The State of Postdoctoral Researchers at Baylor College of Medicine 2011

Hannah Cheung[1]

[1]Postdoctoral Association, Graduate School of Biomedical Sciences, Baylor College of Medicine, Houston, TX

Abstract

Objective

The goals of this study were to determine the current skill levels of postdoctoral researchers at Baylor College of Medicine and to identify factors that contribute to their publication success. The potential factors included: the effectiveness of the Career Development Series, communication with principal investigators, departmental seminars, and postdoctoral association activities (notably career seminars and career symposium). The results will be used to make decisions regarding future postdoctoral training programs and career center development.

Methods

The Postdoctoral Association Executive Committee developed surveys for both postdoctoral researchers (postdocs) and principal investigators (PIs) to complete. The results were collected anonymously through an external web tool (Survey Monkey),and analyzed to find trends of factors contributing to publication success.

Results

Both postdocs and PIs agreed that the top three factors contributing to publication success are: amount of time spent discussing the scientific project one-on-one with the PI, hours in the lab, and collaborations. The data shows that years in the lab, rather than weekly hours in the lab contributed to publication success. Trends alsoindicated that the quality of time spent with the PI increased the rate of publication.

Conclusions

The quality of mentorship rather than the amount of time spent between a postdoc and a PI affected productivity. Postdocs who completed longer training times (5 years) tended to publish more. Research skillsare improving, but were weak in the area of scientific writing. The results emphasize that postdocs need to be more independent and proactive in grant writing, finding expertise, and motivation to succeed.

There is ongoing debate among principal investigators (PIs) and postdoctoral researchers (postdocs)aboutwhat factors contribute to postdoctoral training success. Although success can be defined in various ways, researchers and most future employers examine publication rate as a key measure.Factors that contribute to publication success have been examinedby NRSA and it concludes that those with a higher publication rate were enrolled in the T32 training program and were younger in age (Ross 2009). This study examines whether other factors play a role in postdoctoral researcher success at Baylor College of Medicine (BCM).

Methods

Separate surveys were developed by the Postdoctoral Association Executive Committeefor postdocs and PIs. Each survey contained multiple-choice questions and open comment boxes. Most of the questions addressing publication success were parallel for each group. The questions were uploaded onto a Survey Monkey questionnaire (www.surveymonkey.com) and after approval of the deans at the Graduate School of Biomedical Sciences, anonymous responses were solicited through multiple emailsto postdoc and faculty email lists in August 2011. Door prizes were offered to postdocs as an incentive to complete the survey.Responses were collected for one month and analyzed using both the automated summary report from Survey Monkey and sort functions in Excel. The publication rate was calculated as:

$$\frac{\text{Number of publications (published or in press)}}{\text{Yrs of postdocs}}$$

Box plots and pie charts were generated in IBM SPSS software (IBM Corporation, Armonk, New York).

Results

Responses

191 postdoc respondents (total >550, ~34%). 117 PI respondents (total not determined due to variability of the PI pool).

Table 1: Postdoc population

The majority of postdocs are in their first postdoc position within their first and second years of postdoc research.

Table 1: Distribution of respondents

Year of Postdoc:	<1	1	2	3	4	5
First Postdoc	42	17	38	13	6	10
Second Postdoc	13	7	7	13	3	8
Other	5	2	1	1	3	1

Overall skill levels

Postdocs and PIs were asked to assess the ability of postdocs to generate hypotheses, design experiments, analyze results, and present their findings both orally and in writing. In general, postdocs felt that their graduate school prepared them adequately for postdoctoral research (Table 2) whereas the PIs responded that they were only somewhat prepared to do their research. PIsindicated that the strongest skill of postdocs was in laboratory techniques (60.9%, 67/110) (Table 3).Both postdocs and PIs agreed that scientific writing was the weakest skill:52.2% (97/186) of postdocs indicated that they were only “somewhat” prepared by grad school to do scientific writing while 48.2% (53/110) PIs responded that postdocs were “not really” prepared. Project management was the next weakest skill listed by both groups.

Table 2: Skill level assessment by postdocs

6. Which aspects of your doctorate prepared you for your postdoc work?				
	More than enough	**Somewhat**	**Not really**	**Response Count**
Formulating a hypothesis	**54.8% (102)**	40.9% (76)	4.3% (8)	186
Designing an experiment	**68.8% (130)**	27.5% (52)	3.7% (7)	189
Techniques learned during doctorate or previous research experiences	**48.7% (92)**	46.0% (87)	6.3% (12)	189
Troubleshooting and optimizing conditions for experiments	**58.5% (110)**	35.6% (67)	6.9% (13)	188
Analyzing and interpreting data	**63.3% (119)**	32.4% (61)	4.3% (8)	188
Scientific writing	35.5% (66)	**52.2% (97)**	12.9% (24)	186
Presentations	**54.8% (103)**	38.3% (72)	7.4% (14)	188
Project Management (Time management, making goals, solving problems)	41.4% (77)	**46.2% (86)**	12.4% (23)	186
			answered question	**189**

Table 3: Skill level assessment by PIs

6. What aspects of work are your postdocs generally prepared for?				
	More than enough	Somewhat	Not really	Response Count
Formulating a hypothesis	18.3% (20)	**63.3% (69)**	18.3% (20)	109
Designing an experiment	40.9% (45)	**52.7% (58)**	6.4% (7)	110
Techniques learned during doctorate or previous research experiences	**60.9% (67)**	37.3% (41)	1.8% (2)	110
Troubleshooting and optimizing conditions for experiments	33.6% (37)	**59.1% (65)**	7.3% (8)	110
Analyzing and interpreting data	34.9% (38)	**60.6% (66)**	4.6% (5)	109
Scientific writing	6.4% (7)	45.5% (50)	**48.2% (53)**	110
Presentations	14.5% (16)	**63.6% (70)**	21.8% (24)	110
Project Management (Time management, making goals, solving problems)	10.9% (12)	**69.1% (76)**	20.0% (22)	110
Keeping good lab records	33.9% (37)	**58.7% (64)**	7.3% (8)	109
			answered question	**110**

Grant writing

A majority of PIs (55%, 61/111) expect postdocs to apply for independent funding. It is unclear whether postdocs know about this expectation. Comments entered by PIs acknowledged thatgrant availabilitymay be a hindrance, particularly for international postdocs. Of the responses received, 28.2% of postdocs (58/188)had been successful in obtaining a position on a training grant, or had been awarded their own fellowship or research grant. This funding success waswithin the range of other top-tier institutions where 10% of UC-Davis, funded by nationally awarded fellowshipsin 2000 (http://postdocs.ucdavis.edu/advocacy/pdsrept.PDF),and 40% of Stanford postdocs werefunded by fellowshipsin 2008 (http://www.stanford.edu/group/supd/survey/index.shtml).

Top 3 determinants for success

Postdocs and PIs agreed that the number of hours spent in the lab, meetings between the postdoc and PI, and collaborations contributedthe most to postdoc success. Career development seminars were a helpful, but less important determinant.

Publication rate

There were no majority responses fromPIs when asked the number and type of publications they expected of their postdocs. Nearly half ofPIs expect postdocs to publish at least one article in a journal and 2-3 co-author papers (Table 4). Comments of PIs indicate that these expectations were hopes, but perhaps not strict expectations.

Table 4: Publication expectations of PIs

	Response Percent	Response Count
1 co-author	10.0%	11
2-3 co-author	44.5%	49
1 first-author in a major journal (impact factor >9)	**48.2%**	**53**
1 first-author in a small journal (impact factor <9)	33.6%	37
1 per year of postdoc	40.0%	44
at least 1 per postdoc	7.3%	8
depends on what they will do in their future career	14.5%	16
none	0.0%	0
	answered question	**110**

Next, the actual effect of several factors on publication rate was assessed. First, a majority of postdocs switched fields upon joining their postdoc lab (53.9%). This switch did not hinder theirpublication rate, but actually increased the numbers of publications slightly for those in their first postdoc (Figure 1).

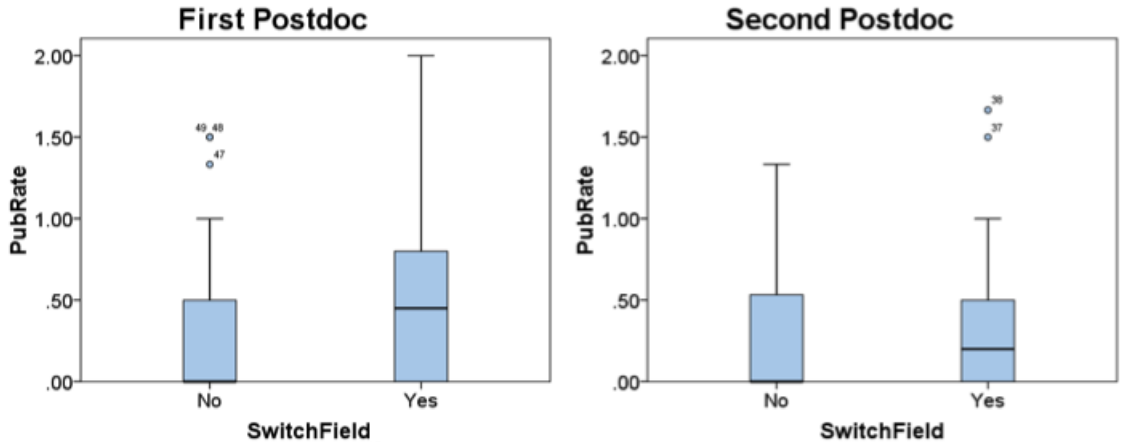

Figure 1. Postdocs were asked whether they had switched fields when they started their current postdoc. Their answers

(Yes of No) were plotted against their respective publication rates. On the left is the box plot for those who are currently doing their first postdoc while the box plot on the right shows those who are on their second postdoc.

The number of hours spent in the lab weekly did not correlate with publication rate (Figure 2). In fact, those spending 40-45hrs/week working in the lab published more on average than those working 55-60 hrs/week, but similar to those working >60 hrs/week. However, the number of postdoc years appeared to have an impact as fifth year postdocs published more than postdocs from other years (Figure 3). This implies that long-term investment into research produced more success.

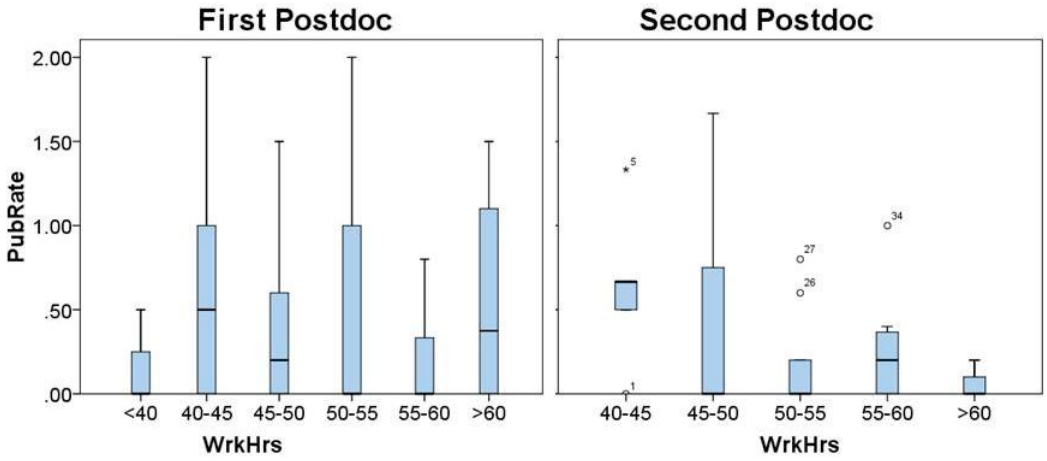

Figure 2. Box plots showing the range of hours worked per week (WrkHrs) plotted againstthe publication rate for those in their first postdoc (left) and second postdoc (right).

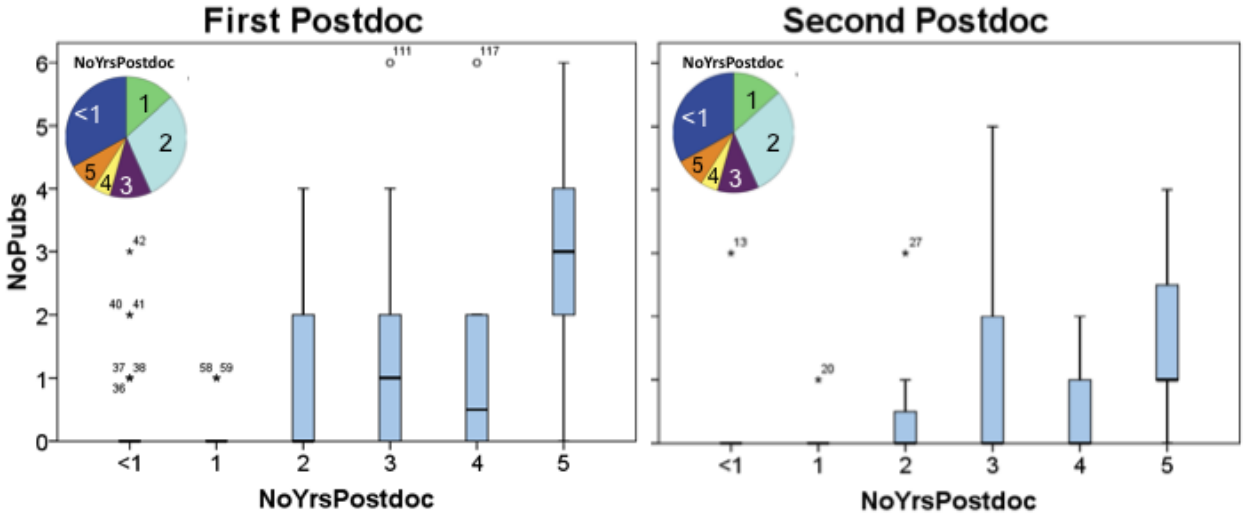

Figure 3. Boxplotsshow the years of postdoctoral training time (NoYrsPostdoc) plotted against the number of publications within that time of training (NoPubs). The pie chart shows the distribution of postdoctoral fellows by year of training.

When evaluating the number of hours spent talking with the PI, 2-3 hours of meeting time per week increased the publication rate slightly (Figure 4). The quality of conversations held with the PI affected the publication rate more for the first postdocs than for those in their second postdoc (Figure 5). The number of publications per individual postdoc was heterogeneous and only two postdocs published in high-impact journals (Impact Factor >9).

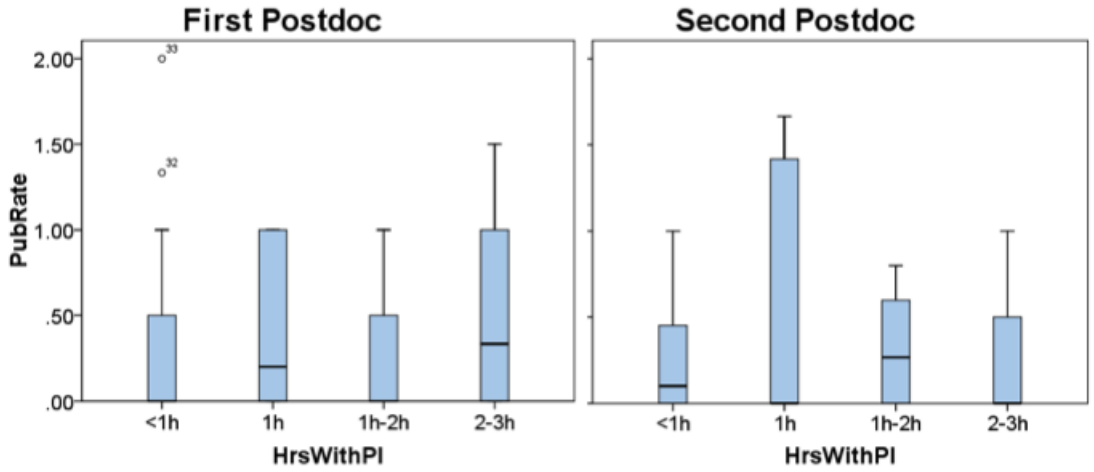

Figure 4. Box plots showing the number of hours spent talking one-on-one with the PI (HrsWithPI) plotted against publication rates (PubRate) for those in their first and second postdocs.

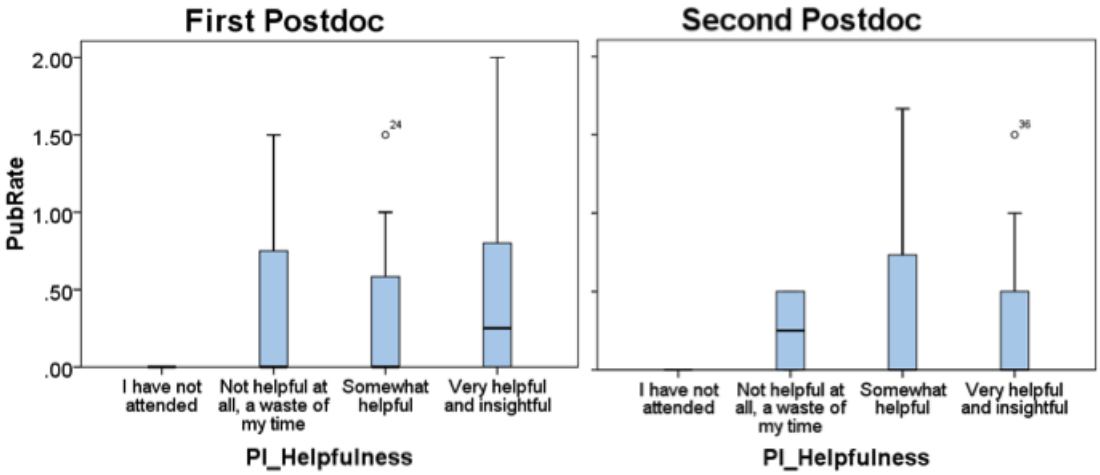

Figure 5. Box plots showing the quality of help from the PI (PI_Helpfulness) plotted against publication rate (PubRate) for both those in their first and second postdocs.

Comments and Future Directions

In this study, we have examined various aspects of postdoctoral work and training to determine their contribution to publication success. Publications clearly involve scientific writing, which was the weakest skill of postdocs as acknowledged by postdocs and PIs alike. Training in scientific writing can start with grant writing, an expectation of a majority of PIs. However, it is unclear how many postdocs pursue such training and what training is

currently available for them. Individual postdoc grant success is similar to available survey results from UC-Davis and Stanford. Thus, there is room for improvement. These survey results have led the postdoctoral association to continue emphasizing the Career Development writing workshops and to initiate grant-writing peer editing groups modeled after the program at the Scripps Institute (http://www.scripps.edu/resources/postdoctoral/career/peerediting.html).

Eventually, postdoctoral work must lead to publications that are often used for future career applications. Alarmingly, this survey concludes that those with a higher publication rate were enrolled in the T32 training program and were younger in age; a fair number of postdocs with 4 or 5 years of postdoc experience (6/191 and 2/191 respectively)have no publications at all. Factors contributing to this situation should be examined. For instance, discussions with department chairs have revealed that large labs often have one "star" postdoc who is much more successful than other postdocsin the same lab. The reason for this is unknown and could explain publication deficiencies. In addition, since only two of the postdocs achieved high-impact journal publications (IF >9), the expectation of publishing one high-impact article during a given postdoc period is perhaps unrealistic. Instead, more effortcould be placed on improving aspects of postdoctoral training such as communication with the PI and scientific writing in order to achieve more publications.

The BCM policy book describes a postdoc as, "a trainee who holds a graduate degree (or equivalent) and who is engaged in a limited period of full-time, advanced, mentored research to develop advanced research skills and independence that will enable them to pursue a career path of their choice." In conversation with various department heads, the meaning of independence was found to include:

- Initiating conversations with PIs
- Initiating collaborations
- Finding expertise when needed
- Not asking PI about where reagents are
- Being able to learn a technique

The extent to which postdocs fulfill these aspects of independent research remains to be examined. A new study shows that the ability of graduate students to think critically in science is enhanced if they have done some teaching (Feldon 2011). In response to this, we are developing more opportunities for postdocs to gain teaching experience. Once those have been established, we can determine whether those experiences affect publication rate. Whether the understanding of independence impactspostdoctoral research quality and outcomes is to be determined.

The role and purpose of postdoc training toward independent research is becoming clearer as we gain a better understanding of the aspects of training that produce more highly skilled scientific workers.Most importantly, our study has demonstrated agreement between postdocs and PIs that a key quality of a good researcher is one who can work as a team with their superiors, collaborators, and colleagues.

References

Feldon DF, Peugh J, Timmerman BE, Maher MA, Hurst M, Strickland D, Gilmore JA, Stiegelmeyer C. **Graduate students' teaching experiences improve their methodological research skills.** *Science* 2011; 333(6045): 1037-9.

Ross RG, Greco-Sanders L, Laudenslager M, Reite M**An Institutional Post-doctoral Research Training Program: Predictors of Publication Rate and Federal Funding Success of Its Graduates***Acad Psychiatry*. 2009; 33(3): 234–240.