this knowledge to improve clinical practice. Residents become familiar with a variety of research designs, statistical concepts, data analysis techniques, and manuscript writing styles that hopefully will help them throughout their clinical practice. We hope others will replicate our study and reconfirm our findings.

Table 1. Resident demographic and univariable analysis of the likelihood of residents' publication

	Total N (%)	Research was Published		Odds Ratio (P Value)
		No (%)	Yes (%)	
Ethnicity				
African American*	22 (19)	22 (100)	0 (0)	
Caucasian	71 (63)	53 (75)	18 (25)	15.98 (0.10)
Others	20 (18)	15 (75)	5 (25)	15.57 (0.11)
Gender				
Female	75 (66)	63 (84)	12 (16)	
Male	28 (34)	27 (71)	11 (29)	2.14 (0.11)
Medical Degree**				
DO	7 (6)	7 (100)	0 (0)	NA**
MD	106 (94)	83 (78)	23 (22)	
Medical School				
University of Tennessee*	45 (40)	37 (82)	8 (18)	
Other	68 (60)	53 (78)	15 (22)	1.31 (0.58)
US vs. International				
International*	9 (8)	5 (56)	4 (44)	
US	104 (92)	85 (82)	19 (18)	0.28 (0.076)
Research Type***				
Basic Science*	6 (5)	5 (83)	1 (17)	
Clinical	99 (88)	79 (80)	20 (20)	1.08 (0.92)
Resident Education	8 (7)	6 (75)	2 (25)	
Research Subject				
General Gynecology*	26 (23)	20 (77)	6 (23)	
General Obstetrics	32 (28)	29 (91)	3 (9)	0.37 (0.43)
Gynecologic Oncology	20 (18)	9 (45)	11 (55)	3.82 (0.001)
Maternal Fetal Medicine	18 (16)	18 (100)	0 (0)	0.09 (0.12)
REI	14 (12)	11 (79)	3 (21)	0.96 (0.50)
Urogynecology	3 (3)	3 (100)	0 (0)	0.45 (0.84)
Research Design				
Others*&	29 (26)	26 (76)	7 (24)	
Prospective	20 (18)	13 (65)	7 (35)	1.69 (0.12)
Retrospective	64 (57)	55 (86)	9 (14)	0.51 (0.054)

*Reference Group

**No Odds ratio is computed due to small cell count

***Basic science and residence education were combined as reference group

&Other research design such as review article or survey

Table 2. Multivariable logistic regression of factors contributing to research publication

Independent Variable	P Value	Odds Ratio (95% CI)
Faculty first-author publication	0.0001	1.27 (1.12, 1.44)
Faculty race: Asian vs. other	0.04	5.26 (1.43, 18.52)

Table 3. Association of attending mentors' demographic and resident's publication

Variable	Total N (%)	Odds Ratio (P Value)
Gender		
Male	8 (24)	3.4 (0.12)
Female*	25 (76)	
Ethnicity		
Caucasian*	26 (79)	12.8 (<0.0001)
African American	2 (6)	
Asian	4 (12)	
Other**	1 (3)	
Specialty		
Maternal Fetal Medicine	11 (33)	3.8 (0.0004)
Gynecologic Oncology	3 (9)	
Reproductive Endocrinology	4 (12)	
Urogynecology**	2 (6)	
General Gynecology*	13 (39)	
Academic Position		
Professor	7 (21)	5.1 (0.006)
Associate Professor	4 (12)	2.1 (0.67)
Assistant Professor*	15 (45)	
Clinical Instructor	7 (21)	0.7 (0.29)

*Reference group

**No odds ratio computed due to small sample size

Table 4. All Academic Faculty Demographics

Variable	Number (%)
Gender	
Male	32 (62)
Female	20 (38)
Ethnicity	
Caucasian	32 (62)
African American	9 (17)
Asian	8 (15)
Other	3 (6)
Specialty	
Maternal Fetal Medicine	13 (25)
Gynecologic Oncology	5 (10)
Reproductive Endocrinology	4 (8)
Urogynecology	3 (6)
General Gynecology	27 (52)
Academic Position	
Professor	15 (29)
Associate Professor	8 (15)
Assistant Professor	21 (40)
Clinical Instructor	8 (15)
Academic Degree	
MD	49 (94)
DO	1 (2)
PhD	2 (4)

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