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# The NIH Intramural Research Loan Repayment Program: Career Outcomes of Participants and Nonparticipants

***Final Report***

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# CHAPTER I

# PROGRAM BACKGROUND AND STUDY MOTIVATION

The Intramural Research Program (IRP) at the National Institutes of Health (NIH) is central to the NIH's objective of acquiring new knowledge to prevent, diagnose, and treat disease and disability. Although it makes up only about 10 percent of NIH's budget, the IRP includes more than 2,000 projects conducted mainly in laboratories and clinical research facilities at the NIH's Bethesda, Maryland, campus. The success of the IRP depends on the NIH's ability to attract and retain first-rate biomedical scientists.

Biomedical scientists at the NIH conduct research in most of its 27 relatively autonomous Institutes and Centers (ICs), each consisting of laboratories that are themselves independent. For this reason, ICs and their labs have wide latitude with regard to staffing decisions, so there are few opportunities for implementing recruitment and retention policies across all ICs. One exception, however, is a set of intramural loan repayment programs administered by the Office of Loan Repayment and Scholarship (OLRS) within the Office of the Director of the NIH. OLRS administers a loan repayment program for research on HIV/AIDS, one for clinical research conducted by people from disadvantaged backgrounds, and one for general research targeted to medical doctors and fellows. These loan repayment programs, referred to collectively as the NIH intramural Loan Repayment Program (LRP), increase the value of total compensation for new NIH scientists by reducing their education-related debt. Such an increase in compensation allows the NIH to be more competitive in attracting and retaining high-quality biomedical researchers relative to academia and private industry, where salaries and other forms of compensation (such as stock options and bonuses) typically are higher than in government (Park 2001).

To respond to the need for information on how the LRP works and whether it is achieving its goals, the OLRS contracted with Mathematica Policy Research, Inc. (MPR) to conduct a comprehensive evaluation of the program.[1] The evaluation consists of two parts:

[1] In addition to the intramural LRP, the NIH has an extramural loan repayment program, which repays education loans for researchers who are not in the intramural program. Unless otherwise specified, references

a process analysis and an outcomes analysis. This report presents findings from the outcomes analysis. A separate report (Humphrey and Silva 2005) presents the findings from the process analysis. The rest of this section provides background on the program and the evaluation's research questions and design.

## A. THE INTRAMURAL RESEARCH LOAN REPAYMENT PROGRAM

The LRP consists of the following four individual programs:

1. The AIDS Research LRP (**AIDS LRP**) was created in 1989 to encourage HIV/AIDS research.

2. The Clinical Research LRP for Individuals from Disadvantaged Backgrounds (**Clinical LRP**) was added in 1994 to encourage individuals from economically disadvantaged backgrounds to pursue careers in clinical research.

3. The General Research LRP (**General LRP**), which began in 1996, is for individuals interested in basic science or clinical research, with priority given to more senior researchers.

4. The General Research LRP for Accreditation Council for Graduate Medical Education Fellows (**ACGME LRP**) began as a pilot program in 2001 and is available to fellows in 19 subspecialty and residency training programs for physicians.

All of the programs repay participants' education debts in exchange for a commitment to work at the NIH for a certain length of time. AIDS LRP and Clinical LRP participants commit to two years, while General LRP and ACGME LRP participants commit to three. The AIDS, Clinical, and General LRPs provide up to $35,000 per year in loan repayments; the ACGME LRP, capped at $5,000 per year until recent years, currently provides each participant with up to $20,000 per year. To participate in any of the four programs, individuals must be in full-time equivalent (FTE) positions, must be citizens or permanent residents of the U.S., and must have large educational loans relative to salary. The minimum debt-to-salary ratio for program eligibility is 20 percent.

## B. EVALUATION OF THE INTRAMURAL LRP

Nearly 15 years after the first cohort of AIDS LRP participants received loan repayments, the LRP has not yet been evaluated rigorously to determine whether it is achieving its goals. A challenge to conducting such an evaluation has been that, for the evaluation effort to be worthwhile, enough time needs to have passed for sufficient numbers

(*continued*)
to the LRP in this report are specific to the intramural program. MPR is currently designing a possible future evaluation of the extramural LRP under a separate contract (Dale and Silva 2005).

of participants to have progressed through the program and on to the rest of their careers. The current study is timely because the LRP is now a mature, fully implemented program. Enough information about the program and its participants has been accumulated to allow for a meaningful analysis of retention at the NIH and in research careers. In addition, the NIH has started to implement an LRP for its extramural research program. Information about the effectiveness of the intramural LRP could help to improve the effectiveness of the extramural LRP.

The process analysis focused on program operations, asking whether the LRP operates as intended. The outcomes analysis focused on career outcomes, asking whether the LRP induces more scientifically trained researchers to enter and remain in research careers at NIH or other research institutions. The current interim report presents preliminary findings as well as background information on the outcomes analysis. The process analysis is reported in Humphrey and Silva (2005).

## 1. Research Questions and Outcomes of Interest

The LRP has two main goals. The first goal, which involves recruitment, is to attract a highly qualified and diverse set of physicians and other researchers to the NIH intramural research program. The second goal is to encourage these qualified health professionals to make a commitment to a career in basic and/or clinical research at the NIH, other federal agencies, universities, teaching hospitals, or academic health centers. This broad goal, which goes beyond employment at the NIH, implies that LRP participants who leave NIH for academic careers in clinical research (as opposed to careers as health care executives, for example) also are program success stories. For research purposes, however, we distinguish between retention at NIH (NIH retention) and retention in a career as a researcher (research retention) both during the mandatory two- or three-year contract periods and in subsequent years. The three main questions for the outcomes analysis, therefore, are the following:

1. Does the LRP increase the probability that desirable candidates will accept a position to conduct research in the NIH intramural research program?

2. Does the LRP increase the probability that researchers will remain at the NIH?

3. Does the LRP increase the probability that researchers will remain in research careers?

    - Does it increase the probability that participants will continue to conduct research related to HIV/AIDS?
    - Does it increase the probability that researchers, including those from disadvantaged backgrounds, will continue to conduct clinical research?
    - Does it increase the probability that researchers, including physician-researchers, will continue to conduct research?

### 2. Methodological Challenges and Overall Design Approach

Designing a study to address those research questions in a rigorous way presents challenges. Most notable is the challenge of making causal statements about the LRP and its recruitment and retention outcomes. Ideally, we would like to compare the career outcomes of LRP participants with the career outcomes they would have achieved in the absence of the program. It is impossible, however, to observe what would have happened (the "counterfactual"). Instead, we approximate the counterfactual by observing outcomes for a comparison group of nonparticipants. In this report, we compare participants with a group of nonparticipants who also worked as biomedical researchers in the NIH intramural research program and who were matched to participants based on the years they were hired, their ICs, and their job titles.

We strengthen these comparisons by using special subgroups of nonparticipants. While the overall group of matched nonparticipants may be a good benchmark against which to compare participants, there may be some remaining differences between participants and nonparticipants that could be unknowingly confounded with the effects of the LRP. For this reason, we will examine subgroups of nonparticipants that would be more like participants. For example, some NIH researchers were ineligible for the LRP because they were hired into non-FTE positions through Intramural Research Training Awards (IRTAs) or Cancer Research Training Awards (CRTAs). These individuals might be very similar to their counterparts, who were hired in the same labs and centers in the same general research positions, but because of the nature of the funding stream that supported their positions, one type is eligible for LRP and the other is not. Also, there are researchers whose debt-to-salary ratio is just low enough to make them ineligible for loan repayment. Given that the debt-to-salary cutoff of 20 percent is arbitrary, we might expect that those who are just below this ratio would be very similar to those just above, so that the differences in outcomes could be attributed to LRP participation (or eligibility). These approaches are limited in that there tends to be both a very small number of IRTAs/CRTAs and people with debt just below the qualifying threshold, so the sample size for the these comparisons may be inadequate.

## C. THE OUTCOMES REPORT

The remainder of this report explains how the outcomes analysis was structured and presents its findings. First we cover the data sources and methods (Chapter II), and descriptive data on the study participants' backgrounds, education and training experiences, and experiences with the NIH (Chapter III). Next, we compare participants with nonparticipants in terms of several outcomes related to recruitment and retention, addressing the main research questions of the outcomes analysis (Chapter IV). We conclude with a summary of findings, along with a discussion of their implications and limitations (Chapter V).

# CHAPTER II

# DATA AND METHODS

To address the study hypotheses, we conducted two surveys and used them to measure recruitment and other career outcomes of LRP participants and comparable nonparticipants. The basic methodology was to compare mean outcomes and use regression methods to adjust for differences in background variables such as age, gender, and graduate degree.

## A. DATA SOURCES

Our outcome analysis drew mainly on two data sources. One, the "recruiter survey," was administered to the NIH staff responsible for recruiting new scientists to the IRP. The second, the "retention survey," was administered to the LRP participants and a sample of nonparticipants working in the same Institutes and Centers (ICs); this questionnaire asked respondents about their job histories and career experiences. In addition to these two surveys conducted by MPR, NIH administrative records were used to identify the sampling frame and to analyze nonresponse patterns.

### 1. Recruiter Survey

The most efficient and feasible way to estimate the possible recruitment effects of the LRP was to survey the NIH staff most responsible for hiring new researchers. We identified the universe of NIH training (fellowship) programs for physicians and surveyed the directors of the programs or their delegates.[1] These individuals are just a subset of those who are in a position to use the intramural loan repayment programs as recruiting tools, but they are an important and well-defined group responsible for recruiting candidates for new research positions in the IRP and would therefore be best able to report on the role that the LRP played in successfully attracting scientists.

[1] The universe of training programs for physicians was accessed from the NIH website at http://www.training.nih.gov/onlineapps/trainingprograms/applications/CLITP_Ads.aspx. We used the list as of June 1, 2004.

With a self-administered questionnaire and telephone followup, we obtained complete surveys from 27 of 39 programs (69 percent) and partial responses from 5 additional programs (13 percent). Three other programs were excluded because they were not accepting new trainees or because their trainees were ineligible for loan repayment.

To obtain evidence on whether the LRP might have influenced scientists' decisions to accept positions in the IRP, the survey asked about the numbers of successful applicants to each program, how many accepted or rejected the position when offered, and which of them were eligible for loan repayment. The survey also asked about recruiters' knowledge of the LRP and its role in the recruiting process.

### 2. The Career Survey of Biomedical Scientists (CSBS)

The CSBS (retention survey) encompassed everyone who ever participated in the intramural LRP, as well as a group of matched nonparticipants who were hired in the same ICs with the same job titles in the same years. The survey, which was administered by mail, web, and telephone followup, asked respondents about their education and training, education-related debt, job history, career accomplishments, and personal background.

The overall response rate to the retention survey was 74 percent and was high across a broad range of subgroups. Table II.1 shows the response rates separately by LRP participation status, IC, cohort (year the researcher began at the IRP), and job title. Response rates were lower (69 percent) in the early years, in part because it was more difficult to locate individuals after such a long period of time. Also, researchers with certain job titles had higher response rates (91 percent for staff scientists) than others (70 percent for clinical associates). Only the nurses subgroup had a low response rate, with 9 of the 21 nurses in our sample (43 percent) completing the questionnaire. Nevertheless, the response rate of more than 69 percent for the other 13 categories of staff and for nearly all of the ICs suggests that the survey respondents were a good representation of the target populations.

Table II.2 shows the response rates for subgroups of participants broken down by gender, race/ethnicity, and program (AIDS LRP, Clinical LRP, and General LRP). This background data, which was gathered from OLRS administrative records, provides additional information for assessing whether response rates vary by subgroup. Analyzing the data in this way, we found that response rates also were high among these subgroups, with every subgroup having a response rate of at least 68 percent.

**Table II.1. CSBS Response Rates, by Subgroup**

| Subgroup | Response Rate | N |
|---|---|---|
| Full Sample | 74.1 | 1,022 |
| **LRP Participation Status** | | |
| Participants | 77.9 | 393 |
| Nonparticipants | 71.9 | 629 |
| **Cohort** | | |
| 1989-1991 | 69.3 | 140 |
| 1992-1994 | 75.9 | 162 |
| 1995-1997 | 71.4 | 259 |
| 1998-2000 | 77.3 | 260 |
| 2001-2003 | 75.6 | 201 |
| **Institute or Center** | | |
| National Cancer Institute (NCI) | 74.2 | 346 |
| National Institute for Allergy and Infectious Disease (NIAID) | 71.7 | 173 |
| Warren Magnuson Clinical Center (CC) | 68.1 | 94 |
| National Institute of Neurological Disorders and Stroke (NINDS) | 75.4 | 65 |
| National Heart, Lung, and Blood Institute (NHLBI) | 75.0 | 60 |
| National Institute for Child Health and Human Development (NICHD) | 76.2 | 42 |
| National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) | 69.0 | 42 |
| National Eye Institute (NEI) | 82.9 | 35 |
| National Institute of Mental Health (NIMH) | 83.3 | 36 |
| National Institute of Dental and Craniofacial Research (NIDCR) | 70.0 | 40 |
| All others | 78.0 | 82 |
| **Job Title** | | |
| Clinical fellow | 74.6 | 284 |
| Clinical associate | 69.8 | 252 |
| Senior staff fellow | 79.5 | 132 |
| Staff fellow | 74.2 | 97 |
| Medical officer | 69.7 | 66 |
| Research fellow | 80.9 | 47 |
| Staff scientist | 91.3 | 46 |
| Investigator | 70.0 | 30 |
| Staff clinician | 81.0 | 21 |
| Nurse | 42.9 | 21 |
| Senior investigator | 68.9 | 16 |
| Research associate | 80.0 | 5 |
| Unknown | 100.0 | 5 |

Source: Calculations from the Career Survey of Biomedical Scientists and data from the NIH Office of Loan Repayment and Scholarship.

**Table II.2. CSBS Response Rates, by Gender, Race/Ethnicity, and Program (Participants Only)**

| Subgroup | Response Rate | N |
|---|---|---|
| All Participants | 77.9 | 393 |
| **Gender** | | |
| Female | 80.1 | 146 |
| Male | 76.5 | 247 |
| **Race/Ethnicity** | | |
| White, non-Hispanic | 81.7 | 235 |
| African American, non-Hispanic | 68.4 | 57 |
| Asian or Pacific Islander | 75.0 | 40 |
| Hispanic | 70.8 | 24 |
| Unknown/Multiple/Other | 75.8 | 33 |
| **Program** | | |
| AIDS LRP | 70.7 | 133 |
| Clinical LRP | 78.9 | 71 |
| General LRP | 82.5 | 189 |

Source: Calculations from the Career Survey of Biomedical Scientists and data from the NIH Office of Loan Repayment and Scholarship.

### 3. Administrative Records

In addition to the two surveys described above, we used data from NIH administrative records to identify and contact sample members and to conduct nonresponse analysis, which describes the characteristics of those who did not complete surveys. We used data from the Office of Loan Repayment and Scholarship (OLRS) to identify the universe of program participants. We used data from the NIH Office of the Director's human resources database (HRDB), which included information on the year each person began in the IRP, their job title, and IC, to identify the list of nonparticipants eligible for inclusion in the CSBS sample, match them to participants in the OLRS database, and contact them.

## B. Analysis Methods

### 1. Recruitment Effects

To estimate the effects of LRP on the recruiting outcome, we compared the success rates of accepted fellowship applicants who were presumed eligible for LRP with the success rates for those who were presumed ineligible. In theory, and all other things being equal, a higher success rate among the eligibles compared to ineligibles would indicate that the LRP was the deciding factor. In reality, it is not possible to determine that all else is equal. It may be that those who had the characteristics that made them eligible for the LRP (high debt, or a disadvantaged background, if in clinical medicine) also might have been more or less prone to accept a position if offered. Nevertheless, we report the difference in acceptance rates as the best available indicator of the likely impact of the recruitment effect. We also report applicants' and recruiters' knowledge of the role of the LRP to create an upper limit on the number of people whose decisions to accept offers could have been affected by the

program. For example, if applicants or eventual LRP participants did not hear of the program until after they started working in the IRP, the LRP could not possibly have changed their behavior at the key juncture of deciding to apply for or accept a position.

## 2. Retention Effects

We measured retention effects by calculating the percentages of LRP participants who were still working at the NIH or conducting research as one of their main job responsibilities a set number of years after they started in the IRP, and comparing them to the corresponding percentages of nonparticipants still working at the NIH or in research after the same period. Similarly, we measured effects on retention periods of 3 to 10 years, although only those sample members from earlier cohorts would have 10 years of job history. The first cohort in our sample began in 1989, and so would have up to 15 years of job history. In addition to comparing retention rates in research generally, we compared retention rates in specific types of research, such as that related to HIV/AIDS, as well as retention rates for specific types of researchers, such as those with medical degrees. As with recruitment effects, we must recognize that there may be underlying differences between the LRP and comparison group members that could be confounded with program effects.

To improve upon the estimates of retention effects that rely on simple comparisons between participants and nonparticipants, we used regression methods to control for background characteristics such as age, race/ethnicity, type of undergraduate major, and birthplace. We also conducted sensitivity analyses, using subsets of the nonparticipants that may be more comparable to participants than the full set of nonparticipants selected for the study. For example, we compare participants to the subset of nonparticipants who were not full time equivalent NIH employees, such as those conducting research on an Individual Research Training Award (IRTA). IRTA-funded researchers with educational debt are likely to be similar to LRP participants except for the fact that the nature of their position's funding precludes them from participating in the LRP.

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# CHAPTER III

# BACKGROUND AND EXPERIENCES OF LRP PARTICIPANTS AND NONPARTICIPANTS

The Career Survey of Biomedical Scientists (CSBS) provides a unique opportunity to learn about participants in the NIH intramural LRP and to compare them with a group of nonparticipants who were hired under similar circumstances. This chapter provides some descriptive statistics to summarize the backgrounds of the participant and comparison groups in terms of their demographics, education, and experiences with the NIH. We also discuss the characteristics of their jobs when the began in the IRP, the jobs they turned down to come to the NIH, and the jobs they expect to hold in the future.

## A. DEMOGRAPHIC CHARACTERISTICS

Participants and nonparticipants differed in a variety of background characteristics, although the differences usually were not large (Table III.1). The LRP participants were two years younger on average than nonparticipants when they began in the IRP and were more likely to be female (38 versus 32 percent), although the greater representation of women among LRP participants came almost entirely from the Clinical program. Similar proportions of researchers in both the participant and nonparticipant groups were white (69 and 66 percent, respectively), but the LRP participants were more likely to be from under-represented minority groups (African American or Hispanic) and less likely to be Asian or foreign-born than nonparticipants. None of our sample members from either group were Native American or Alaska Native.

## B. EDUCATIONAL BACKGROUND AND DEBT PROFILE

Participants and nonparticipants had similar educational backgrounds, but they differed dramatically in the amounts of educational debt they recalled having at the time they joined the IRP. Table III.2 shows the degrees received and subjects studied, along with the estimated level of debt held at that time. The discrepancy in types of undergraduate degrees earned comes primarily from the disproportionate numbers of nonparticipants whose undergraduate training was done overseas, where the pathways to medical school are different. Otherwise, members of both groups mainly earned a bachelor of science degree as

undergraduates, with biology being the most common major subject. Biology, medicine, chemistry, and biochemistry accounted for more than three-quarters of both participants' and nonparticipants' undergraduate majors. Members of both groups also earned a bachelor of arts degree and majored in other subjects. In terms of graduate education, the LRP groups differed, with the Clinical LRP having more physicians (83 percent), compared with the percentages of physicians in the AIDS LRP (66 percent), General LRP (60 percent). With 59 percent physicians, nonparticipants look more like General LRP participants than Clinical LRP participants. As might be expected, medicine was the most typical field of graduate study for NIH scientists, regardless of LRP participation status.

**Table III.1. Background Characteristics of LRP Participants and Nonparticipants (Percentages)**

| | Program | | | | |
|---|---|---|---|---|---|
| Characteristic | AIDS Research | Clinical Research | General Research | All Participants | Non-participants |
| **Gender** | | | | | |
| Male | 64.0 | 49.0 | 65.3 | 62.2 | 67.9 n.s. |
| Female | 36.0 | 51.0 | 34.7 | 37.9 | 32.1 |
| **Age** | | | | | |
| 25 and under | 0.0 | 2.0 | 1.3 | 1.0 | 0.5*** |
| 26 to 29 | 23.6 | 14.0 | 12.6 | 16.2 | 9.9 |
| 30 to 34 | 46.1 | 46.0 | 60.3 | 53.5 | 40.4 |
| 35 to 39 | 21.4 | 24.0 | 20.5 | 21.4 | 25.8 |
| 40 and over | 9.0 | 14.0 | 5.3 | 7.9 | 23.5 |
| **Race/Ethnicity** | | | | | |
| White, non-Hispanic | 79.8 | 36.2 | 72.6 | 68.8 | 65.7*** |
| Black, non-Hispanic | 9.0 | 31.9 | 7.5 | 12.1 | 5.0 |
| Hispanic | 6.7 | 17.0 | 4.1 | 7.1 | 3.6 |
| Asian or Pacific Islander | 4.5 | 12.8 | 13.7 | 10.6 | 24.6 |
| Native American, Alaska Native | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Other | 0.0 | 2.1 | 2.1 | 1.4 | 1.2 |
| **Region of Origin** | | | | | |
| Northeast | 40.5 | 14.3 | 32.6 | 31.8 | 27.0*** |
| Mid-Atlantic | 6.0 | 10.2 | 6.9 | 7.2 | 7.7 |
| Southeast | 4.8 | 12.2 | 4.2 | 5.8 | 2.4 |
| Southwest | 4.8 | 10.2 | 8.3 | 7.6 | 4.1 |
| Midwest | 22.6 | 16.3 | 22.2 | 21.3 | 12.3 |
| West | 9.5 | 4.1 | 9.0 | 8.3 | 6.3 |
| Alaska, Hawaii, and U.S. Territories | 2.4 | 4.1 | 0.7 | 1.8 | 0.7 |
| Non-U.S. | 9.5 | 28.6 | 16.0 | 16.3 | 39.5 |

Source: Data from the Career Survey of Biomedical Scientists.

Note: Statistical significance is based on chi-square test. The result is shown in the first row for each categorical variable.

*Participant-nonparticipant difference statistically significant at the .10 level, two-tailed test.
**Participant-nonparticipant difference statistically significant at the .05 level, two-tailed test.
*** Participant-nonparticipant difference statistically significant at the .01 level, two-tailed test.

n.s. = Participant-nonparticipant difference is not significant at the .10 level, two-tailed test.

**Table III.2. Educational Background and Debt Profile of LRP Participants and Nonparticipants (Percentages)**

| Characteristic | Program | | | | |
|---|---|---|---|---|---|
| | AIDS Research | Clinical Research | General Research | All Participants | Non-participants |
| **Undergraduate Degree** | | | | | |
| Bachelor of arts | 38.3 | 36.4 | 40.9 | 39.3 | 30.6*** |
| Bachelor of science | 56.4 | 56.4 | 51.3 | 53.8 | 52.5 |
| Combined | 3.2 | 1.8 | 4.6 | 3.6 | 1.8 |
| Other | 2.1 | 5.5 | 3.3 | 3.3 | 15.1 |
| **Undergraduate Major** | | | | | |
| Biology, biochemistry, or medicine | 53.2 | 57.4 | 53.3 | 54.0 | 59.4 n.s. |
| Chemistry | 23.4 | 14.8 | 22.1 | 21.2 | 18.8 |
| Other natural sciences, mathematics, computers, and business | 8.5 | 1.9 | 7.1 | 6.6 | 6.7 |
| Social sciences | 3.2 | 9.3 | 8.4 | 7.0 | 4.6 |
| Humanities | 6.4 | 13.0 | 5.8 | 7.3 | 6.0 |
| Other | 5.3 | 3.7 | 3.3 | 4.0 | 4.6 |
| **Graduate Degrees** | | | | | |
| PhD or equivalent | 24.7 | 5.7 | 28.6 | 23.3 | 31.3 n.s. |
| MD or equivalent | 61.3 | 75.5 | 52.6 | 59.3 | 53.0 |
| Both PhD and MD | 4.3 | 7.6 | 7.1 | 6.3 | 6.1 |
| Other | 9.7 | 11.3 | 11.7 | 11.0 | 9.6 |
| **Graduate Department or School** | | | | | |
| Medicine | 61.3 | 71.2 | 62.1 | 63.4 | 61.5 n.s. |
| Public health | 7.5 | 0.0 | 3.9 | 4.4 | 1.9 |
| Biology | 7.5 | 3.9 | 5.2 | 5.7 | 9.0 |
| Chemistry or biochemistry | 3.2 | 1.9 | 8.5 | 5.7 | 8.0 |
| Other | 20.4 | 23.1 | 20.3 | 20.8 | 19.6 |
| **Level of Educational Debt at Start of IRP Term** | | | | | |
| None[a] | 2.3 | 1.9 | 0.7 | 1.4 | 57.9*** |
| $1 to $24,999 | 11.4 | 7.4 | 13.6 | 11.8 | 16.1 |
| $25,000 to $49,999 | 25.0 | 7.4 | 21.4 | 19.9 | 10.6 |
| $50,000 to $64,999 | 14.8 | 16.7 | 16.9 | 16.2 | 4.3 |
| $65,000 to $99,999 | 28.4 | 24.1 | 13.6 | 19.9 | 5.0 |
| $100,000 to $149,999 | 9.1 | 20.4 | 23.4 | 18.6 | 2.9 |
| $150,000 or higher | 9.1 | 22.2 | 10.4 | 12.2 | 3.2 |

Source: Data from the Career Survey of Biomedical Scientists.

Note: Statistical significance is based on chi-square test. The result is shown in the first row for each categorical variable.

n.s. = Participant-nonparticipant difference is not significant at the .10 level, two-tailed test.

*Participant-nonparticipant difference statistically significant at the .10 level, two-tailed test.
**Participant-nonparticipant difference statistically significant at the .05 level, two-tailed test.
*** Participant-nonparticipant difference statistically significant at the .01 level, two-tailed test.

[a] LRP participants can have zero debt at the start of their first IRP term if they returned to graduate school and applied for loan repayment after having already worked at the NIH.

Where the participant and nonparticipant groups diverged was in their levels of educational debt when they started their research careers at the NIH. This was to be expected, because debt level is an eligibility criterion for the program. More than half of nonparticipants had no debt. Of the remaining 42 percent who did have debt, most had low levels of debt, but a substantial fraction had $50,000 or more in outstanding loans. Surprisingly, some participants reported that they had no debt when they began the intramural research program. These individuals had been in the intramural program before they completed their graduate school training, so they accumulated their educational debt—and therefore became eligible for LRP—only *after* having worked at the NIH.

## C. NIH EXPERIENCES

We can be more confident in attributing participant-nonparticipant differences in career outcomes to the LRP if we can determine that the groups started out on equal footing. Table III.3 shows that participants and nonparticipants were close in many respects, although there were some differences that were statistically significant, meaning the differences were not likely due to chance. While the differences may be real, they were not large in practical terms. Nevertheless, the existence of such differences suggests that it is important to consider using these variables as covariates to make statistical adjustments, so the participants and nonparticipants are more comparable. These adjustments are presented in the next chapter.

The years in which they began in the IRP, the ICs, and the job titles were similar for the participants and nonparticipants (Table III.3). This was true by design because we selected nonparticipants to include in the survey based on these characteristics, which came from administrative records, and how well they matched with existing participants. Some statistically significant differences in the cohort year remain because early cohort nonparticipants had a slightly higher response rate than early cohort participants.

Table III.3 shows that the types of research and the salaries of participants and nonparticipants also were similar. While statistically significant, the differences themselves were not large in practical terms. The percentage of participants who described their research as being related to HIV/AIDS was a mix of AIDS LRP participants who were most often in this field (86 percent) and the other participants whose rates of conducting AIDS-related research were lower. The nonparticipants had both researchers in AIDS field as well as other fields, but the percentage in AIDS was slightly lower overall, 25 percent compared to 38 percent overall for the LRP participants.

We also asked which sample members' first NIH jobs involved clinical research and learned that this type of work was very common. As one would expect, Clinical LRP participants had the highest rate (82 percent) of those describing their early work as clinical research, but 64 percent of AIDS LRP participants and 69 percent of General LRP participants also described themselves as having done clinical work. Fewer nonparticipants (about 65 percent) put their first NIH job in this category.

**Table III.3. NIH Experiences of LRP Participants and Nonparticipants (Percentages)**

| Characteristic | Program | | | | |
|---|---|---|---|---|---|
| | AIDS Research | Clinical Research | General Research | All Participants | Non-participants |
| Year entered IRP | | | | | |
| 1989 to 1992 | 44.7 | 7.1 | 9.0 | 19.6 | 19.0*** |
| 1993 to 1996 | 21.3 | 35.7 | 9.6 | 18.0 | 31.6 |
| 1997 to 2000 | 26.6 | 37.5 | 39.1 | 35.0 | 34.3 |
| 2001 to 2003 | 7.5 | 19.6 | 42.3 | 27.5 | 15.0 |
| Average year entered | 1994 | 1998 | 1999 | 1997 | 1996*** |
| Institute or Center | | | | | |
| NIAID | 30.9 | 7.1 | 6.4 | 14.1 | 18.2 n.s. |
| NCI | 33.0 | 25.0 | 41.7 | 36.0 | 33.0 |
| CC | 9.6 | 10.7 | 6.4 | 8.2 | 8.8 |
| All other ICs | 26.6 | 57.1 | 45.5 | 41.8 | 40.0 |
| Type of Research[a] | | | | | |
| HIV/AIDS-related | 85.9 | 10.7 | 17.0 | 37.6 | 24.7*** |
| Clinical | 63.9 | 82.1 | 69.2 | 69.8 | 65.4 n.s. |
| Job Title | | | | | |
| Clinical fellow | 3.2 | 44.6 | 45.5 | 32.4 | 25.0*** |
| Clinical associate | 39.4 | 33.9 | 7.1 | 21.9 | 24.1 |
| Senior staff fellow | 10.6 | 12.5 | 7.1 | 9.2 | 17.0 |
| Staff fellow | 17.0 | 3.6 | 4.5 | 8.2 | 10.4 |
| Medical officer | 8.5 | 0.0 | 1.3 | 3.3 | 8.0 |
| Other | 21.3 | 5.4 | 34.6 | 25.2 | 15.5 |
| Annual Salary | | | | | |
| Less than $25,000 | 1.3 | 0.0 | 3.0 | 1.9 | 2.5*** |
| $25,000 to $49,999 | 73.1 | 42.2 | 65.9 | 64.0 | 58.9 |
| $50,000 to $64,999 | 18.0 | 44.4 | 20.7 | 24.0 | 17.0 |
| $65,000 to $99,999 | 7.7 | 8.9 | 5.2 | 6.6 | 13.7 |
| $100,000 or more | 0.0 | 4.4 | 5.2 | 3.5 | 7.8 |
| Received NIH scholarship or loan before entry into IRP | 22.2 | 12.0 | 22.4 | 20.6 | 15.7* |
| Had friend, colleague, or relative who worked at NIH | 61.8 | 45.1 | 53.6 | 54.6 | 57.7 |
| Had competing job offer when accepted position in IRP | 68.9 | 56.9 | 69.1 | 66.9 | 59.6** |

Source: Data from the Career Survey of Biomedical Scientists.

Note: Statistical significance is based on chi-square test. The result is shown in the first row for each categorical variable.

[a]Categories are not mutually exclusive. Hypothesis tests are t-tests, conducted separately for each response.

n.s. = Participant-nonparticipant difference is not significant at the .10 level, two-tailed test.

*Participant-nonparticipant difference statistically significant at the .10 level, two-tailed test.
**Participant-nonparticipant difference statistically significant at the .05 level, two-tailed test.
*** Participant-nonparticipant difference statistically significant at the .01 level, two-tailed test.

A majority in both groups reported annual salaries in the range of $25,000 to $50,000 for their first NIH research position, although on average the participants were slightly more likely to receive the highest levels of pay.[1] This is probably related to the higher percentage of participants than nonparticipants who were trained as physicians. Those with medical degrees are often paid more than PhD researchers because physician-researchers must be lured away from higher paying jobs in private practice.

## D. ALTERNATIVE JOB OPTIONS

Loan repayment is designed in part to help the NIH, as a government employer, to compete for talented scientists with other providers of research opportunities and employment. Most members of our study sample had other options available to them when they joined the IRP. Two-thirds of participants and 60 percent of nonparticipants reported having a competing job offer at the time they accepted a research position at the NIH. Examining these alternatives helps us to understand the competitive environment within which the NIH loan repayment program operated.

As shown in Table III.4, the vast majority of those alternative job offers (87 percent for participants and 82 percent for nonparticipants) were from academic institutions, with just a handful from government (6 and 5 percent), private industry (6 and 11 percent), and other institutions (1 and 2 percent).[2] It is not surprising that the alternative to taking an NIH research position was taking an academic position, since the large majority of participants were considering fellowship positions only, either as postdoctoral or medical subspecialty fellows. In most cases, both participants and nonparticipants turned down positions that paid a similar or lower salary than their NIH positions. Clinical LRP participants were the most likely to turn down jobs with higher salaries, and AIDS LRP participants were the least likely. Among the competing jobs, starting bonuses were not uncommon; these were available to almost a quarter of those who had a competing offer. Health and retirement benefits, while much more common, were not universal. Only about half of the competing offers came with a retirement plan and, for participants, 87 percent of their alternative job possibilities offered a health plan, compared to 85 percent of job offers for nonparticipants. The NIH offer of loan repayment was an unusual option among job offers; fewer than 3 percent of participants had that option in the competing job offers and about 1 percent of nonparticipants reported loan repayment as a feature of non-NIH alternatives.

[1] Salaries could not easily be adjusted for inflation because they were reported in ranges. Also, the base year differed for each respondent depending on the year they began in the IRP. Comparisons of salaries for respondents who began in the same year show that the participants and nonparticipants were similar. Also, the level of alternative salaries in nominal terms rose very slightly over time, as one would expect.

[2] While we asked respondents to say whether they had *any* competing offers, which could include multiple offers, we specified that they describe the characteristics only of the most attractive alternative offer.

**Table III.4. Characteristics of Alternative Job Offers Turned Down by Participants and Nonparticipants (Percentages)**

| Characteristic of Competing Offer | Program | | | | |
|---|---|---|---|---|---|
| | AIDS Research | Clinical Research | General Research | All Participants | Non-participants |
| **Institution Type** | | | | | |
| Academic | 90.3 | 76.7 | 87.6 | 86.8 | 82.0 |
| Government | 3.2 | 3.3 | 8.6 | 6.1 | 4.7 |
| Private non-academic | 3.2 | 20.0 | 3.8 | 6.1 | 11.0 |
| Other | 3.2 | 0.0 | 0.0 | 1.0 | 2.4 |
| **Type of Position** | | | | | |
| Medical residency | 3.2 | 0.0 | 7.7 | 5.1 | 3.2 |
| Sub-specialty fellowship | 41.9 | 43.3 | 37.5 | 39.8 | 36.5 |
| Post-doctoral fellowship | 33.9 | 13.3 | 26.0 | 26.5 | 25.8 |
| Attending or staff physician | 9.7 | 33.3 | 12.5 | 14.8 | 15.9 |
| Other | 11.3 | 10.0 | 16.4 | 13.8 | 18.7 |
| **Annual Salary Category** | | | | | |
| Higher than NIH salary | 19.6 | 36.0 | 10.9 | 17.3 | 19.7 |
| Same as NIH salary | 68.6 | 20.0 | 64.1 | 58.9 | 60.6 |
| Lower than NIH salary | 11.8 | 44.0 | 25.0 | 23.8 | 19.7 |
| **Benefits Offered**[a] | | | | | |
| Starting or moving bonus | 12.5 | 17.4 | 31.5 | 23.4 | 23.4 |
| Annual bonus | 3.6 | 4.4 | 12.0 | 8.2 | 5.7 |
| Stock options | 0.0 | 0.0 | 2.2 | 1.2 | 0.0 |
| Housing | 1.8 | 4.4 | 9.8 | 6.4 | 4.3 |
| Retirement | 28.6 | 56.5 | 54.4 | 46.2 | 47.4 |
| Health plan | 78.6 | 91.3 | 90.2 | 86.6 | 84.7 |
| Loan repayment | 1.8 | 4.4 | 2.2 | 2.3 | 1.4 |
| Other | 3.6 | 8.7 | 4.4 | 4.7 | 3.8 |

Source: Data from the Career Survey of Biomedical Scientists.

Note: Data pertain to sample members who reported having another job offer when they accepted a position in the IRP. None of the participant-nonparticipant differences are statistically significant at the .10 level.

[a]Categories are not mutually exclusive. Hypothesis tests are t-tests, conducted separately for each response.

## E. CAREER EXPECTATIONS

Our evaluation strategy relied on surveying respondents who had been in the labor force for several years to learn whether they stayed at the NIH and in research. We also asked respondents directly about their future career plans. While self-reported career expectations have not been proven to be good predictors of actual career outcomes, they do provide a simple tool for examining attitudes related to long-term retention. Table III.5 summarizes these attitudes for LRP participants and nonparticipants.

**Table III.5. Career Plans of LRP Participants and Nonparticipants (Percentages)**

| Characteristic | Program | | | | |
|---|---|---|---|---|---|
| | AIDS Research | Clinical Research | General Research | All Participants | Non-participants |
| **Work at NIH for Most of Career** | | | | | |
| Very likely | 11.8 | 18.2 | 17.2 | 15.6 | 20.5 |
| Somewhat likely | 24.7 | 27.3 | 25.4 | 25.5 | 25.9 |
| Not likely | 63.5 | 54.6 | 57.5 | 58.9 | 53.6 |
| **Conduct Research As Main Job Responsibility** | | | | | |
| Very likely | 60.0 | 55.1 | 59.5 | 58.9 | 52.3 |
| Somewhat likely | 21.1 | 24.5 | 25.0 | 23.7 | 24.5 |
| Not likely | 18.9 | 20.4 | 15.5 | 17.4 | 23.3 |
| **Remain in Research Field of Specialty** | | | | | |
| Very likely | 67.8 | 76.1 | 71.8 | 71.2 | 74.8 |
| Somewhat likely | 21.1 | 15.2 | 20.1 | 19.7 | 14.8 |
| Not likely | 11.1 | 8.7 | 8.1 | 9.1 | 10.5 |
| **Work in Private Industry** | | | | | |
| Very likely | 20.2 | 9.5 | 8.0 | 12.3 | 14.3 |
| Somewhat likely | 29.2 | 23.8 | 25.6 | 26.5 | 28.1 |
| Not likely | 50.6 | 66.7 | 66.4 | 61.2 | 57.7 |
| **Work in an Academic Institution** | | | | | |
| Very likely | 33.3 | 59.6 | 50.7 | 46.7 | 44.4 |
| Somewhat likely | 46.0 | 21.3 | 35.2 | 36.2 | 36.8 |
| Not likely | 20.7 | 19.2 | 14.1 | 17.0 | 18.9 |
| **Practice Clinical Medicine** | | | | | |
| Very likely | 27.3 | 40.8 | 28.9 | 30.4 | 33.8 |
| Somewhat likely | 20.5 | 20.4 | 22.2 | 21.3 | 18.3 |
| Not likely | 52.3 | 38.8 | 49.0 | 48.3 | 47.9 |

Source: Data from the Career Survey of Biomedical Scientists.

Note: Statistical significance is based on chi-square test. None of the participant-nonparticipant differences are statistically significant at the 0.10 level.

We found that researchers expect to be relatively mobile, but to stay in the field for which they are trained. More than half of both LRP participant and nonparticipant groups said it was very unlikely that they would work at the NIH for most of their careers. Indeed, many of the sample members had already left the NIH by the time of the survey, a phenomenon we discuss more in the next chapter. In fact, slightly *more* participants than nonparticipants, 59 versus 54 percent, said they were "not likely" to stay at the NIH. However, most sample members said they would continue to conduct research as their main job responsibility, and the rate was higher for participants than nonparticipants, with 59 percent of participants and only 52 percent of nonparticipants saying it was "very likely."

Another interesting finding was that, with only about half saying they would stay in research (another 24 percent saying it was "somewhat likely" they would stay), a higher percentage (71 percent of participants and 75 percent of nonparticipants) said they would

"very likely" stay in their field of specialty. The other settings in which respondents saw themselves working in the future were academia (most often reported "likely," with more than 80 percent of all groups saying "somewhat" or "very likely"); clinical medicine (most common for clinical LRP participants); and private industry ("very likely" for 19 percent of AIDS LRP participants, less so for other participant subgroups, and 14 percent for nonparticipants).[3]

Taken as a whole, these career expectations suggest that job transitions are likely for all researchers, although more likely for some subgroups than others, but with fewer transitions out of the field overall. We may observe shifts in the responsibilities that sample members have on their jobs, with some spending more time in the clinic or lab doing research, while others do more to manage the research, supervise the work of others, teach, or do other tasks. The next chapter reports on survey respondents' retrospective job histories to address these issues in more detail.

[3] The career plans reported in Table III.5 come from those who have just begun their research careers as well as those who had begun their careers as many as 15 years earlier. As would be expected, we found that most respondents who said they had expected to remain at the NIH and conduct research and their main job responsibility had done so as of the time of the questionnaire.

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# CHAPTER IV

# CAREER OUTCOMES

Our survey data on the career choices and outcomes of biomedical scientists suggest that the LRP appears to be meeting many of its objectives. We found positive impacts on recruitment and several measures of retention. Estimated impacts on other outcomes such as publications and tenure were not statistically significant.

This section describes how we used the survey data to measure recruitment, retention, and other outcomes, and how we generated estimates of the program's impact. Impact estimates are presented for each outcome, with detailed subgroup findings shown in an appendix.

## A. RECRUITMENT

For recent MDs who might be eligible for loan repayment, we asked the directors of 30 NIH Fellowship programs about their experiences with new applicants to their programs and the role that availability of loan repayment played in attracting top candidates.

When we asked fellowship program directors about their awareness of the programs we found that they varied, although most had some knowledge of the offerings. At the extremes, only one program director (3 percent) was "not at all familiar" with any of the LRPs and five (17 percent) were "very familiar" with all of them. For each LRP, a majority of the fellowship program directors were "somewhat familiar" or "very familiar" with the loan repayment program (Table IV.1).

We then asked recruiters to tell us whether they used the LRP as a recruiting tool and found that most did. Seventy percent actively used the program to attract physicians into their programs. Another 7 percent passively promoted the LRP, referring interested applicants to other NIH staff or to the LRP website while some fellowship programs (23 percent) did not even mention the LRP (Table IV.2). Some of this variation may be related to the likelihood of the program's applicants being eligible for loan repayment.

**Table IV.1. Familiarity of NIH Fellowship Program Directors with NIH Intramural Loan Repayment Programs**

| Program | Not at All Familiar | Somewhat Familiar | Very Familiar |
|---|---|---|---|
| General LRP | 23.3 | 36.7 | 40.0 |
| General LRP (ACGME) | 30.0 | 23.3 | 46.7 |
| Clinical LRP | 26.7 | 50.0 | 23.3 |
| AIDS LRP | 16.7 | 36.7 | 46.7 |
| Any of the above | 3.3 | — | — |
| All of the above | — | — | 16.7 |

Source: Data from MPR Survey of NIH Recruitment.

Note: N = 30 program directors who responded to this question.

**Table IV.2. Use of LRP As a Recruiting Tool**

| Response | Programs | Percentage |
|---|---|---|
| Do not mention them in recruiting | 7 | 23.3 |
| If asked about them, refer questions to other staff in IC or to OD or to website | 2 | 6.7 |
| Mention them routinely as a part of recruitment | 12 | 40.0 |
| Advertise them (e.g. via website link or printed information) | 9 | 30.0 |
| Total | 30 | 100.0 |

Source: Data from MPR Survey of NIH Recruitment.

In order to estimate the impact of the LRP on recruitment success, we asked the fellowship program directors to tell us how many of the fellowship applicants they had offered a position (by making an offer or ranking the applicant in a match program) had accepted their offers. We compared acceptance (success) rates for fellows who were presumed eligible for loan repayment with those who were not.

We found that among all 27 programs whose fellows could be classified (141 fellows), the acceptance rate for those who were presumed eligible for the LRP was nearly 18 points higher, or 84 versus 67 percent success (Table IV.3)

**Table IV.3. Acceptance Rates, by LRP Eligibility Status (Percentage of Admitted Fellows Who Accepted a Position)**

| | Percentage Who Accepted | | | | |
|---|---|---|---|---|---|
| | Presumed Eligible | Presumed Ineligible | Difference | Number of Fellows | Number of Programs |
| All programs | 84.4 | 66.9 | 17.5 | 141 | 27 |
| Programs with both eligible and ineligible candidates | 73.3 | 54.1 | 19.2 | 35 | 6 |

Source: Data from MPR Survey of NIH Recruitment.

Some of this difference in success rates merely reflects differences between programs, as some programs with all LRP-eligible fellows had a higher acceptance rate than those with no LRP-eligible fellows. To determine whether this overall result would still hold if we eliminated the between-program confounding, we examined the subset of six programs (comprising 35 fellows) that had both eligible and ineligible candidates. Similar to the finding of an 18-point difference for eligibles and ineligibles in all 27 programs, we found a difference of 19 points in this subset between those presumed eligible and those presumed ineligible for loan repayment. In both cases, the data are consistent with the hypothesis that the availability of the LRP as a recruiting tool makes it more likely that promising researchers will accept a position in the intramural program.

There are several limitations to bear in mind. These findings are restricted to fellowship programs for physicians and rely on program directors' possibly imprecise judgments and recollections about whether candidates would have been eligible for loan repayment. Nevertheless, physicians are an important target group for the LRP. Among entrants into the IRP, new fellowship applicants with degrees in medicine are most likely to have both high levels of educational debt and career alternatives that make them difficult to attract. While the issues of recall and accuracy of survey respondents was a concern, we administered the survey to program directors who generally were responsible for recruiting a small number of fellows and who in many cases had recently completed a recruiting cycle at the time of the survey.

To provide an additional piece of evidence on the ability of the LRP to boost recruitment of scientists, we used the retention survey to determine when applicants reported first hearing of the program. If applicants only first hear of the program *after* they have accepted a position, then it could not have provided any recruitment incentive. For those who had heard of the program, it is unknown how influential it may have been in their decision to come to the NIH, since award decisions can only be made after a researcher has accepted their position.

The evidence on applicants' knowledge of the LRP suggests that it could have had a recruitment effect, but it may have been diluted. Over half of the eventual LRP participants

had not known about the loan repayment programs when they began working in the intramural research program (Table IV.4).[1] However, most of the remainder thought that they would be funded, suggesting that the uncertainty of the funding decision was not a major impediment to the use of LRP as a recruiting tool. More recent cohorts were more likely to have been aware of the program before they made a decision to accept a position.

**Table IV.4. Perceived Likelihood of Receiving Loan Repayment**

| Estimated likelihood | Participants | Nonparticipants |
|---|---|---|
| Very likely | 28.7 | 3.2 |
| Somewhat likely | 9.7 | 1.6 |
| 50/50 | 6.7 | 0.5 |
| Somewhat unlikely | 1.7 | 0.5 |
| Very unlikely | 0.7 | 8.1 |
| Did not know about LRP at the time | 52.7 | 86.3 |

Source: Data from the Career Survey of Biomedical Scientists.

Among nonparticipants, far more were not aware of the program, although it is difficult to know how many of those would have been good candidates for LRP funding. Over half (58 percent) of them had no debt at the time they started in the IRP and many others might have been ineligible for other reasons. The timing of when nonparticipants learned about the program, however, was not closely related to whether they had educational debt at the time they began in the IRP.

## B. RETENTION

There are several types of retention outcomes that are of interest to policymakers. These outcomes include retention at the NIH, in specific types of research (HIV/AIDS-related or clinical research), and in research more generally. For each type of retention outcome, we used self-reported job histories to construct yearly indicators for whether each sample member was still working in the designated area. The retention outcomes at any given time point were defined only for those who could potentially have reached that length of retention. For example, six-year retention in AIDS research was defined only for those who (1) had a job doing AIDS research at "baseline," and (2) had a baseline date that was at least six years before they completed the questionnaire. Baseline refers to the year in which

[1] The percentages include some people who began in the IRP before the loan repayment programs were implemented, so they are somewhat lower than for more recent cohorts of IRP researchers, but the percentages are similar to those reported in Table IV.4

the sample member joined the intramural research program at the NIH. If their baseline year (the year they entered the IRP) was less than six years before the survey, which took place in late 2004 or early 2005, they were not included in any analysis of six-year outcomes.

Each table discussed below presents the average (mean) outcome for participants and nonparticipants, as well as the unadjusted and regression-adjusted differences of means. The regression-adjusted differences are based on a statistical model that controls for each sample member's age, gender, race/ethnic group, country or region of residence, academic degrees, cohort, IC where they first began their career, and job title at baseline. We report the statistical significance of both the unadjusted and adjusted difference.[2]

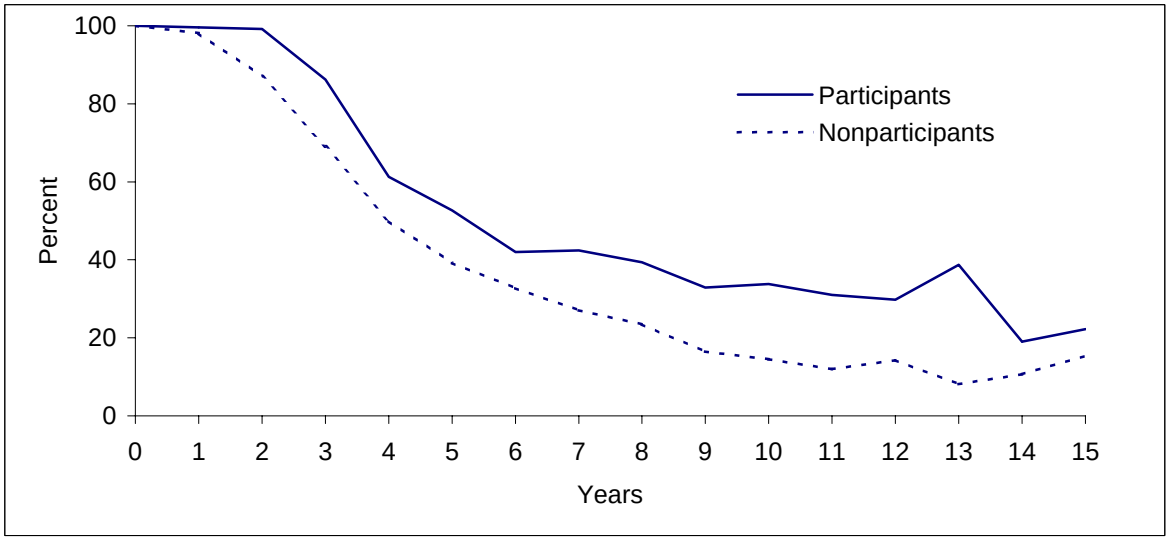
## 1. Retention at the NIH

The first outcome of interest is whether the researchers remained in the NIH intramural research program. On average, participants and nonparticipants remained in NIH jobs at moderate rates during their first three years, but their retention fell precipitously in the fourth and subsequent years. The retention rates of participants during the three years following the start of their first NIH job were 100, 99, and 86 percent, while 98, 87, and 69 percent of nonparticipants stayed in NIH jobs in the first three years (see Figure IV.1). The gaps between the two groups—2, 12, and 17 percent for years one through three—were statistically significant for each of these years.

After the initial three-year period, retention rates for both groups declined steadily for six years, before leveling off around year nine. Between years 4 and 12, the retention rates of participants remained 9 to 19 percentage points above those of nonparticipants, and the differences between the retention rates of the two groups were significant throughout the entire period. It is important to note that the survival curve shown in Figures IV.1 is based on a composite of several cohorts of sample members. In each year the composition of the group can change, so the percentages can appear to rise over time. Furthermore, the estimates for those later years are based on a small subset of the analysis sample, those who began their careers at the NIH in the early 1990s. Therefore, the long-term retention findings should be interpreted with some caution. For example, they do not reflect the experiences of the participants in the General LRP, which did not begin until 1996, eight years before the survey was administered.

[2] Two-sample *t*-tests were conducted on the means of the two groups for each outcome to determine whether the gap was statistically different from zero; similarly, we used the standard error from the multivariate regression to determine whether the coefficient on participation was significant. Statistical significance is indicated by *** if the impact was significant at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level.

**Figure IV.1. NIH Retention Over Time**




| Year Since Starting in the IRP | Participants | Nonparticipants | Difference | Adjusted Difference | Sample Size |
|---|---|---|---|---|---|
| 1 | 99.6 | 98.1 | 1.6* | 0.6 | 620 |
| 2 | 99.2 | 87.0 | 12.2*** | 12.9*** | 612 |
| 3 | 86.2 | 69.1 | 17.1*** | 23.2*** | 565 |
| 4 | 61.3 | 50.0 | 11.3** | 17.8*** | 499 |
| 5 | 52.7 | 39.2 | 13.5*** | 22.8*** | 455 |
| 6 | 42.0 | 32.7 | 9.3* | 14.4** | 397 |
| 7 | 42.4 | 27.1 | 15.3*** | 17.2*** | 350 |
| 8 | 39.4 | 23.5 | 15.9*** | 16.9*** | 308 |
| 9 | 32.9 | 16.5 | 16.5*** | 8.6 | 255 |
| 10 | 33.8 | 14.5 | 19.3*** | 15.7** | 206 |
| 11 | 31.0 | 12.0 | 19.1*** | 14.8* | 175 |
| 12 | 29.8 | 14.3 | 15.5** | 15.2 | 131 |
| 13 | 38.7 | 8.1 | 30.6*** | 29.9** | 93 |
| 14 | 19.0 | 10.7 | 8.3 | 4.2 | 49 |
| 15 | 22.2 | 15.4 | 6.8 | n.a. | 22 |

Source: Data from the Career Survey of Biomedical Scientists.

Note: Background variables used to adjust differences include year entered the IRP, age, gender, race/ethnicity, country or region of residence, degree received, Institute or Center, and job title.

*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.
*** Significantly different from zero at the .01 level, two-tailed test.

The higher rates of retention for participants after three years were consistent among many subgroups. Tabulations representing a detailed subgroup analysis, which examines retention at three times points for each outcome, are presented in Appendix A. For example, participants with a PhD or MD were still in their NIH jobs after three years at significantly higher rates than their nonparticipant counterparts. There was a difference of 30 percent between PhD participants and nonparticipants and 20 percent between MD participants and nonparticipants (see Table A.1). Similarly, participants who first enrolled in the program before 1993 or after 1996 had higher rates of retention than nonparticipants who were hired during the same period.[3]

Significant differences in the rates of retention for participants and nonparticipants were still common among many subgroups after six and ten years. However, the regression-adjusted difference in retention in these later periods appears to be driven by one subgroup, those with an MD. The only significant regression-adjusted-difference showed participants with an MD as having 17 and 20 percentage points greater likelihood than their nonparticipant counterparts to still hold their NIH jobs after six and ten years, respectively.

## 2. Retention in AIDS Research

As with retention in NIH jobs, retention in jobs related to AIDS research was quite high during the first three years, which may reflect the duration of many fellowship programs or initial employment contracts, as well as the duration of the typical LRP contract. However, after the initial three-year period, the retention rates fell much less sharply than for NIH jobs, and were fairly stable over years 5 through 10. During the first two years, the retention rates of participants were 99 percent each year, compared to 95 and 87 for nonparticipants (see Figure IV.2).

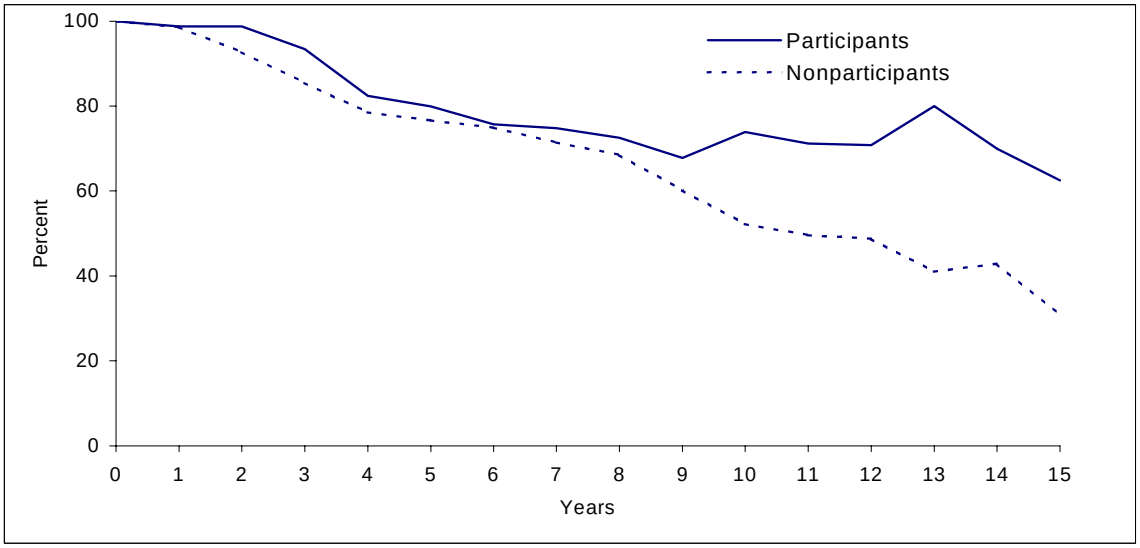
For four of the first five years following the start of a job in AIDS research, the gap between participants and nonparticipants was significant (4 percent for year one, 12 percent for year two, and 13 percent for years four and five). Over the next seven years, the retention rate for nonparticipants was higher than for participants, ranging between zero and ten percent, but was never statistically significant.[4]

The subgroup findings were less clear. After three, six, and ten years, there were significant differences in retention rates only for two subgroups: participants with an MD and participants who started between 1993 and 1996. Participants with an MD had a retention rate in AIDS research 23 percentage points higher than nonparticipants after 6 years. Similarly, the retention rates of participants who entered the program in 1993 through

[3] Participants in the intervening (1993-1996) cohort also had higher retention rates than nonparticipants, with a smaller gap between the two groups; however, this difference was not statistically significant.

[4] In years 13 and 14, the retention rates for participants were again higher than for nonparticipants, and the gap actually increased dramatically to 19 percent, but these gaps were based on very small samples.

**Figure IV.2. AIDS Research Retention Over Time**




| Year Since Starting in the IRP | Participants | Nonparticipants | Difference | Adjusted Difference | Sample Size |
|---|---|---|---|---|---|
| 1 | 99.1 | 94.7 | 4.3* | 4.4 | 202 |
| 2 | 99.1 | 86.7 | 12.4*** | 14.2*** | 208 |
| 3 | 89.0 | 82.2 | 6.8 | 10.5 | 210 |
| 4 | 76.0 | 63.2 | 12.8* | 19.3** | 195 |
| 5 | 68.1 | 54.9 | 13.1* | 24.1*** | 185 |
| 6 | 56.8 | 57.8 | -1.0 | 16.5* | 171 |
| 7 | 53.8 | 56.0 | -2.2 | 9.1 | 153 |
| 8 | 50.7 | 57.4 | -6.6 | 5.9 | 135 |
| 9 | 41.7 | 51.7 | -10.1 | -2.2 | 118 |
| 10 | 40.8 | 48.1 | -7.3 | -1.1 | 101 |
| 11 | 43.2 | 44.9 | -1.7 | 12.6 | 93 |
| 12 | 43.2 | 42.9 | 0.4 | 12.4 | 72 |
| 13 | 47.8 | 28.6 | 19.3 | 31.9 | 51 |
| 14 | 44.4 | 25.0 | 19.4 | n.a. | 30 |
| 15 | 28.6 | 25.0 | 3.6 | n.a. | 11 |

Source: Data from the Career Survey of Biomedical Scientists.

Note: Background variables used to adjust differences include year entered the IRP, age, gender, race/ethnicity, country or region of residence, degree received, Institute or Center, and job title.

*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.
*** Significantly different from zero at the .01 level, two-tailed test.

1996 were significantly higher than their nonparticipant counterparts from the same cohorts after six years, but were significantly lower after ten years; however, these results were based on relatively small samples.

### 3. Retention in Clinical Research

The findings for clinical research retention parallel those for AIDS jobs, but fewer differences were significant: the only significant differences between the rates of retention for participants and nonparticipants in jobs involving clinical research occurred during the first three years. After the second and third years, participants were still in clinical research 98 and 92 percent of the time compared to 92 and 85 percent for nonparticipants (see Figure IV.3). The notable difference for clinical research jobs was that after the initial decline in the first four years, the retention rate remained fairly stable over the rest of the period, generally fluctuating between 70 and 80 percent for both groups. After year nine, the gap between the two groups grew to between seven and 13 percent, but was never again significant.

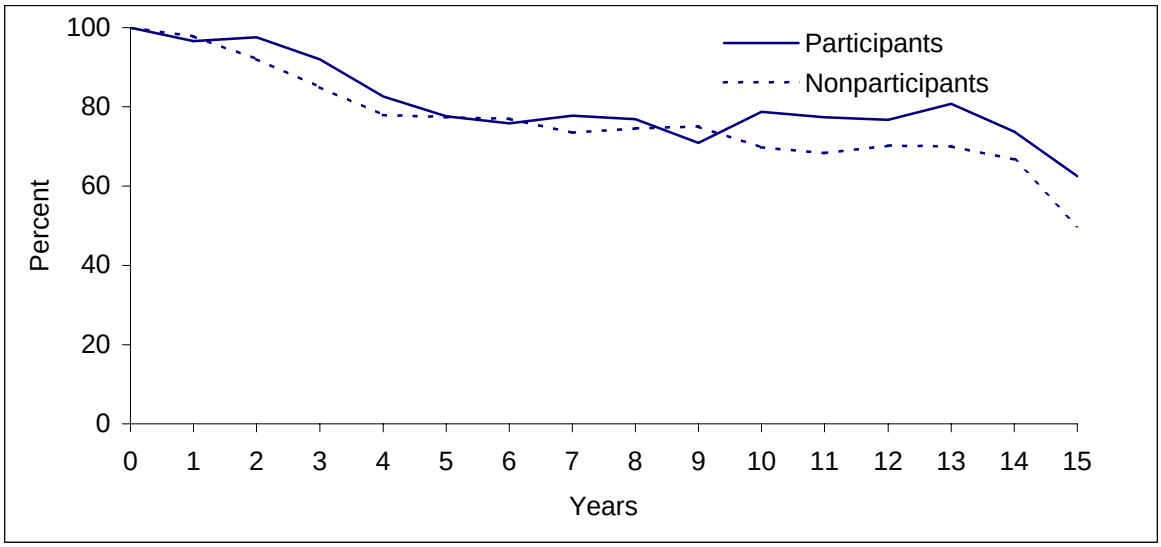
In the third year, the overall retention differences for the two groups were reflected in some of the subgroups. Looking at the unadjusted differences, participants with an MD or in the 1997-2000 cohort had retention rates that were eight and ten percentage points higher than similar nonparticipants, respectively. There are similar gaps in the regression-adjusted differences, though only significant for the 1993-1996 and 2001-2003 cohorts.

In all of the subgroup analyses of clinical research retention, there was a significant difference in retention after ten years only for the 1993-1996 cohort. This group is particularly noteworthy because 88 percent of participants were still doing clinical research after ten years, compared to 61 percent of nonparticipants. As with the findings for ten-year retention in NIH jobs, this group likely represents people whose first job was in clinical research and who stayed in the field the entire time. In addition, the clinical research LRP began during this period, so many members of this cohort were among the first participants of the program; this finding is similar to the findings for the AIDS researchers.

### 4. Retention in Research

The retention rates for jobs involving research of any kind (which includes AIDS and clinical research) were high for both participants and nonparticipants, with a significantly higher rate for participants during the second and third years. During the three years following the start of their first general research job, the retention rates were 99, 99, and 93 percent for participants, and 99, 93, and 86 percent for nonparticipants (see Figure IV.4). Influenced heavily by retention in AIDS and clinical research jobs, participants and nonparticipants remained in general research at high levels in subsequent years, with rates falling slightly over time.

**Figure IV.3. Clinical Research Retention Over Time**



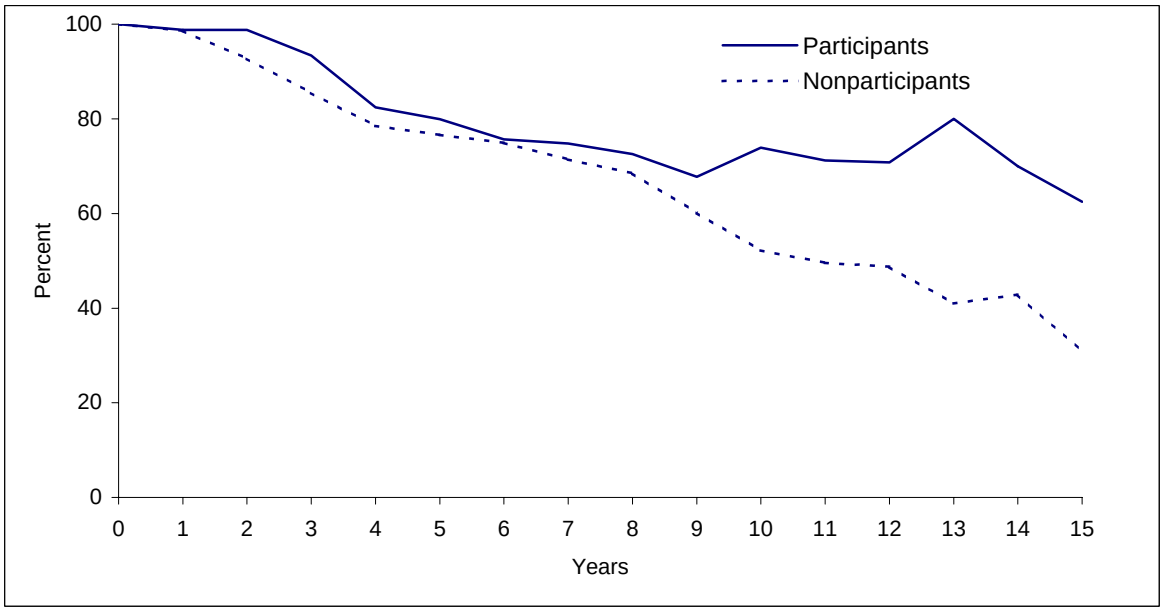

| Year Since Starting in the IRP | Participants | Nonparticipants | Difference | Adjusted Difference | Sample Size |
|---|---|---|---|---|---|
| 1 | 96.6 | 97.8 | -1.2 | -2.4 | 472 |
| 2 | 97.6 | 92.1 | 5.5*** | 5.9** | 470 |
| 3 | 92.0 | 85.0 | 7.0** | 8.6** | 442 |
| 4 | 82.6 | 77.9 | 4.7 | 3.5 | 396 |
| 5 | 77.6 | 77.4 | 0.2 | -1.7 | 360 |
| 6 | 75.8 | 77.0 | -1.1 | 0.2 | 311 |
| 7 | 77.8 | 73.5 | 4.3 | 3.5 | 274 |
| 8 | 76.9 | 74.5 | 2.4 | 4.9 | 244 |
| 9 | 70.9 | 75.0 | -4.1 | -2.0 | 203 |
| 10 | 78.7 | 69.8 | 8.9 | 6.4 | 157 |
| 11 | 77.4 | 68.3 | 9.1 | 2.8 | 135 |
| 12 | 76.7 | 70.2 | 6.6 | -1.8 | 100 |
| 13 | 80.8 | 70.0 | 10.8 | -6.6 | 66 |
| 14 | 73.7 | 66.7 | 7.0 | n.a. | 37 |
| 15 | 62.5 | 50.0 | 12.5 | n.a. | 16 |

Source: Data from the Career Survey of Biomedical Scientists.

Note: Background variables used to adjust differences include year entered the IRP, age, gender, race/ethnicity, country or region of residence, degree received, Institute or Center, and job title.

*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.
*** Significantly different from zero at the .01 level, two-tailed test.

**Figure IV.4. General Research Retention Over Time**




| Year Since Starting in the IRP | Participants | Nonparticipants | Difference | Adjusted Difference | Sample Size |
|---|---|---|---|---|---|
| 1 | 98.8 | 98.6 | 0.3 | -0.2 | 602 |
| 2 | 98.8 | 92.7 | 6.2*** | 6.2*** | 595 |
| 3 | 93.4 | 85.5 | 7.9*** | 11.5*** | 552 |
| 4 | 82.4 | 78.5 | 4.0 | 7.6* | 490 |
| 5 | 79.9 | 76.6 | 3.3 | 6.3 | 446 |
| 6 | 75.7 | 74.9 | 0.8 | 7.0 | 395 |
| 7 | 74.8 | 71.4 | 3.4 | 7.0 | 347 |
| 8 | 72.6 | 68.5 | 4.1 | 8.2 | 306 |
| 9 | 67.8 | 60.2 | 7.6 | 5.6 | 253 |
| 10 | 73.9 | 52.2 | 21.7*** | 21.4*** | 203 |
| 11 | 71.2 | 49.6 | 21.6*** | 15.6* | 172 |
| 12 | 70.8 | 48.8 | 22.1** | 18.6 | 130 |
| 13 | 80.0 | 41.0 | 39.0*** | 36.6*** | 91 |
| 14 | 70.0 | 42.9 | 27.1* | 2.0 | 48 |
| 15 | 62.5 | 30.8 | 31.7 | n.a. | 21 |

Source: Data from the Career Survey of Biomedical Scientists.

Note: Background variables used to adjust differences include year entered the IRP, age, gender, race/ethnicity, country or region of residence, degree received, Institute or Center, and job title.

*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.
*** Significantly different from zero at the .01 level, two-tailed test.

After the initial three-year period, the retention rate gap between the two groups remained between one and four percent over the next several years. After year nine, however, a statistically significant 22 percentage point gap emerges as the retention rates of participants remain in the 70 to 80 percent range, while the retention rates for nonparticipants fall below 50 percent. This gap persists in following few years, growing even larger for longer periods of retention.

As with the NIH jobs, higher rates of retention for participants after three years were found among several subgroups. Participants with a PhD or MD were still in research after three years at significantly higher rates than their nonparticipant counterparts; the differences between participants and nonparticipants were eight percent for PhDs and nine percent for MDs (see Table A.10). Similarly, participants who first enrolled in the program between 1993 and 2000 had higher rates of retention than nonparticipants who applied during the same period.

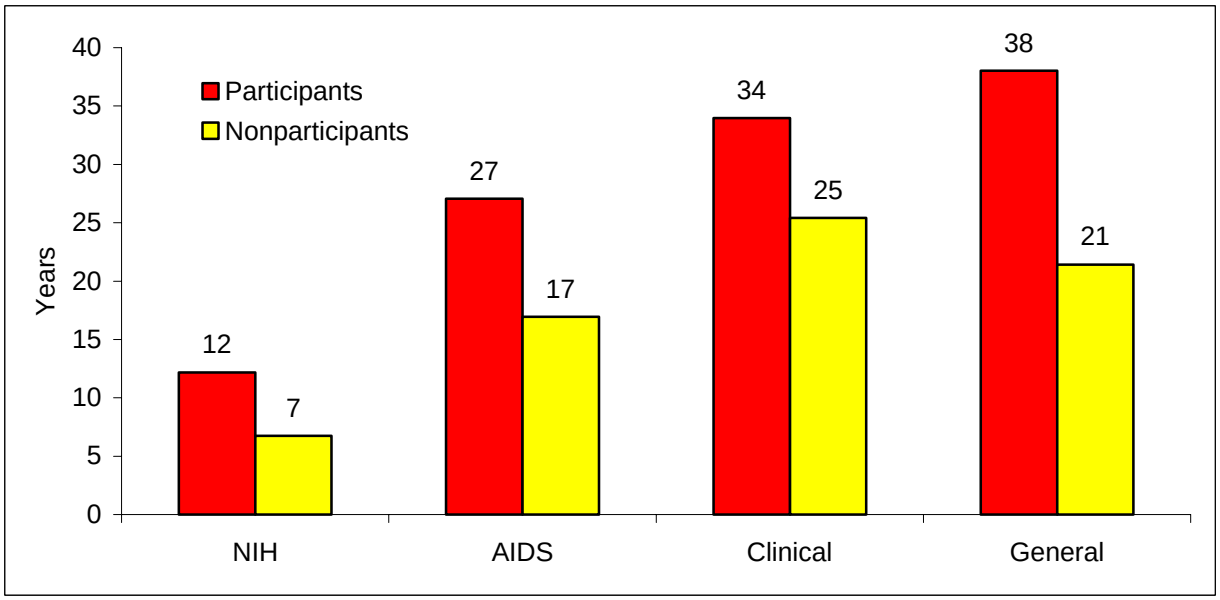
Significant differences in the retention rates for participants and nonparticipants were non-existent after six years, but re-emerged after 10 years. The unadjusted results showed that participants with a PhD and those who entered the program between 1993 and 1996 were more likely to still be doing general research after ten years. Using the regression-adjusted results, the significant difference between participants and nonparticipants overall appears to be driven solely by those who entered the program in 1993-1996 (see Appendix A).

### 5. Duration Analysis of All Four Retention Outcomes

In addition to the year-by-year examination of the rates of retention by participants and nonparticipants in various types of research, another way to examine the issue of retention is to predict the average length of stay in a job. Using the yearly data on retention, we can use a survival-time regression model to examine the duration in each type of job as a function of individual characteristics. We used a commonly estimated parametric model known as the exponential proportional hazard model (Cox and Oakes 1984) and checked the findings using alternative specifications. Using the coefficients estimated from the model we predicted the length of job tenure for participants and nonparticipants, holding constant their background characteristics. These estimates yield the predicted average length of retention for each group, presented in Figure IV.5.

For each of the outcomes we have been studying-NIH, AIDS research, clinical research, and general research-participants are predicted to stay in the targeted research area significantly longer than nonparticipants. The disparity between the two groups ranges from 5 years in an NIH job to 17 years in research more generally. In both of those cases, the numbers of years participants are predicted to remain in a job is nearly double the average years predicted for nonparticipants.

**Figure IV.5. Predicted Duration of Research Careers**




The predicted career lengths appeared long for both groups, especially the participants. One reason for this is the fact that most participants were still in research positions at the time of the survey. Therefore the assumption we make about the underlying distribution of career durations beyond the observation period of the study affects how long we expect they will remain on average. Indeed, the research career durations for both groups were shorter under alternative models. Nevertheless, the participant-nonparticipant *difference* was highly significant and robust to the choice of distributional assumptions used in the statistical model.

## C. ACADEMIC OUTCOMES

We also examined outcomes related to career status, finding that most of the differences between the participants and nonparticipants were not statistically significant once we controlled for background characteristics. If we do not correct for pre-existing differences in background characteristics, we find that nonparticipants were more likely to hold tenure track research positions, achieve tenure, publish in books and scholarly journals, and have a larger number of publications than participants. However, tenure and publication are heavily influenced by career experiences gained prior to entering the IRP, and we noted in Chapter 3 that there were differences in observable characteristics of participants and nonparticipants, such as age at baseline (and hence years out of graduate school) so we focus our discussion on the regression-adjusted differences.

For nearly all outcomes related to tenure status and publication, we find no significant differences between participants and nonparticipants, including ever holding a tenure track position, achieving tenure, publication of any journal articles, publication of any books, the

number of books published, publication of any research, and the total number of publications (see Table IV.5). For nearly all of these measures, after accounting for observable differences, participants achieved many of these outcomes at nominally higher rates or levels, but none were significant. However, participants were likely to have four more journal articles published than nonparticipants.

**Table IV.5. Academic Outcomes**

| | Participants | Non-participants | Difference | Adjusted Difference | Sample Size |
|---|---|---|---|---|---|
| Tenure Status | | | | | |
| Tenure Track | 21.3 | 27.1 | -5.8* | -5.1 | 710 |
| Achieved Tenure | 7.4 | 12.8 | -5.4** | 2.5 | 710 |
| Publications | | | | | |
| Any articles | 92.9 | 94.6 | -1.7 | -0.6 | 674 |
| Number of articles | 19.7 | 25.3 | -5.6** | 4.2* | 674 |
| Any books | 63.4 | 68.9 | -5.5 | 1.4 | 676 |
| Number of books | 2.6 | 3.9 | -1.3*** | 0.0 | 676 |
| Any publications | 96.5 | 95.9 | 0.6 | 1.4 | 674 |
| Number of publications | 22.4 | 29.2 | -6.8** | 4.2 | 674 |

Source: Data from the Career Survey of Biomedical Scientists.

Note: Background variables used to adjust differences include year entered the IRP, age, gender, race/ethnicity, country or region of residence, degree received, Institute or Center, and job title.

*Significantly different from zero the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.
*** Significantly different from zero at the .01 level, two-tailed test.

The subgroup analyses do not uncover many significant differences in the effect of participation on tenure status and publication across degree type and cohort. While there is variation in the regression-adjusted difference between participants and nonparticipants for tenure track positions and having received tenure when separated by degree or year of entry, none of the differences are statistically significant. Across all outcomes related to publication, only three impacts were significant: nonparticipants without an MD or PhD were more likely to have published a journal article than similar participants, and participants with a PhD or those who entered between 1993 and 1996 were more likely than nonparticipants to have published a book (see Appendix A).

## D. ROBUSTNESS OF FINDINGS

In order to determine whether our findings were possibly influenced by the specification of the model, we conducted several alternative analyses. One group of analyses focused on the specification of the regression model and which control variables were included. Our final model included background variables to adjust for differences in IRP entrance year, age, gender, race/ethnicity, country or region of residence, degree received, IC, and job title. Other specifications included the receipt of a previous NIH grant, knowing someone else in the program, having a competing job offer, and fields of study in both

undergraduate and graduate school. Both the models with additional variables and shorter regressions based on a bare minimum of controls had results similar to those presented in the tables.

While the overall group of matched nonparticipants may be a good benchmark against which to compare participants, there may be some remaining differences between participants and nonparticipants that could be unknowingly confounded with the effects of the LRP. For this reason, we examined several subgroups of nonparticipants that would contain researchers more like participants. One method was to use propensity score matching to identify nonparticipants most like the participants in their individual characteristics. Then, using the nonparticipants who were most similar to the participants, we re-estimated the impact analyses, with little difference in the results.

Another approach to identifying a more accurate comparison group was to search for some subgroups of nonparticipants who were like participants, but may not have been eligible for funding through the LRP. Specifically, we looked at four groups of nonparticipants: those born outside the U.S., those hired into non-FTE positions through IRTA, those holding other non-FTE positions, and those with low debt-to-salary ratios. Again, we conducted the retention and duration analysis for each subgroup of nonparticipants, with results presented in Figure IV.6 (NIH) and Figure IV.8 (General Research).[5]

With the exception of those in non-FTE IRTA positions, the retention patterns of the various subgroups of nonparticipants are fairly similar over the 10-year period presented in the figures. Furthermore, when we use the data on retention over time in the duration model to estimate the predicted retention for the various groups, we again find that the results are fairly consistent across the specifications. If anything, we may be underestimating the potential impact of the LRP by using all nonparticipants as our comparison group.[6]

[5] The sample sizes were too small to support similar analyses for AIDS and Clinical Research retention outcomes.

[6] The results for the sensitivity analyses for AIDS and clinical research revealed similar results, though there was more fluctuation in the retention data of the subgroups due to their size, especially for longer durations.

**Figure IV.6. NIH Retention Over Time**

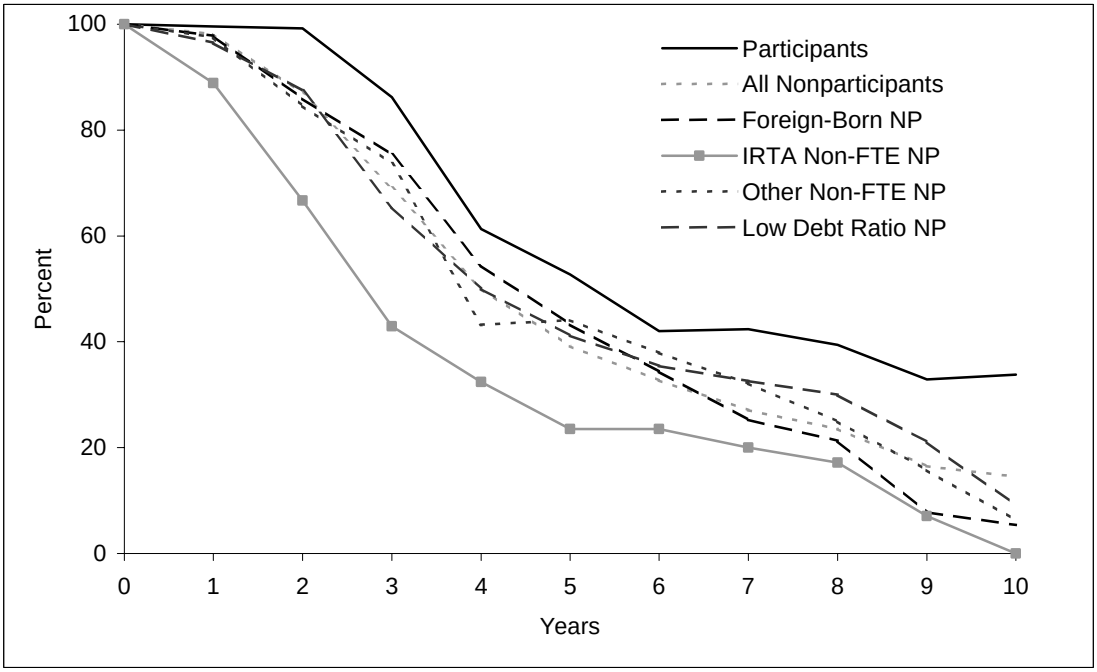



**Figure IV.7. Predicted Tenure at the NIH**

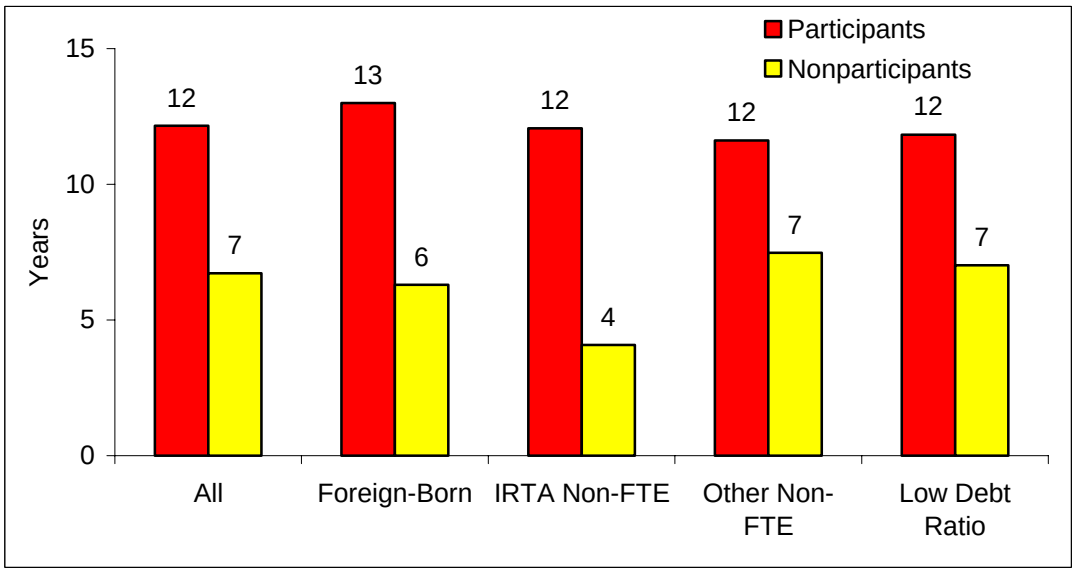


**Figure IV.8. General Research Retention Over Time**

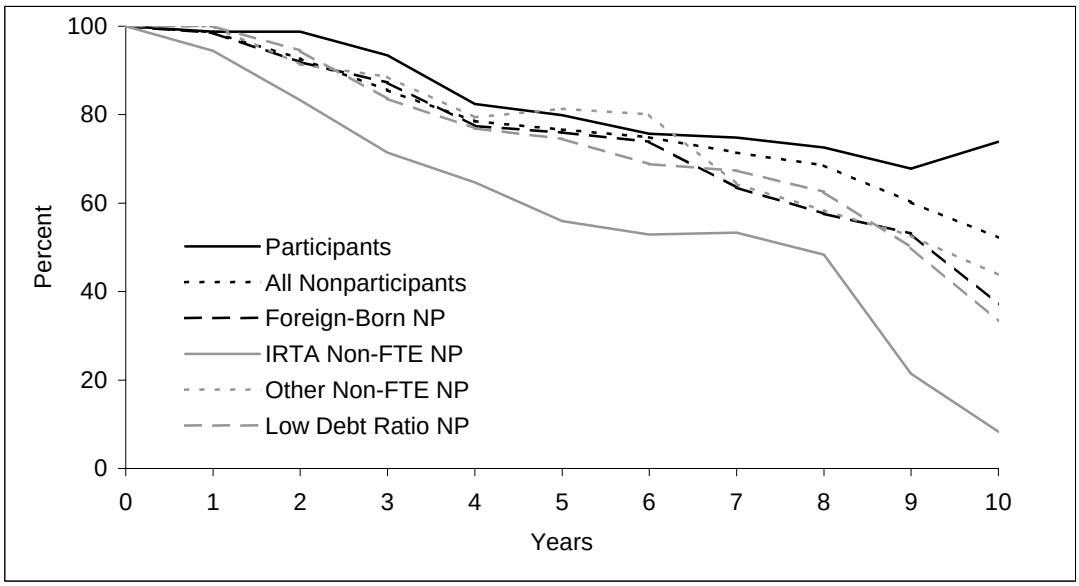
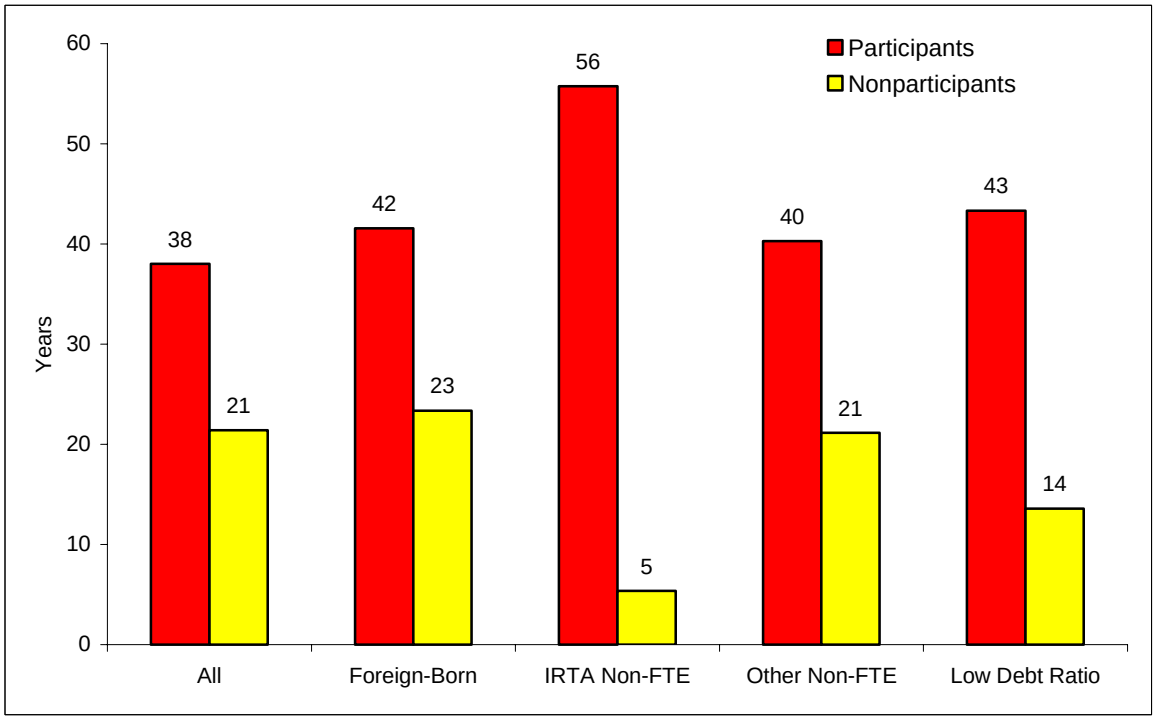



**Figure IV.9. Predicted Research Career Duration**



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# CHAPTER V

# CONCLUSIONS

This report presented findings from the outcomes evaluation of the NIH intramural research Loan Repayment Program. We conducted and analyzed data from two surveys, one of NIH recruiters and one of current and former IRP researchers. The findings support the overall conclusion that the LRP had positive impacts on both recruiting and retention. While we refer to these differences between participants and nonparticipants as impacts, we note some important limitations of the study that require careful interpretation of the findings.

## A. CAREER OUTCOMES

Eligibility for loan repayment was associated with a higher success rate at attracting desirable candidates into medical fellowship programs once they were offered a position. We estimated that LRP eligibility increased the applicant acceptance rate from 67 to 84 percent.

Participation in the LRP was associated with higher rates of both NIH and research retention, including retention in specific types of research (HIV/AIDS-related and clinical). For example, we estimated that LRP participation raised NIH retention after three years from 69 to 86 percent. Over the longer term, the differences in NIH retention rates remained at similar levels, even when we account for background factors that are potentially confounded with participant-nonparticipant differences. Much of the NIH retention advantage came from researchers with medical degrees.

Research retention and retention in specific areas (AIDS-related research and clinical research) showed the same trend of positive impacts in the first few years of researchers' careers, but the story was less clear beyond that. LRP effects on overall research retention remained positive and appeared very large at the mid-career point, ten years and beyond. However, the impacts on AIDS and clinical research were more difficult to detect due to smaller samples, especially for the longer-term outcomes. For some years there was a higher percentage of nonparticipants than participants still in the research area, but those differences were not statistically significant.

The findings suggested considerably larger impacts on long-term retention than on short-term retention, but such findings should be interpreted with caution. Anything we learn about long-term retention is necessarily based on the experiences of those who participated in the early years of the program's implementation, which started in 1989 with the AIDS Research LRP. Besides being different from the more recent cohorts, which include participants in the General and Clinical Research LRPs, the long term followup sample is much smaller, and therefore more subject to chance variation. That explains why many of the long-term impacts, even where large, were not statistically significant.

The findings on year-by-year retention translate into a large predicted advantage for participants in terms of career duration, whether in the NIH research program, in research more generally, or in specific research areas (AIDS and clinical). Based on the self-reported employment histories to date, we predict that LRP participants will tend to remain in research for the duration of a full career, compared to a shorter tenure for nonparticipants.

LRP participants generally stayed longer at the NIH and in research, but they were not necessarily more likely to achieve tenured research positions or publish in academic journals or books. We found that these positive outcomes were more prevalent for nonparticipants. When we controlled for such background characteristics as age and the year they entered the IRP, however, the participants were just as likely or more likely to have achieved these positive outcomes. Most of the differences, however, were not statistically significant, so we conclude that there is no evidence yet for an impact on tenure and publication.

## B. LIMITATIONS

All of the findings from this study are based on a quasi-experimental research design. That is, we compared outcomes for groups of participants and nonparticipants (or LRP eligibles and ineligibles) without having randomly assigned study subjects to the two "treatment" conditions. Thus, without a true control group, we cannot say with certainty that there are no unobservable determinants of career outcomes that might be confounded with participation status. We can only test whether the groups were similar in terms of observed characteristics, such as age, gender, race/ethnicity, and the characteristics of their first NIH position (year of first position, IC, and job title) and use statistical methods to control for those observed differences.

In addition, there are always limitations associated with the tools one uses to measure outcomes, and this study is no different. We relied heavily on self-reported outcomes. Respondents had to indicate whether they considered a research position to be AIDS-related or to involve clinical research and to describe the job responsibilities in a way that we could count that job as a research position. In many cases, they had to recall these job responsibilities as well as starting and ending dates from many years prior to the survey. The average recall period for CSBS respondents was approximately eight years. In such retrospective surveys, recall error and telescoping—the tendency to recall events as occurring more recently than they did—can reduce the accuracy of responses. For example, if a researcher was working on a Simian virus that is different from although related to the human immunodeficiency virus (HIV), they may not have said it was an AIDS-related

research position when it was considered so for the purposes of awarding a contract under the AIDS LRP rules. Similarly, a researcher who spent ten years at the NIH but whose responsibilities shifted away from running clinical trials over time to other duties may not have categorized that position as being "clinical research." Similar reporting errors are possible for the recruiter survey, in which program directors may not have recalled the characteristics of each applicant well enough to categorize them as likely eligible or likely ineligible for loan repayment. Finally, nonresponse to surveys is always a concern. While we generally had high response rates, there is always a possibility that the findings for respondents do not generalize to the full population.

A final concern that affects our interpretation of findings has to do with the study's aggregation of many cohorts of participants. In order to obtain a large enough sample to conduct meaningful analyses, we surveyed everyone who ever participated in the LRP (and a group of their counterparts), or in other words, every cohort. Yet to estimate long-term retention impacts, we relied more heavily on the early cohorts. Therefore, we confound the timing of program impacts with other factors that vary over time, such as the nature of the "average" LRP experience, the type of person who enters the LRP, and the labor market conditions facing scientists and physicians. Our estimates should therefore be treated as averages over the life of the program, with the longer duration program (the AIDS LRP) being correspondingly more heavily represented and the more recent components (General Research LRP) having a smaller influence. Future impacts may not be the same as the averages we reported here.

We addressed some of the limitations of the study by conducting sensitivity analysis and using multiple data sources. As a result of these efforts, we are fairly confident that the LRP is a helpful recruitment tool and that it improves retention in research positions in the NIH and beyond the NIH, at least in the short term. A companion volume to this one (Humphrey and Silva 2004) provides an analysis based on qualitative methods using interviews and focus groups. Taken together, these two reports provide the best available evidence on the operations and effectiveness of the NIH intramural LRP.

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# APPENDIX A

# SUBGROUP ANALYSIS TABLES

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**Table A.1. NIH Retention**

| | Participants | Non-participants | Difference | Adjusted Difference | Sample Size |
|---|---|---|---|---|---|
| **3-Year Retention** | | | | | |
| Overall | 86.2 | 69.1 | 17.1*** | 23.2*** | 565 |
| Degree Type | | | | | |
| PhD or equivalent | 89.8 | 71.3 | 18.5*** | 29.5*** | 167 |
| MD or equivalent | 86.4 | 66.0 | 20.3*** | 20.4*** | 294 |
| Other | 82.1 | 71.2 | 10.9 | 12.0 | 98 |
| Entry Cohort | | | | | |
| 1989-1992 | 93.5 | 74.6 | 18.9*** | 18.2* | 105 |
| 1993-1996 | 78.6 | 65.8 | 12.8 | 6.9 | 159 |
| 1997-2000 | 83.5 | 68.5 | 15.0*** | 28.6*** | 227 |
| 2001-2003 | 91.3 | 74.1 | 17.2** | 29.3* | 73 |
| **6-Year Retention** | | | | | |
| Overall | 42.0 | 32.7 | 9.3* | 14.4** | 397 |
| Degree Type | | | | | |
| PhD or equivalent | 30.6 | 39.8 | -9.2 | -2.7 | 124 |
| MD or equivalent | 45.7 | 29.8 | 15.8** | 17.1** | 205 |
| Other | 48.0 | 25.0 | 23.0* | 13.1 | 65 |
| Entry Cohort | | | | | |
| 1989-1992 | 52.1 | 28.8 | 23.3** | 16.5 | 107 |
| 1993-1996 | 40.5 | 31.9 | 8.6 | 9.0 | 158 |
| 1997-2000 | 34.0 | 38.2 | -4.2 | 7.7 | 126 |
| 2001-2003 | | | | | |
| **10-Year Retention** | | | | | |
| Overall | 33.8 | 14.5 | 19.3*** | 15.7** | 206 |
| Degree Type | | | | | |
| PhD or equivalent | 21.4 | 13.7 | 7.7 | -5.8 | 65 |
| MD or equivalent | 35.6 | 16.4 | 19.1** | 20.2** | 118 |
| Other | 44.4 | 7.7 | 36.8** | *n.a.* | 22 |
| Entry Cohort | | | | | |
| 1989-1992 | 35.6 | 19.0 | 16.6* | 9.6 | 103 |
| 1993-1996 | 35.3 | 14.5 | 20.8* | 30.0 | 79 |
| 1997-2000 | n.a. | n.a | n.a | n.a | n.a |
| 2001-2003 | n.a | n.a | n.a | n.a | n.a |

Source: Data from the Career Survey of Biomedical Scientists.

Note: Background variables used to adjust differences include year entered the IRP, age, gender, race/ethnicity, country or region of residence, degree received, Institute or Center, and job title.

*Significantly different from zero the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.
*** Significantly different from zero at the .01 level, two-tailed test.

n.a. = Not applicable.

**Table A.2. AIDS Research Retention**

| | Participants | Non-participants | Difference | Adjusted Difference | Sample Size |
|---|---|---|---|---|---|
| **3-Year Retention** | | | | | |
| Overall | 89.0 | 82.2 | 6.8 | 10.5 | 210 |
| Degree Type | | | | | |
| PhD or equivalent | 96.2 | 96.6 | -0.4 | 0.9 | 55 |
| MD or equivalent | 85.7 | 75.5 | 10.2 | 9.7 | 116 |
| Other | 94.7 | 78.9 | 15.8 | 2.2 | 38 |
| Entry Cohort | | | | | |
| 1989-1992 | 94.9 | 83.3 | 11.5 | 1.4 | 63 |
| 1993-1996 | 83.3 | 86.7 | -3.3 | 16.9 | 54 |
| 1997-2000 | 86.1 | 77.5 | 8.6 | 19.0 | 76 |
| 2001-2003 | 90.0 | 83.3 | 6.7 | *n.a.* | 16 |
| **6-Year Retention** | | | | | |
| Overall | 56.8 | 57.8 | -1.0 | 16.5* | 171 |
| Degree Type | | | | | |
| PhD or equivalent | 54.5 | 91.7 | -37.1*** | 0.2 | 46 |
| MD or equivalent | 56.9 | 47.7 | 9.1 | 23.3* | 95 |
| Other | 64.3 | 33.3 | 31.0 | *n.a.* | 29 |
| Entry Cohort | | | | | |
| 1989-1992 | 57.9 | 48.1 | 9.7 | 31.2 | 65 |
| 1993-1996 | 61.5 | 51.7 | 9.8 | 81.0** | 55 |
| 1997-2000 | 52.2 | 73.1 | -20.9 | 23.0 | 52 |
| 2001-2003 | | | | | |
| **10-Year Retention** | | | | | |
| Overall | 40.8 | 48.1 | -7.3 | -1.1 | 101 |
| Degree Type | | | | | |
| PhD or equivalent | 30.0 | 61.5 | -31.5 | -5.1 | 23 |
| MD or equivalent | 39.4 | 41.9 | -2.5 | 11.0 | 64 |
| Other | 66.7 | 50.0 | 16.7 | *n.a.* | 14 |
| Entry Cohort | | | | | |
| 1989-1992 | 44.4 | 48.1 | -3.7 | 20.1 | 63 |
| 1993-1996 | 44.4 | 54.4 | -10.1 | -50.7* | 31 |
| 1997-2000 | n.a | n.a | n.a | n.a | n.a |
| 2001-2003 | n.a | n.a | n.a | n.a | n.a |

Source: Data from the Career Survey of Biomedical Scientists.

Note: Background variables used to adjust differences include year entered the IRP, age, gender, race/ethnicity, country or region of residence, degree received, Institute or Center, and job title.

*Significantly different from zero the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.
*** Significantly different from zero at the .01 level, two-tailed test.

n.a. = Not applicable.

**Table A.3. Clinical Research Retention**

| | Participants | Non-participants | Difference | Adjusted Difference | Sample Size |
|---|---|---|---|---|---|
| **3-Year Retention** | | | | | |
| Overall | 92.0 | 85.0 | 7.0** | 8.6** | 442 |
| Degree Type | | | | | |
| PhD or equivalent | 92.6 | 91.1 | 1.5 | 12.8 | 72 |
| MD or equivalent | 91.8 | 83.8 | 8.0** | 8.0 | 276 |
| Other | 94.6 | 83.0 | 11.6 | 5.2 | 90 |
| Entry Cohort | | | | | |
| 1989-1992 | 90.0 | 87.8 | 2.2 | 2.5 | 89 |
| 1993-1996 | 97.4 | 89.5 | 7.8 | 11.2* | 124 |
| 1997-2000 | 89.6 | 80.0 | 9.6* | 12.8 | 172 |
| 2001-2003 | 93.8 | 82.6 | 11.1 | 42.1** | 55 |
| **6-Year Retention** | | | | | |
| Overall | 75.8 | 77.0 | -1.1 | 0.2 | 311 |
| Degree Type | | | | | |
| PhD or equivalent | 70.6 | 69.7 | 0.9 | 49.4 | 50 |
| MD or equivalent | 79.7 | 81.7 | -1.9 | -5.5 | 199 |
| Other | 69.6 | 67.6 | 2.0 | -21.7 | 60 |
| Entry Cohort | | | | | |
| 1989-1992 | 83.3 | 80.0 | 3.3 | -0.7 | 92 |
| 1993-1996 | 78.0 | 79.5 | -1.5 | -3.2 | 129 |
| 1997-2000 | 65.7 | 72.0 | -6.3 | -9.5 | 85 |
| 2001-2003 | | | | | |
| **10-Year Retention** | | | | | |
| Overall | 78.7 | 69.8 | 8.9 | 6.4 | 157 |
| Degree Type | | | | | |
| PhD or equivalent | 57.1 | 50.0 | 7.1 | *n.a.* | 23 |
| MD or equivalent | 84.4 | 77.9 | 6.5 | 9.0 | 113 |
| Other | 66.7 | 50.0 | 16.7 | *n.a.* | 21 |
| Entry Cohort | | | | | |
| 1989-1992 | 78.0 | 79.5 | -1.5 | -3.2 | 129 |
| 1993-1996 | 65.7 | 72.0 | -6.3 | -9.5 | 85 |
| 1997-2000 | n.a | n.a | n.a | n.a | n.a |
| 2001-2003 | n.a | n.a | n.a | n.a | n.a |

Source: Data from the Career Survey of Biomedical Scientists.

Note: Background variables used to adjust differences include year entered the IRP, age, gender, race/ethnicity, country or region of residence, degree received, Institute or Center, and job title.

*Significantly different from zero the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.
*** Significantly different from zero at the .01 level, two-tailed test.

n.a. = Not applicable.

**Table A.4. General Research Retention**

| | Participants | Non-participants | Difference | Adjusted Difference | Sample Size |
|---|---|---|---|---|---|
| | | | **3-Year Retention** | | |
| Overall | 93.4 | 85.5 | 7.9*** | 11.5*** | 552 |
| Degree Type | | | | | |
| PhD or equivalent | 96.6 | 89.0 | 7.6* | 8.8 | 167 |
| MD or equivalent | 93.0 | 83.9 | 9.2** | 10.8** | 284 |
| Other | 92.3 | 82.1 | 10.2 | 4.6 | 95 |
| Entry Cohort | | | | | |
| 1989-1992 | 93.8 | 89.8 | 3.9 | 2.0 | 107 |
| 1993-1996 | 97.4 | 87.1 | 10.4* | 13.4** | 155 |
| 1997-2000 | 90.4 | 82.0 | 8.5* | 10.8 | 216 |
| 2001-2003 | 95.7 | 85.2 | 10.5 | 35.8*** | 73 |
| | | | **6-Year Retention** | | |
| Overall | 75.7 | 74.9 | 0.8 | 7.0 | 395 |
| Degree Type | | | | | |
| PhD or equivalent | 75.0 | 77.5 | -2.5 | 12.3 | 125 |
| MD or equivalent | 76.5 | 74.4 | 2.2 | -1.3 | 202 |
| Other | 76.9 | 69.2 | 7.7 | 10.0 | 65 |
| Entry Cohort | | | | | |
| 1989-1992 | 79.6 | 72.4 | 7.2 | 10.3 | 107 |
| 1993-1996 | 83.3 | 80.0 | 3.3 | 8.7 | 157 |
| 1997-2000 | 68.0 | 72.0 | -4.0 | 2.8 | 125 |
| 2001-2003 | | | | | |
| | | | **10-Year Retention** | | |
| Overall | 73.9 | 52.2 | 21.7*** | 21.4*** | 203 |
| Degree Type | | | | | |
| PhD or equivalent | 64.3 | 27.5 | 36.8*** | 16.2 | 65 |
| MD or equivalent | 77.8 | 70.0 | 7.8 | 13.1 | 115 |
| Other | 70.0 | 50.0 | 20.0 | *n.a.* | 22 |
| Entry Cohort | | | | | |
| 1989-1992 | 78.3 | 73.2 | 5.0 | 14.6 | 102 |
| 1993-1996 | 82.4 | 48.3 | 34.0** | 39.3** | 77 |
| 1997-2000 | n.a. | n.a. | n.a. | n.a. | n.a. |
| 2001-2003 | n.a. | n.a. | n.a. | n.a. | n.a. |

Source: Data from the Career Survey of Biomedical Scientists.

Note: Background variables used to adjust differences include year entered the IRP, age, gender, race/ethnicity, country or region of residence, degree received, Institute or Center, and job title.

*Significantly different from zero the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.
*** Significantly different from zero at the .01 level, two-tailed test.

n.a. = Not applicable.

**Table A.5. Tenure Track and Tenure**

| | Participants | Non-participants | Difference | Adjusted Difference | Sample Size |
|---|---|---|---|---|---|
| **Tenure Track Positions Held** | | | | | |
| Overall | 21.3 | 27.1 | -5.8* | -5.1 | 710 |
| Degree Type | | | | | |
| PhD or equivalent | 25.0 | 26.0 | -1.0 | 7.4 | 191 |
| MD or equivalent | 21.5 | 29.6 | -8.0* | -7.1 | 375 |
| Other | 17.3 | 22.5 | -5.2 | -18.6 | 132 |
| Entry Cohort | | | | | |
| 1989-1992 | 32.7 | 33.8 | -1.1 | 4.3 | 129 |
| 1993-1996 | 38.0 | 35.9 | 2.1 | -7.8 | 181 |
| 1997-2000 | 19.8 | 21.2 | -1.4 | -5.5 | 252 |
| 2001-2003 | 4.8 | 14.5 | -9.8** | -10.1 | 146 |
| **Tenure Attained** | | | | | |
| Overall | 7.4 | 12.8 | -5.4** | 2.5 | 710 |
| Degree Type | | | | | |
| PhD or equivalent | 10.3 | 18.7 | -8.4 | 12.0 | 191 |
| MD or equivalent | 5.8 | 11.8 | -6.0** | 0.2 | 375 |
| Other | 9.6 | 7.5 | 2.1 | -0.3 | 132 |
| Entry Cohort | | | | | |
| 1989-1992 | 21.8 | 21.6 | 0.2 | 2.8 | 129 |
| 1993-1996 | 8.0 | 14.5 | -6.5 | 4.0 | 181 |
| 1997-2000 | 5.7 | 9.6 | -3.9 | 3.1 | 252 |
| 2001-2003 | 0.0 | 4.8 | -4.8** | 0.9 | 146 |

Source: Data from the Career Survey of Biomedical Scientists.

Note: Background variables used to adjust differences include year entered the IRP, age, gender, race/ethnicity, country or region of residence, degree received, Institute or Center, and job title.

*Significantly different from zero the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.
*** Significantly different from zero at the .01 level, two-tailed test.

**Table A.6. Publication of Articles**

| | Participants | Non-participants | Difference | Adjusted Difference | Sample Size |
|---|---|---|---|---|---|
| **Any Articles** | | | | | |
| Overall | 92.9 | 94.6 | -1.7 | -0.6 | 674 |
| Degree Type | | | | | |
| PhD or equivalent | 100.0 | 98.3 | 1.7 | 2.5 | 187 |
| MD or equivalent | 92.0 | 92.7 | -0.6 | 2.9 | 354 |
| Other | 88.2 | 93.2 | -5.0 | -14.1* | 125 |
| Entry Cohort | | | | | |
| 1989-1992 | 100.0 | 98.4 | 1.6 | 0.5 | 117 |
| 1993-1996 | 97.8 | 99.2 | -1.4 | -0.8 | 171 |
| 1997-2000 | 95.1 | 92.9 | 2.2 | -0.1 | 244 |
| 2001-2003 | 82.5 | 85.0 | -2.5 | 1.3 | 140 |
| **Number of Articles** | | | | | |
| Overall | 19.7 | 25.3 | -5.6** | 4.2* | 674 |
| Degree Type | | | | | |
| PhD or equivalent | 24.1 | 34.7 | -10.5** | 9.4 | 187 |
| MD or equivalent | 17.5 | 21.5 | -4.0 | 3.1 | 354 |
| Other | 21.8 | 19.9 | 1.9 | -3.3 | 125 |
| Entry Cohort | | | | | |
| 1989-1992 | 48.2 | 36.5 | 11.7 | 12.2 | 117 |
| 1993-1996 | 20.0 | 28.1 | -8.1** | 0.3 | 171 |
| 1997-2000 | 14.5 | 22.1 | -7.6** | -0.7 | 244 |
| 2001-2003 | 7.4 | 15.0 | -7.6* | 3.7 | 140 |

Source: Data from the Career Survey of Biomedical Scientists.

Note: Background variables used to adjust differences include year entered the IRP, age, gender, race/ethnicity, country or region of residence, degree received, Institute or Center, and job title.

*Significantly different from zero the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.
*** Significantly different from zero at the .01 level, two-tailed test.

**Table A.7. Publication of Books**

| | Participants | Non-participants | Difference | Adjusted Difference | Sample Size |
|---|---|---|---|---|---|
| **Any Books** | | | | | |
| Overall | 63.4 | 68.9 | -5.5 | 1.4 | 676 |
| Degree Type | | | | | |
| PhD or equivalent | 70.1 | 70.8 | -0.7 | 26.2*** | 187 |
| MD or equivalent | 59.1 | 69.3 | -10.1** | -4.4 | 356 |
| Other | 70.6 | 67.6 | 3.0 | 4.9 | 125 |
| Entry Cohort | | | | | |
| 1989-1992 | 79.2 | 81.5 | -2.3 | 7.7 | 118 |
| 1993-1996 | 73.9 | 69.6 | 4.3 | 21.7** | 171 |
| 1997-2000 | 62.5 | 69.5 | -7.0 | -9.6 | 245 |
| 2001-2003 | 47.5 | 51.7 | -4.2 | 3.6 | 140 |
| **Number of Books** | | | | | |
| Overall | 2.6 | 3.9 | -1.3*** | 0.0 | 676 |
| Degree Type | | | | | |
| PhD or equivalent | 2.4 | 3.8 | -1.5* | 1.1 | 187 |
| MD or equivalent | 2.9 | 4.2 | -1.3** | 0.0 | 356 |
| Other | 2.1 | 3.3 | -1.1 | -1.5 | 125 |
| Entry Cohort | | | | | |
| 1989-1992 | 6.0 | 5.3 | 0.7 | 1.6 | 118 |
| 1993-1996 | 2.9 | 4.2 | -1.3 | -0.5 | 171 |
| 1997-2000 | 2.0 | 3.6 | -1.6** | -0.5 | 245 |
| 2001-2003 | 1.0 | 2.2 | -1.2** | -0.2 | 140 |

Source: Data from the Career Survey of Biomedical Scientists.

Note: Background variables used to adjust differences include year entered the IRP, age, gender, race/ethnicity, country or region of residence, degree received, Institute or Center, and job title.

*Significantly different from zero the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.
*** Significantly different from zero at the .01 level, two-tailed test.

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**Table A.8. Total Publications**

| | Participants | Non-participants | Difference | Adjusted Difference | Sample Size |
|---|---|---|---|---|---|
| **Any Publications** | | | | | |
| Overall | 96.5 | 95.9 | 0.6 | 1.4 | 674 |
| Degree Type | | | | | |
| PhD or equivalent | 100.0 | 98.3 | 1.7 | 2.5 | 187 |
| MD or equivalent | 96.3 | 95.3 | 1.0 | 2.4 | 354 |
| Other | 94.1 | 93.2 | 0.9 | 0.5 | 125 |
| Entry Cohort | | | | | |
| 1989-1992 | 100.0 | 98.4 | 1.6 | 0.5 | 117 |
| 1993-1996 | 97.8 | 99.2 | -1.4 | -0.8 | 171 |
| 1997-2000 | 98.1 | 95.0 | 3.0 | 0.6 | 244 |
| 2001-2003 | 91.3 | 88.3 | 2.9 | 7.6 | 140 |
| **Number of Publications** | | | | | |
| Overall | 22.4 | 29.2 | -6.8** | 4.2 | 674 |
| Degree Type | | | | | |
| PhD or equivalent | 26.5 | 38.5 | -12.0** | 10.5 | 187 |
| MD or equivalent | 20.4 | 25.6 | -5.3 | 3.1 | 354 |
| Other | 23.9 | 23.2 | 0.8 | -4.8 | 125 |
| Entry Cohort | | | | | |
| 1989-1992 | 54.2 | 41.9 | 12.3 | 13.7 | 117 |
| 1993-1996 | 22.8 | 32.3 | -9.4** | -0.2 | 171 |
| 1997-2000 | 16.5 | 25.7 | -9.3** | -1.2 | 244 |
| 2001-2003 | 8.4 | 17.2 | -8.8** | 3.5 | 140 |

Source: Data from the Career Survey of Biomedical Scientists.

Note: Background variables used to adjust differences include year entered the IRP, age, gender, race/ethnicity, country or region of residence, degree received, Institute or Center, and job title.

*Significantly different from zero the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.
*** Significantly different from zero at the .01 level, two-tailed test.