Tohoku J. Exp. Med., 2016, **239**, 325-331

Having a Mentor or a Doctoral Degree Is Helpful for Mid-Career Physicians to Publish Papers in Peer-Reviewed Journals

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The evidence suggests that mentoring is one of useful teaching methods in academic medicine but it is not clear for which outcome mentoring is effective. In this study, the authors investigated the number of original research articles that the participants had published in peer-reviewed English-language journals (as a first or a corresponding author) within one year prior to investigation and what characteristics of the participants who published at least one paper would be like compared to those who did not. In March 2015, the authors recruit early- and mid-career Japanese physicians (238 men and 240 women; mean age 40.6 years old) in a web survey. In total, 23.9% of physicians had published at least one original research article as a first author, 10.0% had published as a corresponding author, and 23.4% had a research mentor. A multivariate logistic regression model adjusting for variables selected at $p < 0.15$ in univariable models showed that even after adjusting for their motivation levels for clinical research, physicians with a research mentor [odds ratio (OR) 6.68; 95% confidence interval (CI), 3.74-11.93], physicians who obtained DMSc, roughly equivalent to PhD in the West (OR, 2.17; 95% CI, 1.26-3.72), and physicians who worked at teaching hospitals (OR 6.39; 95% CI, 2.54-16.04) were more likely to publish an original paper in a peer-reviewed journal. Having a research mentor or DMSc is associated with an experience of successfully publishing original papers in peer-reviewed journals for young and mid-career physician-researchers.

Keywords: clinical research; epidemiology; medical education; mentoring; young and mid-career physician-researchers
Tohoku J. Exp. Med., 2016 August, **239** (4), 325-331.

Introduction

Biomedical research has been dominated by the United States for the past several decades with a 52-70% representation in the top clinical research and basic science journals during 1991-2000 (Fukui and Rahman 2002). From 1991 to 2010, Japan contributed substantially to the top basic science journals; however, its contribution to top general medicine journals was considerably smaller and stagnant during this period (Fukui et al. 2013). While basic research is more focused on animal experiments, clinical research does not merely focus on clinical trials, but directly increases the quality level of patient care through a unique and innovative research question embedded in daily clinical practice. (Farrugia et al. 2010) However, the number of physician-researchers has critically declined because Japan presently faces a severe physician shortage: the number of medical doctors per 1000 persons in Japan was 2.3 in 2012 versus the average number among OECD countries, 3.2. (OECD Health Statistics (database) 2015) According to the Japan Federation of Medical Worker's Unions' report in 2007, 30.9% of physician respondents worked more than 80 hours per week; thus, the majority of clinicians can hardly have protected time for research (Japan Federation of Medical Worker's Unions 2007). To balance between clinical practice and research activity, we specifically focused on the

Received May 17, 2016; revised and accepted July 25, 2016. Published online August 13, 2016; doi: 10.1620/tjem.239.325.
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effect of a research mentor on conducting research in this study. Hence, the purpose of this study was to clarify whether having a research mentor is associated with successfully publishing original papers in peer-reviewed journals as a first or a corresponding author for young and mid-career physician-researchers.

Methods

Participants

We included 250 male and 250 female early- to mid-career physicians, typically in their 30's and 40's. To recruit them, we randomly sent an email to 2,321 out of 22,881 physicians in their 30's and 40's registered at a commercial company thorough the internet from throughout Japan for a week from March 20 until March 26, 2015. Subjects provided an informed consent and were asked to complete a self-administered questionnaire with an incentive (10 dollars).

This study was a part of a larger multi-institutional project to promote hypothesis-driven clinical research among early- and mid-career physicians, and was funded by the Ministry of Health, Labor, and Welfare of Japan. The study was approved by the lead institutional review board at St. Luke's International Hospital in Tokyo, Japan.

Measures

The primary outcome of interest was the number of original papers published in peer-reviewed English-language journals, as a first or a corresponding author, within one year prior to the investigation.

Items investigated in this study included the physicians' baseline characteristics, working conditions, training, and research. Baseline characteristics included gender, age, marital status, occupation of partner (physician/others/unemployed), number of children, and household income in the previous year (US$ 100,000 <; US$ 100,000-US$ 200,000; ≤ US$ 200,000). Working conditions included clinical department (surgery, basic science, other, or medicine), work place (teaching hospital, non-teaching hospital, clinic, or other), and weekly working hours subtracted by research hours. Items related to training included years of experience as a physician, holding a Doctor of Medical Science (DMSc), board certification, and fellowship completion. In Japan, one obtains MD in a medical school and then DMSc in a graduate school, which is a terminal degree for those graduated from a medical school, roughly equivalent to a PhD in the West. Items related to research included research type, and time at first clinical research experience (conference presentation or writing an academic paper). Regarding research type, participants were asked to choose one of four types of research: basic science, clinical research, social science, or other. We defined "research mentor" as "a person who is more experienced or knowledgeable to lead or guide you in a certain research area of expertise." For participants reporting the presence of a mentor, we asked about the mentor's gender and position. We also measured motivation for clinical research by asking "To what extent are you interested in clinical research?" The response pattern ranged from 1 (not at all) to 5 (very much).

Statistical analysis

The outcome was the number of original papers published, as either a first or a corresponding author, that was dividing into two groups at a median (i.e., 0) of its distribution and reported as a binary outcome (i.e., no papers vs. at least one paper). All comparisons were assessed via t-test for continuous variables, or a chi-square or a Fisher's exact test for categorical variables. A logistic regression analysis was applied to investigate factors associated with publishing successfully as a first or a corresponding author. Odds ratios (OR) were estimated along with 95 % confidence intervals (CI). A multivariable logistic regression model was performed, adjusting for variables selected at $p < 0.15$ in univariable logistic models. All analyses were conducted using SAS software version 9.3 (Cary, NC); statistical significance was set at $p < 0.05$.

Results

Among the 500 subjects for the analyses (250 men and 250 women), 197 researchers (39.4%) reported that they were involved in research at the time of investigation. To focus on clinical research, we subsequently excluded 22 participants who were involved in basic science research activities. Our final analysis included 478 participants.

Table 1 shows baseline physician characteristics stratified by gender. Among all participants, men were slightly older ($p < 0.001$) and more experienced ($p < 0.001$) than women. More women tended to work at teaching hospitals, while more men worked at non-teaching hospitals. Men were more likely to obtain DMSc ($p = 0.055$), board certification ($p = 0.029$), or fellowship ($p = 0.043$). Men worked longer than women ($p < 0.001$), but women ($p < 0.001$) and partners of male participants ($p < 0.001$) worked longer in their households than men.

Table 2 shows the factors associated with successfully publishing an original paper as a first or a corresponding author in a peer-reviewed English-language journal. Participants were more likely to write an original paper if they worked in a teaching hospital ($p < 0.001$). Those holding DMSc ($p = 0.001$), board certification ($p = 0.028$), or fellow certification ($p = 0.074$) were also significantly more likely to publish compared to those without. Those who have household income less than US$ 100,000 were more likely to write an original paper compared to those who have household income more than US$ 100,000. The average degree of motivation for clinical research was higher among those who published than among those who did not ($p < 0.001$). Additionally, participants who had a research mentor were significantly more likely to successfully publish an original research article compared to those who did not have a mentor or those who were unclear if they had a mentor ($p < 0.001$). This trend that the higher percentage of publishing among physicians with a mentor compared to the percentage among those without was consistently observed across the work places investigated; 70.0% vs. 40.5% at a teaching hospitals ($p = 0.002$), 47.8% vs. 12.8% at non-teaching hospitals ($p < 0.001$), and 58.3% vs. 1.7% at clinics ($p < 0.001$). Neither the research mentors' gender nor their position made a difference on the likelihood of a successful publication.

Table 3 shows the result of a multivariable logistic model for factors associated with writing an original article as a first or a corresponding author. Variables selected at p

Table 1. Baseline characteristics (n = 478).

	Men (n = 238) N (%) or mean [SD]	Women (n = 240) N (%) or mean [SD]	*p**
Age	41.5 [5.0]	39.7 [4.7]	< 0.001
Physician experience	16.2 [4.9]	14.7 [4.7]	< 0.001
Work place			0.041
Teaching hospitals	49 (20.6)	60 (25.0)	
Non-teaching hospitals	144 (60.5)	130 (54.2)	
Others	43 (18.1)	39 (16.3)	
Clinic	2 (0.8)	11 (4.6)	
Doctor of Medical Science			0.055
Obtained	127 (53.4)	107 (44.6)	
Board certified			0.029
Obtained	173 (72.7)	151 (62.9)	
Fellow			0.043
Obtained	206 (86.6)	190 (79.2)	
Weekly working hours	54.2 [19.2]	40.9 [18.5]	< 0.001
Weekly working hours other than research time	50.1 [18.3]	39.2 [16.8]	< 0.001
Marital status			< 0.001
Married	210 (88.2)	151 (62.9)	
Single or divorced	28 (11.8)	89 (37.1)	
Children			0.006
1 +	199 (89.2)	128 (78.5)	
None	24 (10.8)	35 (21.5)	
Number of children			0.019
More than 2	53 (26.6)	23 (18.0)	
2	88 (44.2)	49(38.3)	
1	58 (29.2)	56 (43.8)	
Resign at time of first child birth			0.026
resigned	10 (5.0)	16 (12.5)	
not resigned	189 (95.0)	112 (87.5)	
Domestic working hours			< 0.001
None	46 (19.3)	18 (7.5)	
1-1.9	106 (44.5)	41 (17.1)	
2-2.9	45 (18.9)	45 (18.8)	
3 ≤	41 (17.2)	136 (59.3)	
Domestic working hours of partner			< 0.001
None	33 (13.9)	125 (52.1)	
1-1.9	7 (2.9)	52 (21.7)	
2-2.9	3 (1.3)	28 (11.7)	
3 ≤	195 (81.9)	35 (14.6)	
Household income			0.109
US$ 200,000 <	73 (30.7)	82 (34.2)	
US$ 100,000-200,000	143 (60.1)	124 (51.7)	
US$ < 100,000	22 (9.2)	34 (14.2)	
Mentor			0.165
1 +	48 (20.2)	64 (26.7)	
Not sure	38 (16.0)	42 (17.5)	
None	152 (63.9)	134 (55.8)	

*Based on t-test for continuous variables, or a chi-square or a Fisher's exact test for categorical variables.

Table 2. Association of working conditions, qualifications, research, and mentor with having an original paper as a first or corresponding author.

	First or Corresponding author			Logistic Univariable model	
	1≤ (n = 122) N (%) or mean [SD]	0 (n = 356) N (%) or mean [SD]	p*	OR (95%CI)	$p^{\dagger}$
Work place			< 0.001		< 0.001
Teaching hospitals	57 (46.7)	52 (14.6)		8.89 (4.04-19.54)	
Non-teaching hospitals	52 (42.6)	222 (62.4)		1.90 (0.89-4.04)	
Others	4 (3.3)	9 (2.5)		3.60 (0.92-14.13)	
Clinic	9 (7.4)	73 (20.5)		reference group	
Clinical department			0.638		0.676
Surgical departments	55 (45.1)	169 (47.5)		0.94 (0.62-1.43)	
Basic and others	7 (5.7)	14 (3.9)		1.44 (0.56-3.74)	
General internal medicine	60 (49.2)	173 (48.6)		reference group	
Doctor of Medical Science			0.001		0.001
Obtained	76 (62.3)	158 (44.4)		2.07 (1.36-3.16)	
Board certified			0.028		0.022
Obtained	93 (76.2)	231 (64.9)		1.74 (1.08-2.78)	
Fellow			0.074		0.057
Obtained	108 (88.5)	288 (80.9)		1.82 (0.98-3.37)	
Weekly working hours other than research time	45.5 [19.5]	44.4 [18.0]	0.567	1.00 (0.99-1.02)	0.566
Household income			0.041		0.045
US$ 200,000 <	38 (31.2)	117 (32.9)		0.50 (0.26-0.96)	
US$ 100,000-200,000	62 (50.8)	205 (57.6)		0.47 (0.26-0.86)	
US$ < 100,000	22 (18.0)	34 (9.6)		reference group	
Timing of first experience of conference presentation			0.246		0.204
Up to first two years of residency	87 (72.5)	219 (66.2)		1.35 (0.85-2.14)	
Longer than 2 years	33 (27.5)	112 (33.8)		reference group	
Timing of first experience of writing academic papers			0.247		0.249
Up to first two years of residency	39 (32.5)	92 (27.8)		1.03 (0.61-1.74)	
3-5 years after medical school graduation	41 (34.2)	142 (42.9)		0.70 (0.42-1.16)	
Longer than 5 years	40 (33.3)	97 (29.3)		reference group	
Mentor			< 0.001		< 0.001
1 +	66 (54.1)	46 (12.9)		8.11 (4.93-13.33)	
Not sure	13 (10.7)	67 (18.8)		1.10 (0.56-2.16)	
None	43 (35.3)	243 (68.3)		reference group	
Gender of mentor			0.110		0.068
Male	37 (80.4)	61 (92.4)		2.97 (0.92-9.53)	
Profile of mentor			0.925		0.925
Chair/professor/director at same department	25 (37.9)	19 (41.3)		0.83 (0.33-2.12)	
Other faculties/members at same department	22 (33.3)	15 (32.6)		0.93 (0.35-2.46)	
Others	19 (28.8)	12 (26.1)		reference group	
Motivation for clinical research	2.9 [0.9]	2.1 [1.1]	< 0.001	1.82 (1.22-2.72)	0.003

*Based on t-test for continuous variables, or a chi-square or a Fisher's exact test for categorical variables.

$^{\dagger}p$ for the category or trend p.

< 0.15 in univariable models included work place (p < 0.001), DMSc holder (p = 0.001), board certification (p = 0.022), fellowship completion (p = 0.057), household income (p = 0.045), having a research mentor (p < 0.001), a research mentor' gender (p = 0.068), and having a higher degree of motivation for clinical research (p = 0.003). After

Table 3. Multivariable logistic model for writing an original paper as a first or a corresponding author.

	First or Corresponding author	
	Multivariable model (R^2 0.27; n = 478)	
	OR (95%CI)	*p**
Work place		< 0.001
Teaching hospitals	6.39 (2.54-16.04)	
Non-teaching hospitals	2.37 (0.97-5.76)	
Others	4.16 (0.86-20.18)	
Clinic	reference group	
Doctor of Medical Science		0.005
Obtained	2.17 (1.26-3.72)	
Household income		0.026
US$ 200,000 <	0.46 (0.21-1.02)	
US$ 100,000-200,000	0.36 (0.17-0.76)	
US$ < 100,000	reference group	
Mentor		< 0.001
1 +	6.68 (3.74-11.93)	
Not sure	1.10 (0.52-2.32)	
None	reference group	
Motivation for clinical research	1.84 (1.43-2.37)	< 0.001

*p for the category or trend p.
Not adjusting for a research mentor's gender due to small number.

adjusting for these variables, the multivariable model showed that participants who had a research mentor were nearly 6.7 times (OR, 6.68; 95% CI, 3.74-11.93) more likely to have successfully published an original paper in a peer-reviewed journal compared to those who did not have a mentor. In addition, the DMSc holders (OR 2.17, 95% CI, 1.26-3.72) were more likely to publish an original paper. Compared to those who have household income less than US$ 100,000, those who have household income US$ 100,000-200,000 (OR 0.36, 95% CI, 0.17-0.76), or more than US$ 200,000 (OR 0.46, 95% CI, 0.21-1.02) were less likely to publish an original paper. The likelihood ratio of publishing a scientific paper increased by nearly double (OR 1.84, 95% CI, 1.43-2.37) in one-unit increase in motivation degree for clinical researches. There were no statistical interactions between mentor and the other variables (such as work place, clinical department, and working hours).

Discussion

This study demonstrated that having a mentor was significantly associated with successful publication of an original paper in a peer-reviewed English-language journal as either a first or a corresponding author. Our results suggested that a mentor plays a critical role in providing young physicians the skills necessary to conduct clinical research. Few previous studies have investigated which factors predict successful research activity, and those available have mainly studied physicians from Western countries. Despite the paucity of data, several of these studies have shed light on the importance of mentorship in academic medicine. However, the dynamics of this relationship, specifically how mentorship affects academic productivity, has not been fully articulated. In addition, formalized mentorship programs are not prevalent, even in the United States (Sambunjak et al. 2006). According to three systematic reviews regarding mentoring in academic medicine (Sambunjak et al. 2006, 2010; Kashiwagi et al. 2013), the effects of mentorship vary among studies. It shows that having a mentor exerts an effect on specialty choice, career choice in research, career satisfaction, gender equality, leadership promotion, and career development (Feldman et al. 2010; DeCastro et al. 2014). Corroborating the results of our study, several previous studies have reported mentors' positive effect on publishing research (Levinson et al. 1991; Palepu et al. 1998; Curtis et al. 2003; Steiner et al. 2004), completing a thesis (Sciscione et al. 1998; Ramondetta et al. 2003) and obtaining a grant (Palepu et al. 1998; Curtis et al. 2003; Steiner et al. 2004).

In Japan, there are very few reports on the role of mentors, except for one study that reported a surprisingly high prevalence of research mentors (91% of 683 respondents), likely due to biased sampling of medical faculties that were university affiliated teaching hospitals in Japan (Sakushima et al. 2015). In contrast, the prevalence of a research mentor in our study was only 25.0% in total, and 39.4% of participants who were currently involved in research at the time of investigation. We believe that our data represents a far more realistic estimate of the current situation in Japan, where few mentors exist. Our study demonstrated that even at clinics or non-teaching hospitals, research mentorship was linked to better odds of successful publication. This

finding suggests that having a mentor is, in and of itself, a powerful factor that promotes physician involvement with research activities.

Mentorship involves personal development for mentors and mentees alike (UCSF Faculty Mentoring Program 2010). In the previous Japanese data cited above (Sakushima et al. 2015), research mentors' roles focused specifically on research methodology (i.e., writing manuscripts, research design, research management, etc.) and did not include career development activities, such as serving as a role model, promoting professional networking, and mentee advocacy. Multiple previous studies have reported that the barriers for clinicians to be involved in research activities are many, and include time constraints due to lack of staff, skill gaps due to insufficient skills training, and concern about the impact on the doctor-patient relationship (Ross et al. 1999). Core skills in research methodologies broadly applicable to clinical research are important, but negotiating protected research time, obtaining grants, gaining promotions, and taking leadership roles in academic medicine are arguably equally important to a successful long-term research career. In addition, in our study, we observed significant differences in work and family information between men and women. Thus, a mentor presence is beneficial to women who faces difficulty of balancing between work and life and who wishes to pursue their career.

The strength of our study is that we measured the degree of motivation for clinical research and, even after adjusting for this valuable, we successfully demonstrated the positive effect of a mentor on the outcome of interest. There are several limitations in our study that should be addressed. In addition to sample size, this was an internet-based survey with an incentive (10 dollars), which may introduce bias. Furthermore, the survey was open for approximately one week and physicians with busy clinical practices, or even those who were busy with clinical research in addition to their clinical duties, may not have been able to participate. Although this method may introduce sampling bias, we confirmed that the characteristics of potential participants who registered the internet-based survey service company were similar in terms of age and work place to those registered in the national Survey of Physicians, Dentists and Pharmacists (Ministry of Health Labour and Welfare 2012). Second, the cross-sectional design of this study precludes us from commenting on the directionality of the relationship between a mentor presence and a publishing success. As this association has been observed in other populations, we assume that our findings are valid and reflect the positive reciprocal relationship that mentors have on mentees motivated to conduct clinical research. Third, our study demonstrated that those who have household income of US$ < 100,000 were more likely to successfully publish an original research paper. It is widely known that research activities are usually not related to income. In this regard, our result requires careful interpretation because the household income is marital total income which does not represent each participant's own salary. Therefore, a relationship between the income of married couples and publication outcome may need to be explored separately in further studies. Finally, we did not explore the mentor-specific functions involved in a mentorship, such as obtaining grant support, giving advice on work-life balance and future vision, or monitoring the frequency of mentor-mentee meetings. These critical functions of mentorship warrant further exploration in future studies.

Future implications

Clinical researchers are an endangered species worldwide, and are particularly scarce in Japan. The reason for their small numbers is multifactorial and includes deficiencies in prioritizing clinical research in the current medical education system. Unlike in the United States, pre-medical and medical students, as well as resident trainees in Japan seldom have research experiences prior to their third post-graduate year or beyond, when many opt to return to an academic center to pursue graduate-level research training. Newly certified physicians begin their residencies under the typical Japanese apprentice system, especially in surgical specialties where clinical skills are taught from senior to junior surgeons from hand to hand. This paternalistic mentorship in Japan should be explored in terms of scientific evidence. Nonetheless, our data shows that 55.8% of respondents with DMSc, a terminal degree roughly equivalent to PhD in the West, were not actively engaged in research at the time of this investigation. As the DMSc degree signifies independent research ability, this begs the question of whether even advanced graduate programs are adequately selecting and training individuals to prioritize research during their medical careers. Improvement of the current situation in Japan will hinge on developing work environments where physician-scientists are actively encouraged to pursue long-term research careers. Mentorship has been shown to be beneficial in this regard as well.

In conclusion, having a research mentor is likely to encourage clinicians in Japan to be actively involved in clinical research that meets international standards of quality. Further, teaching hospitals should consider increasing the number of mentors for young physicians, as well as providing faculty development curricula to increase the quality of mentoring. In addition, those pursuing DMSc degree should be trained and expected to take leadership roles in providing educational curricula for both medical students and post-graduate physicians, which promotes long-term research careers.

Acknowledgments

This study was a part of a larger multi-institutional project to promote hypothesis-driven clinical research among early- and mid-career physicians, and was funded by the Ministry of Health, Labor, and Welfare of Japan (Contract No. 201315043A).

Conflict of Interest

The authors declare no conflict of interest.

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