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Length of Fellowship Training in Population Health Research and Long-term Bibliometric Outcomes

Tiffany L. Holland[a], **Keewan Kim**[a], **Carrie J. Nobles**[a], **Ya-Ling Lu**[b], **Indulaxmi Seeni**[a], **Sunni L. Mumford**[a], **Stephen E. Gilman**[c], **Lindsay D. Levine**[a], **Victoria C. Andriessen**[a], **Enrique F. Schisterman**[a]

[a]Epidemiology Branch, Division of Intramural Population Health Research, Eunice Kennedy Shriver National Institute of Child Health and Human Development, National Institutes of Health, Bethesda, MD;

[b]NIH Library, National Institutes of Health, Bethesda, MD;

[c]Social and Behavioral Sciences Branch, Division of Intramural Population Health Research, Eunice Kennedy Shriver National Institute of Child Health and Human Development, National Institutes of Health, Bethesda, MD.

Abstract

Background: The length of research fellowships, the number of doctorates pursuing them, and the academic job market have changed dramatically in recent years. However, there is limited investigation on attributes of fellowships most relevant to future scientific achievement. We analyzed the association of a modifiable aspect of research training, fellowship length, with future achievement and differences across research discipline in the Division of Intramural Population Health Research (DIPHR), Eunice Kennedy Shriver National Institute of Child Health and Human Development, National Institutes of Health.

Methods: Demographics of 88 DIPHR trainees from 1998 to 2016 were collected from publicly available annual reports. Research performance metrics, including total publication count and H index through 2016, were collected via Scopus. We used linear regression models for associations between fellowship length, including both total exposure to research training and duration of postdoctoral training alone, and research performance adjusted for start year, publications at entry, branch (e.g., Biostatistics and Bioinformatics, Epidemiology, and Health Behavior), and mentor seniority.

Results: Each additional year of research training in DIPHR was associated with a 15% increase in H index (95% confidence interval [CI] = 3.0, 28.4) and 21% more lifetime publications (95% CI = 3.0, 41.9). Results were similar, although attenuated, when evaluating postdoctoral training alone. Differences by discipline were observed, with the strongest positive associations in the Biostatistics and Bioinformatics and Epidemiology Branches.

Correspondence: Enrique F. Schisterman, Epidemiology Branch, Division of Intramural Population Health Research, Eunice Kennedy Shriver National Institute of Child Health and Human Development, National Institutes of Health, 6710B Rockledge Drive, MSC7004, Bethesda, MD 20892. schistee@mail.nih.gov.

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Conclusions: Longer training at DIPHR was associated with improved measures of research performance, though this relationship varied by discipline. Additional research is needed to tailor training programs to optimize success of trainees.

Keywords

Bibliometrics; Fellowship training; Population health; Postdoctoral fellowships

In recent years, research training in the field of population health both before and after obtaining a doctoral degree has changed substantially. Though research training in this field was traditionally given less emphasis than in other disciplines (e.g., biology or medicine), the total number of individuals pursuing postdoctoral fellowships in population health has increased despite limited availability of tenure track academic positions[1,2]. In response to the heightened competition for tenure track positions, doctoral graduates who aspire to become independent scientists are pursuing extended postdoctoral training, often including more than one postdoctoral fellowship.[1] Along with these changes in fellowship duration and academic job prospects, there has been an increase in the average age at which academic milestones are achieved. The age of first independent faculty appointments for PhDs rose from 34 in 1979 to 38 in 2003.[3] Furthermore, the percentage of principal investigators who are recipients of an R01 grant under 36 years of age has decreased from 18% in 1983 to 3% in 2010.[4] This delay in first receipt of an R01 grant, a key indicator of a researcher's ability to establish an independent research program in the population health and biomedical sciences, may be attributed to increased competition, fewer young scientists pursuing academia, or an increased length of time spent as a postdoctoral fellow, among other factors. With regards to fellowship length, it is unknown whether these changes have impacted research performance and subsequent success in obtaining a tenure track position.[5]

There is a pressing need to describe and characterize ongoing practices in research training and to evaluate the effectiveness of current practices in promoting research performance. Therefore, we investigated whether a modifiable aspect of research training, fellowship length, is associated with future research performance, a proxy for establishment within one's field. To quantitatively examine trends in research performance in relation to research fellowship length, we obtained H index, lifetime publications, and number of publications since the end of fellowship training for fellows receiving training within a population health division at the National Institutes of Health (NIH). Additionally, we investigated the association between fellowship length and future research performance parameters among fellows trained in three public health research domains: biostatistics, epidemiology, and health behavior.

METHODS

We analyzed research performance among 88 fellows who received their fellowship training between 1998 and 2016 in the Division of Intramural Population Health Research (DIPHR), formerly known as the Division of Epidemiology, Statistics, and Prevention Research (DESPR), of the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) of the NIH. The NIH provides training for approximately 4000 postdoctoral research fellows in a given year.[6] Within DIPHR, fellows complete their training in one of four offices/branches: the Office of the Director, the Biostatistics and Bioinformatics Branch, the Epidemiology Branch, and the Health Behavior Branch (currently the Social and Behavioral Sciences Branch). The Office of the Director primarily focuses on general reproductive epidemiology; the Biostatistics and Bioinformatics Branch focuses on methods development; the Epidemiology Branch focuses on reproductive, perinatal, and pediatric epidemiology and research methods; and the Health Behavior Branch focuses on health-related behaviors. Fellows who pursue training in the Office of the Director often have a terminal degree in epidemiology or biostatistics although those in the Biostatistics and Bioinformatics Branch and Epidemiology Branch generally have terminal degrees in those respective disciplines. In the Health Behavior Branch, fellows tend to have terminal degrees in psychology, education, or the social science department in a school of public health. We chose to focus our analysis solely on fellowship training within DIPHR, rather than including other divisions and institutes of the NIH, because institutional knowledge of standards of training and expectations of fellows in the Division was necessary for the interpretation of the findings.

Data Sources

Publicly available records, such as DIPHR annual reports, were used to determine fellows' names, sex, length and dates of fellowship, type(s) of fellowship (including both predoctoral and postdoctoral fellowships), branch, mentors' name(s), institution and department of doctoral education, and position upon leaving the NIH. This documentation existed for 88 fellows who began their fellowship on or after 1998 and ended their fellowship on or before 2016, allowing for assessment of their productivity after completion of their fellowship. In cases in which sex was uncertain, sex was confirmed by either consulting their previous mentor or by completing an online search using the fellow's full name and fellowship information.

We utilized this information in an online search of publicly available information to determine current positions and affiliations of DIPHR-trained fellows. Main sources of information included academic webpages of those who moved on to academia and LinkedIn pages for those outside of academia. When LinkedIn was utilized, identification was confirmed by DIPHR fellowship dates or current employment information on their profile that matched our records. We used Scopus to retrieve all publication-related metrics, including publication counts, H index, and active publication years.

Type and Duration of Training

This analysis included both predoctoral Intramural Research Training Award (IRTA) and postdoctoral (IRTA or research fellow) fellowships. Because individual institutions establish independent regulations on the length and criteria for training fellowships, it is important to note that the fellowship types referenced in this analysis are specific to those undertaken at the NIH. Further, fellows could have completed more than one type of fellowship during their time at NIH and were further categorized into the forms of training they received.

The NIH predoctoral fellowship is available to doctoral students who complete dissertation research in collaboration between their institution and the NIH. The NIH postdoctoral fellowship is available to individuals who have recently completed a doctoral degree and have less than 5 years of relevant research experience. For both predoctoral and postdoctoral fellowships, fellows receive 100% protected time for research training. During this time, postdoctoral fellows are expected to engage in multiple research initiatives to further their future research careers. Postdoctoral fellowships have a maximum length of 5 years.[6] The NIH research fellowship is available to individuals with a doctoral degree who have demonstrated outstanding scholastic achievement and the ability to conduct successfully, with little supervision, a pre-established program in biomedical research. There were four fellows who continued onto a research fellow position in DIPHR after their postdoctoral fellowship in our data. Research fellowships have a maximum length of 8 years[7]; however, the four fellows who completed a research fellow position at DIPHR spent less than 2 years in the position.

In the main analysis evaluating total exposure to research training in DIPHR, we evaluated total length of training at DIPHR, starting from the beginning of the first position (IRTA predoctoral or postdoctoral position) and ending at the last position (end of IRTA predoctoral, postdoctoral, or research fellow position). In a secondary analysis, we restricted training time to postdoctoral positions only, starting from the beginning of their postdoctoral position (IRTA postdoctoral fellowship) and ending after their last postdoctoral position (IRTA postdoctoral fellowship or research fellowship), to examine the potential impact of predoctoral fellowship training on our main findings. This secondary analysis excluded six fellows who only received predoctoral training. Training was contiguous for all fellows in DIPHR, with no gaps between positions for those with more than one position type.

Outcome Assessment

The outcome of interest was research performance, assessed by H index, number of lifetime publications, number of lifetime first author publications, number of lifetime last author publications, and number of publications since end of fellowship. Publication data were retrieved from Scopus and assessed in December 2016.

Hirsch defined H index as “the number of papers with citation number >H” and proposed it as “a representative measure of individual scientific achievement.” For example, if a fellow has five published articles, four have four or more citations and one has less than four citations, then this fellow’s H index is four.[8] Use of the H index adds depth to our measures of research performance as it measures both productivity and citation impact.[9] Publications since the end of research training included all publications starting from the year after the fellowship ended through the date of collection. For example, a postdoctoral fellow who terminated their fellowship in 2003 had a “publications since end of postdoc” count that included all publications from 2004 to December 2016. This analysis excluded 21 fellows who completed their training in 2016 or later.

Other Covariates

We identified fellow's current position and categorized into one of the following six categories: academia, government, government-research, industry, postdoc, and other. Government roles that were almost entirely research driven were considered to be government-research positions, whereas government roles in which the main function was not research were considered government only. We additionally obtained information on the department from which the fellow received their PhD and categorized their doctoral training as being in one of the following categories: agriculture life sciences, arts and sciences, engineering, math, public health, school of medicine, science, or social science.

Statistical Analysis

We summarized characteristics of 88 fellows, including sex, current position, branch, type of fellowship, and department granting doctorate degree (Table 1). These characteristics were stratified by median fellowship length (≤2 vs. >2 years) in descriptive analyses. Research performance parameters were log-transformed to obtain normal distribution. We utilized linear regression models to examine the associations between fellowship length (years) and log-transformed research performance parameters, including H index, number of lifetime publications, number of lifetime first author publications, number of lifetime last author publications, and number of publications since end of fellowship (Table 2). The presented results are interpreted as percent difference (95% confidence interval [CI]) in research performance per additional year of fellowship training. We excluded one fellow whose publication history was unidentifiable, with 87 fellows included in the regression analyses. In the models for number of publications since end of fellowship, we further excluded 21 fellows who ended their training on or after 2016, leaving 66 fellows in the analysis. Models were adjusted for start year, number of publications at entry into training, branch, and mentor seniority at the time of training (Senior Investigator or Investigator/Staff Scientist). We also stratified the analysis by branch by including an interaction term between years of training and indicators of branch in the regression models; fellows from the Office of Director were excluded from this analysis due to small sample size (n = 5). In a separate analysis, we excluded predoctoral training time to investigate the association of postdoctoral fellowship length and research performance.

Though numerous lifestyle factors and personal characteristics, including marital status, parental status, or nationality, can influence a fellows' decision making regarding duration of training, as well as impact research performance metrics, those data were unavailable for the analysis. Thus, we performed a sensitivity analysis to analyze the impact of a potential unmeasured confounder (U) on the association between fellowship length and research performance (Figure). Specifically, we analyzed an assumed prevalence rate of 20%, 50%, and 70% for the unmeasured confounder (e.g., 20%, 50%, and 70% married or fellows of foreign nationality) and simulated data for a range of associations between U and length of fellowship and U and research performance parameters (e.g., H index, lifetime publications). The associations between U and length of fellowship ranged from a β of −2, −1, 1, and 2. The association between U and research performance parameters varied from a β of −1.5, −0.5, 0.5, and 1.5, which is equivalent to a −150%, −100%, 50%, and 150% change in research performance. This project utilized publicly available data and was therefore exempt from institutional review. We used SAS version 9.4 (SAS Institute, Cary, North Carolina) and R version 3.3.2 (R Foundation for Statistical Computing, Vienna, Austria) for all statistical analyses.

RESULTS

Of the 88 fellowship trainees included in the analysis, 64 (72%) were female (Table 1). Overall length of training ranged from 1 to 5 years, with 10 (12%) receiving 1 year, 37 (43%) 2 years, 24 (28%) 3 years, 15 (17%) 4 years, and 1 (1%) 5 years of training. When stratified by fellowship length, 48 (55%) had a fellowship length of ≤2 years, and 40 (45%) had a fellowship length of >2 years. Overall, 49% of fellows currently held an academic position, followed by those who were current postdoctoral fellows (17%), government-researchers (16%), in industry (9%), in a nonresearch government position (6%), and in another type of position (3%). Approximately half of fellows completed their fellowship in the Epidemiology Branch (49%), with 24% in the Biostatistics and Bioinformatics Branch, 22% in the Health Behavior Branch, and 6% in the Office of Director. The majority of fellows received only postdoctoral training in DIPHR (77%), with others receiving both pre- and postdoctoral fellowship training (11%), while some received predoctoral fellowship training only (7%). Among those who completed additional training as a research fellow, some completed both postdoctoral and research fellowship training (3%), while others completed predoctoral, postdoctoral, and research fellowship training (1%).

In the main analyses evaluating total exposure to research training (total years of predoctoral and postdoctoral training), we found that there was a 15% increase in H index ($\beta = 0.14$; 95% CI = 0.03, 0.25), 20.9% more lifetime publications ($\beta = 0.19$; 95% CI = 0.03, 0.35), and 13% more lifetime first author publications ($\beta = 0.12$; 95% CI = −0.02, 0.27) with each additional year of training, adjusting for start year, publications at entry, branch, and mentor seniority (Table 2). We found no clear association between duration of training and lifetime last author publications or publications since the end of their fellowship. When stratified by branch, we found that there was a 36% ($\beta = 0.31$; 95% CI = 0.02, 0.61) and 22% ($\beta = 0.20$; 95% CI = 0.05, 0.35) increase in H index with each additional year of training within the Biostatistics and Bioinformatics Branch and Epidemiology Branch, respectively. Additionally, we found that each additional year of training in these two branches was associated with a 38% ($\beta = 0.32$; 95% CI = −0.09, 0.73) and 38% ($\beta = 0.32$; 95% CI = 0.11, 0.52) increase in lifetime publications, respectively, and a trend of increased lifetime first author publications, lifetime last author publications, and publications since end of fellowship, though the estimates are imprecise. Overall training length was not associated with research performance in the Health Behavior Branch. We detected an interaction between years of training and being in the Epidemiology versus Health Behavior Branches in relation to lifetime publications ($\beta = -0.44$; 95% CI = −0.79, −0.08 for the multiplicative interaction term).

In a separate analysis where we evaluated total years of postdoctoral training only, we found consistent results but with less precise estimates (Table 3). Overall, we found that there was a 11% increase in H index ($\beta = 0.10$; 95% CI = −0.01, 0.21), 9.4% more lifetime publications ($\beta = 0.09$; 95% CI = −0.06, 0.25), and 13% more lifetime first author publications (β = 0.12; 95% CI = −0.03, 0.26) with each additional year of training. When evaluating interactions by branch, for each year of training, a 32% (β = 0.28; 95% CI = 0.02, 0.54) and 23% (β = 0.21; 95% CI = −0.04, 0.38) increase in H index for the Biostatistics and Bioinformatics Branch and Epidemiology Branch, respectively, were observed. Additionally, each additional year of training in these two branches was associated with a 34% (β = 0.29; 95% CI = −0.07, 0.65) and 36% (β = 0.31; 95% CI = 0.08, 0.54) increase in lifetime publications, respectively, and a trend of increased risk of lifetime first author publications, lifetime last author publications, and publications since end of fellowship.

The results of a sensitivity analysis to evaluate the potential impact of an unmeasured confounder affecting fellowship duration and both H index and lifetime publications are presented in Figure. For an unmeasured confounder with a prevalence of 50%, we found that the association between years of training and H index was robust against the presence of an unmeasured confounder which is moderately correlated with the fellowship duration and H index for the Biostatistics and Bioinformatics Branch and Epidemiology Branch. However, in the presence of a strong confounder, for example, in a scenario where the unmeasured confounder is strongly inversely associated with both duration in years (β = −2) and H index (β = −1.5 or −150% change in H index), then our findings could be explained by an unmeasured confounder, though such an extreme scenario is unlikely. The results for a sensitivity analysis evaluating unmeasured confounders with prevalence of 20% and 70% were similar.

DISCUSSION

Overall, our findings suggest positive associations between fellowship length and research performance, particularly for H index and number of lifetime publications, among intramural research trainees in the Division of Intramural Population Health Research of the NICHD. These findings were similar when evaluating total exposure to research training (total years of predoctoral and postdoctoral training) and years of postdoctoral training alone. When stratified by research branch, consistent results were found in the Biostatistics and Bioinformatics Branch and Epidemiology Branch but not in the Health Behavior Branch, possibly due to variations in specific research area and career path. It is possible that graduates of the Biostatistics and Bioinformatics and Epidemiology Branches follow a research path that requires publishing as the currency for promotion, while Health Behavior graduates choose a research path in which peer-review publication is not required for promotion.

As the nature of research training in population health sciences continues to change, it is important that we ascertain if these changes are beneficial to future scientists. As seen within the Biostatistics and Bioinformatics Branch and Epidemiology Branch, an additional year of training may have a positive lifetime career impact on the H index and publication count of the former fellows. This suggests that longer training may serve as a critical period for future research success and that institutional changes to training should not be taken lightly. Our findings that longer training was similarly associated with total lifetime publication count and first-author lifetime publication count further reinforce that this training period may provide a critical window for establishing an independent research trajectory.

Our results suggest that the optimal length of a fellowship in terms of future research performance may differ by field of research. This difference could be attributed to varying job markets, publication rates in each field, and current positions where publication is not part of the main task. Between 1993 and 2008, the percentage of US-trained behavioral and social science doctoral recipients who were employed full time decreased dramatically, whereas the percentage of those who were employed part-time increased.[10] During this same period, the percentage of US-trained clinical science doctoral recipients only suffered a slight decline in full-time employment and slight increase in part-time employment. Given that job market trends may differ by research discipline, it is important that research discipline be taken into account when determining optimal fellowship length. Aside from job market alone, it is also possible that fellows are more or less likely to enter a career with ample opportunities to publish papers depending on the nature of their fellowship.[11] Although we were unable to assess the relationship between research area and current position type (e.g., academic, industry, government) due to small sample sizes in each group, it is possible that these differences in career trajectory by research area may explain the variation in research performance parameters.

As we used publicly available data only, this study was limited by our inability to consider all potential confounders that may have an effect on the association between fellowship length and future research performance, and how this association differs by research branch. Future research is needed to assess a broader range of predictors, particularly those that are potentially modifiable, and how the relationship of these factors to research productivity metrics may vary by trainee characteristics (e.g., by sex or race/ethnicity). Additionally, we lacked information on other sites of postdoctoral training, as well as nontenure positions held before trainees obtained permanent positions, which will in some cases have led to misclassification of total training time. However, it is important to note that we performed a sensitivity analysis for unmeasured confounding to address this potential limitation. The sensitivity analysis indicated that the results of our study were relatively robust to the presence of a single unmeasured confounder, suggesting that unmeasured confounding is unlikely to fully explain the association between fellowship length and research performance observed in the Biostatistics and Bioinformatics and Epidemiology Branches. That said, there remains a potential for confounding by indication in the analyses of fellowship length if the fellows who are most productive are retained for longer durations. Branch-specific analyses for the Biostatistics and Bioinformatics Branch and Health Behavior Branch were likely underpowered, having approximately half the number of fellows during the study period as Epidemiology Branch. Therefore, larger sample sizes are needed to fully examine the question of disciplinary differences.

This study was also limited by the unique nature of the NIH intramural fellowship. The NIH training program provides dedicated time for research free from teaching and other administrative duties that many academic pre- or postdoctoral research programs require. Furthermore, this study was limited to the intramural fellowship program in one division of one institute within the NIH. As a result, our findings may be difficult to generalize to other training programs both within and outside of the NIH. In particular, as training within DIPHR is focused on obtaining an independent research position in academia, our findings may not extend to fellows with other career trajectories. Our analysis was limited by our narrow definition of future research performance, including H index and lifetime publications, though these two measures are frequently used measures of research achievement. Additionally, we had no record of whether the DIPHR postdoctoral fellowship was the trainee's first postdoctoral fellowship or whether or not the fellow continued on to a second postdoctoral fellowship upon leaving DIPHR. As a result, our analysis focused specifically on fellowship length in DIPHR and cannot shed light on the effect of the overall combined length of fellowships across institutions and future research performance. While our findings do suggest that longer duration of training may be associated with future research performance, this is only one factor among many that may influence the success of trainees. In advising trainees, mentors must weigh a variety of factors related to their mentees, both personal and professional, and further exploration of the factors that foster success of trainees in pursuing their career goals by both mentors and institutions is a vital need. However, our inferences are based on the range of postdoctoral training years available (1–5 years), and our findings cannot be extrapolated beyond that range.

Given that the research trainees of today are responsible for the scientific discoveries of tomorrow, it is imperative that we continue to analyze the effects of changes made to the research fellowship. Particularly, both lifetime exposure to research training and postdoctoral training specifically appeared to be positively associated with selected research performance parameters, though the optimal research training length may vary by specific field. With the increasingly competitive job market for PhDs, utilization of this information can help our trainees put their best foot forward in their research career, particularly in the field of population health research. Additional research on the effect of a broader range of fellowship characteristics on research performance, including differences across disciplines, could help tailor training programs to optimize the success of trainees.

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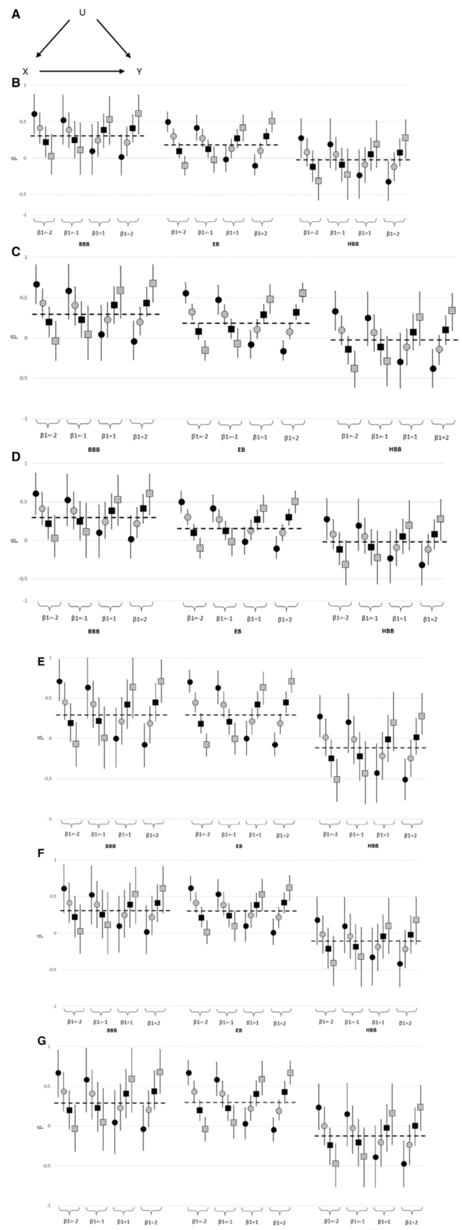

FIGURE.

Sensitivity analysis for the effect of a single unmeasured confounder (U) with prevalence of 20%, 50%, and 70% on the observed relationship between duration of fellowship training and research performance parameters, using data collected for fellows from DIPHR. A directed acyclic graph (A) shows the presumed association of the unmeasured confounder (U) with duration of training (X) and research performance parameter (Y). Sensitivity analyses for H index and lifetime publications are presented for 20% (B, C), 50% (D, E), and 70% (F, G) prevalence of relationship between duration of fellowship training and research performance parameters, respectively. B, associations between X and Y; B1, association of U with X, B2, association of U with Y; close circle, $\beta_2 = 1.5$; shaded circle, $\beta_2 = -0.5$; closed square, $\beta_2 = 0.5$; shaded square, $\beta_2 = 1.5$; dashed lines, observed associations between X and Y. β, associations between X and Y. BBB, Biostatistics and Bioinformatics Branch; EB, Epidemiology Branch; HBB, Health Behaviors Branch.

TABLE 1.

Characteristics of Intramural Fellows From DIPHR, by Fellowship Duration (≤2 or >2 Years), 1998–2016

% (N)	Overall 100 (87)	≤2 Years 54 (47)	>2 Years 46 (40)
Sex			
Women	74 (64)	75 (35)	73 (29)
Current position			
Academic	49 (43)	47 (22)	53 (21)
Current postdoc	17 (15)	21 (10)	13 (5)
Government	5 (4)	6 (3)	3 (1)
Government-research	16 (14)	13 (6)	20 (8)
Industry	9 (8)	9 (4)	10 (4)
Other[a]	4 (3)	4 (2)	3 (1)
Branch			
Office of Director	6 (5)	2 (1)	10 (4)
Biostatistics and Bioinformatics	23 (20)	28 (13)	18 (7)
Epidemiology	49 (43)	55 (26)	43 (17)
Health Behavior	22 (19)	15 (7)	30 (12)
Type of fellowship			
Predoctoral	7 (6)	9 (4)	5 (2)
Postdoctoral	77 (67)	89 (42)	63 (25)
Pre- + postdoctoral	12 (10)	2 (1)	23 (9)
Postdoctoral + research fellow	4 (3)	0 (0)	8 (3)
Predoctoral + postdoctoral + research fellow	1 (1)	0 (0)	3 (1)
Department granting doctorate			
Agriculture Life Sciences	2 (2)	4 (2)	0 (0)
Arts and Sciences	14 (12)	13 (6)	15 (6)
Engineering	4 (3)	2 (1)	5 (2)
Math	5 (4)	9 (4)	0 (0)
Public Health	58 (50)	55 (26)	60 (24)
Medicine	10 (9)	9 (4)	13 (5)
Social Science	4 (3)	2 (1)	5 (2)
Other science programs[b]	5 (4)	6 (3)	3 (1)

[a]Includes nonprofit organization and position unavailable.

[b]Includes mathematical, applied, and natural science departments.

TABLE 2.

Association of Duration of Total Exposure to Research Training (Year) at DIPHR, With Log-transformed Research Performance Parameters

	Log (H Index in 2016) (n = 87) β (95% CI)	Log (Lifetime Publications) (n = 87) β (95% CI)	Log (First Author Publications) (n = 87) β (95% CI)	Log (Last Author Publications) (n = 87) β (95% CI	Log (No. Publications Since End of Fellowship) (n = 66)[a] β (95% CI)
Overall					
Unadjusted	**0.23 (0.08, 0.39)**	**0.24 (0.04, 0.44)**	**0.19 (0.01, 0.37)**	0.18 (−0.03, 0.40)	0.08 (−0.19, 0.34)
Adjusted[b]	**0.14 (0.03, 0.25)**	**0.19 (0.03, 0.35)**	0.12 (−0.02, 0.27)	0.07 (−0.11, 0.26)	0.01 (−0.26, 0.27)
By branch[c]					
Unadjusted					
BBB (n = 20)	**0.50 (0.12, 0.89)**	**0.53 (0.02, 1.03)**	**0.41 (−0.06, 0.40)**	0.43 (−0.17, 1.02)	0.61 (−0.05, 1.27)
EB (n = 43)	**0.22 (0.02, 0.41)**	**0.27 (0.02, 0.52)**	0.17 (−0.06, 0.40)	0.23 (−0.07, 0.53)	0.16 (−0.15, 0.48)
HB (n = 19)	0.09 (−0.19, 0.36)	0.01 (−0.34, 0.37)	0.03 (−0.30, 0.36)	−0.02 (−0.44, 0.40)	−0.41 (−0.88, 0.06)
Adjusted[d]					
BBB (n = 20)	**0.31 (0.02, 0.61)**	0.32 (−0.09, 0.73)	0.22 (−0.17, 0.61)	0.20 (−0.51, 0.17)	0.36 (−0.28, 1.00)
EB (n = 43)	**0.20 (0.05, 0.35)**	**0.32 (0.11, 0.52)**	**0.22 (0.01, 0.42)**	0.18 (−0.07, 0.43)	0.21 (−0.11, 0.52)
HB (n = 19)	−0.02 (−0.23, 0.19)	−0.12 (−0.40, 0.16)	−0.08 (−0.35, 0.19)	−0.17 (−0.51, 0.17)	**−0.49 (−0.93, −0.05)**

Bold indicates estimates at $p<0.05$.

[a]Excludes 21 fellows who ended their training on or after 2016.

[b]Adjusts for start year, number of publications at entry, branch, and mentor seniority.

[c]Excludes 5 fellows in the Office of the Director.

[d]Adjusts for start year, number of publications at entry, and mentor seniority.

BBB, Biostatistics and Bioinformatics; DIPHR, Division of Intramural Population Health Research; EB, Epidemiology Branch; HB, Health Behavior.

TABLE 3.

Association of Duration of Postdoctoral Fellowship Training Alone (Year) at DIPHR, with Log-Transformed Research Performance Parameters, Excluding Fellows Who Completed Predoctoral Fellowship Only

	Log (H Index in 2016) (n = 81) β (95% CI)	**Log (Lifetime Publications) (n = 81) β (95% CI)**	**Log (First Author Publications) (n = 81) β (95% CI)**	**Log (Last Author Publications) (n = 81) β (95% CI)**	**Log (No. Publications Since End of Fellowship) (n = 60)[a] β (95% CI)**
Overall					
Unadjusted	0.16 (−0.02, 0.33)	0.12 (−0.09, 0.34)	0.15 (−0.05, 0.35)	0.11 (−0.13, 0.36)	−0.04 (−0.32, 0.25)
Adjusted[b]	0.10 (−0.01, 0.21)	0.09 (−0.06, 0.25)	0.12 (−0.03, 0.26)	0.05 (−0.15, 0.24)	−0.10 (−0.36, 0.17)
By branch[c]					
Unadjusted					
BBB (n = 18)	**0.50 (0.09, 0.91)**	**0.54 (0.04, 1.05)**	0.42 (−0.04, 0.88)	0.46 (−0.18, 1.09)	**0.73 (0.08, 1.37)**
EB (n = 41)	0.12 (−0.14, 0.38)	0.18 (−0.14, 0.50)	0.22 (−0.07, 0.51)	0.07 (−0.34, 0.47)	0.04 (−0.35, 0.43)
HB (n = 18)	0.07 (−0.21, 0.36)	−0.01 (−0.35, 0.37)	0.003 (−0.32, 0.33)	0.05 (−0.40, 0.49)	−0.39 (−0.85, 0.07)
Adjusted[d]					
BBB (n = 18)	**0.28 (0.02, 0.54)**	0.29 (−0.07, 0.65)	0.21 (−0.14, 0.56)	0.20 (−0.29, 0.69)	0.41 (−0.18, 0.99)
EB (n = 41)	**0.21 (0.04, 0.38)**	**0.31 (0.08, 0.54)**	**0.33 (0.11, 0.55)**	0.19 (−0.12, 0.50)	0.15 (−0.20, 0.50)
HB (n = 18)	−0.04 (−0.23, 0.14)	−0.13 (−0.38, 0.12)	−0.12 (−0.36, 0.13)	−0.11 (−0.45, 0.24)	**−0.50 (−0.90, −0.09)**

Bold indicates estimates at $p<0.05$.

[a] Excludes 21 fellows who ended their training on or after 2016.

[b] Adjusts for start year, number of publications at entry, branch, and mentor seniority.

[c] Excludes 4 fellows in the Office of the Director.

[d] Adjusts for start year, number of publications at entry, and mentor seniority.

BBB, Biostatistics and Bioinformatics; DIPHR, Division of Intramural Population Health Research; EB, Epidemiology Branch; HB, Health Behavior.