

Career Pathways of Foreign-Born Scientists and Engineers Trained and/or Working in the U.S.

What Can Be Learned from Surveying Postdocs and What We Hope to Learn from the NPA Proposed Survey?

Prepared by Alyson Reed, Executive Director, and Jonathan Gitlin, Chair, International Postdoc Committee, National Postdoctoral Association

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A number of survey mechanisms have been used to gather information on postdoctoral scholars conducting research in the U.S. The National Science Foundation (NSF) routinely gathers such information about those who have earned their doctoral degrees in the U.S., broken down by citizenship status. The limitations of the various NSF surveys for answering the research questions articulated by the workshop organizers will be addressed by another panelist at this conference and so are not directly addressed here.

In addition to the NSF survey instruments, a number of other surveys have been conducted by various professional societies, publications, university systems, and research institutions that include information about the postdoctoral career phase. These include annual surveys conducted by AAAS/*Science*, *The Scientist*, the American Chemical Society, the American Institute of Physics, and the University of California. However, none of these surveys produced any statistically valid information comparing postdocs based on their citizenship or residency status.

The National Postdoc Survey conducted by Sigma Xi in 2004 has been the most significant sampling of data from postdoctoral researchers living and working in the United States to date. Although the data are now several years old, it offers us the most complete snapshot so far of the postdoc population and their opinions. Prior to the collection of the survey, there had been the supposition that disparities existed between international postdocs and those who were citizens or permanent residents.

Looking at productivity, the Sigma Xi survey found the following:

Papers: International postdocs publish more

Average peer-reviewed publications as a postdoc

- Citizens/PR 2.6
- Temporary 3.3 (27% more)

However, international postdocs reported that there was less expectation for them to publish their research compared to their peers (74.2% vs 81.7%).

Difference is smaller (.1 papers/year) after controlling for time as a postdoc, field, institution, sex, but statistically significant

Hours: Non-citizens work longer hours

Average weekly hours worked

- Citizens/PR 50
- Temporary 52 (4% more)

Difference is smaller (1.3 hours/week) after controlling for time as a postdoc, field, institution, sex, but still statistically significant. While an extra two hours a week doesn't seem like much, when looked at over a year, and coupled with the lower compensation levels of foreign postdocs, it creates a greater disparity when it comes to valuing the contributions of foreign postdocs. The survey also showed that the extra time spent by foreign postdocs was usually spent conducting experiments; foreign postdocs reported spending 30 hours a week on research as opposed to citizens and permanent residents who by contrast spent 25 hours a week on research.

Grants: Citizens write more grant proposals (results suggest mostly fellowship applications)
Grant proposals written while a postdoc

- Citizens 1.6
- Non-citizens 1.1 (31% fewer)

International postdocs write fewer grant proposals even after controlling for field, institution, sex. This may be attributable to the fact that many postdoctoral research/training grants and fellowships are restricted to US citizens. As a result, a greater proportion of foreign postdocs were found to be funded directly by their advisor as opposed to having their own funding source (56.8% vs 38.7%).

Disparities in pay scales have frequently been claimed for international postdocs, and the Sigma Xi survey did find that on average international postdocs were paid around seven percent less than their peers. It is possible that this disparity may be in part due to the finding above, where more foreign postdocs are paid directly by their PIs. These supervisors may be either unwilling to pay their staff the recommended NIH scale, or may simply be unaware of increases to pay guidelines. Benefits were less likely to be available to international postdocs, such as life insurance, health insurance for families, dental insurance and disability benefits, although there appeared to be a significant proportion of international postdocs who remained unaware as to whether or not they were entitled to such plans. It is possible that these discrepancies may be in part due to cultural differences between the postdocs' home countries and the US. There was a lower level of overall satisfaction with compensation compared to those postdocs not on temporary visas. International postdocs with children on average paid less for daycare than their peers. This could be a reflection of their spouses visas though; those on J-2s will be able to work, but those accompanying H1-B holders are not allowed to seek employment in the US.

On average, international postdocs were more likely to be looking for jobs within the structure of a research university or industry than their peers, and significantly less likely to be seeking employment in liberal arts colleges, or becoming self employed. The lack of interest in self-employment may be directly related to the need for employer-sponsored visas for those who are no longer training as scholars. Around one in four international postdocs reported that they were required to return to their home countries following the end of their position.

Experiences with principal investigators showed few disparities between international postdocs and their peers, although more international postdocs were likely to receive formal performance evaluations.

The survey also found that international postdocs reported being less happy with the quality of training they were receiving for their future careers, and reported making less use, or being unaware, of either formal or informal training, with regards to skills such as public speaking (citizens/PR 81.8%, international 64.3%), teaching (Citizens/PR 44.9%, international 28.1%), writing (Citizens/PR 78.6%, international 63.7%), and other areas. Although international postdocs reported less formal training in all these categories, the greatest difference between this group and US citizens and permanent residents was in respect to *informal* training. Again, it is possible that this difference could be due to cultural differences in acknowledging this type of informal training, given the similarities reported by both groups with respect to their advisors and their work loads. US citizens and permanent residents, who have had much greater exposure to the peculiarities of the US academic culture may well recognize opportunities for such informal training. In contrast, foreign PhDs may simply view the same opportunities as added burdens or additions to their workload without any implicit benefit to their career development. US citizens and permanent residents reported spending twice as much time each week on career development compared to international postdocs (1.5 hours a week compared to 0.7 hours a week).

Among the international postdocs responding to the Sigma Xi survey, cross-variate analysis to determine whether there are any significant discrepancies between researchers who obtained their PhDs within the US as opposed to abroad has not been performed. It is likely that looking at the data in this light may show that foreign PhDs trained in the US have similar outcomes to “native” PhD holders, as they will be more immersed in the academic culture of the US. Being armed with the same expectations as their native peers may allow this subgroup to take better advantage of the opportunities presented to them during their postdoctoral tenure.

Overall, the Sigma Xi survey remains a highly useful database for information on postdocs living and working in the US, but several years have passed since its collection, and the postdoctoral landscape has been shifting in that time. Therefore the collection of current data is important in order for informed change to be accomplished. The NPA is proposing to conduct a second national postdoc survey project to enable comparisons with the previous Sigma Xi data, but also to enable more in-depth analyses of various sub-sets of the international postdoc population in the U.S. This second survey will provide up-to-date information in order for stakeholders to identify areas where change is most needed, and also to determine where improvements have best been made.

By filtering the data in similar ways to the Sigma Xi survey data, it will be possible to look for trends in the postdoctoral experience, and to see whether or not the actions taken by funding bodies and research institutions over the past five years have had any concrete effects on the training experience for postdocs.

Difficulties in obtaining visas has frequently come up as an issue for international postdocs responding to the Sigma Xi survey. High-profile cases such as that of Dr. Goverdhan Mehta, a

renowned Indian scientist who found the process of obtaining a visa to work in the US so degrading he eventually turned down his position at a US university, keep it on the agenda, and recently the NPA published a white paper on visa reform as it pertains to the STEM workforce. The proposed NPA survey should be able to identify what percentage of foreign postdocs living and working in the US have had problems obtaining their visas. However, by its very nature, the survey will not identify those prospective postdocs who encountered visa issues of a great enough magnitude to prevent their entry into the US STEM workforce.

The proposed NPA survey will aim to tease out differences in the postdoctoral experience not simply due to visa status, but with a finer granularity: Although native PhDs can be thought of as relatively similar for these purposes, foreign PhDs are not, with a wide range of home nations, native languages and the like. Do postdocs from developed nations have better training experiences than those from India and China? Are native English speakers significantly more advantaged than those who speak it as a second language? These are questions that will be answered by the NPA survey, along with the ability to filter the data by other variables such as career plans or family arrangements.

Limitations of Current and Proposed Surveys

A major limitation of both the Sigma Xi survey and the proposed NPA survey is that they do not provide any information on long-term career *outcomes* of the postdocs surveyed. As part of the proposed NPA survey project, we plan to take a number of steps to address these limitations: 1) work with NSF to enhance data collection on the career pathways of former postdocs trained in the U.S.; 2) conduct a feasibility study of collecting longitudinal data on respondents to the NPA survey; 3) provide more detailed guidance to research institutions on how they can track the career outcomes of their former postdocs.

Many of the research questions posed by the conference organizers would require a greater degree of uniformity in both postdoctoral training models and definitions across various countries, along with more systematic data collection and reporting on the postdoc population in each country where they reside. Until such time as the U.S. and other countries that host postdoctoral trainees have a more global system for collecting such information, many of the questions posed by this workshop will remain unanswered.