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An Evaluation of the National Institutes of Health Director's New Innovator Award Program Finalists for Fiscal Years 2007–2009

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Executive Summary

The National Institutes of Health (NIH) New Innovator (NI) Award Program was created in FY 2007 to support promising new investigators who were proposing innovative, high-risk, high-reward research. NI awards are targeted to early stage investigators who are defined as investigators within 10 years of their terminal research degree or medical residency and who have not yet received a substantial NIH research grant, such as the NIH R01 grant. NIH awarded 115 NI awards in FY 2007–2009; however, 120 early career investigators submitted an NI award application in this same timeframe, scored well in review, but did *not* receive funding. The NIH Office of the Director contracted with the IDA Science and Technology Policy Institute (STPI) to assess potential differences between the 120 award finalists in comparison to the 115 NI awardees.

This report complements and extends the companion STPI report *Outcome Evaluation of the National Institutes of Health Director's New Innovator Award Program for FY 2007–2009* by analyzing career and research indicators for finalists with respect to those measured for awardees.

A team of STPI researchers used a mixed-methods approach to assess the career trajectory, publication patterns, and funding for finalists compared to awardees who did receive the award. The primary assessment tools used in this approach were as follows:

- Survey finalists on their perceptions of their career progression and productivity since they submitted their NI award applications
- Bibliometric analysis to assess changes in productivity, impact, coauthor network, and interdisciplinarity among finalists
- Grant analysis to assess the ability of finalists to secure NIH funding after their NI applications

Data obtained through the survey, bibliometric analyses, and grant analyses assessed characteristics of professional advancement, funding, and career publications of finalists and awardees before and after the NI application submission or award receipt. The data indicate that:

- With the exception of journal cover recognition, there were no statistically significant differences in finalist and awardee perceptions of their career status as measured by indicators of research and laboratory expansion, receipt of tenure, and employment status.

- For all NIH grants, DP1 grants awarded through the NDPA program, and combinations of R01 Type 1 and Type 2 grants assessed in this report, finalists and awardees were similar in the proportion of the group funded, percent of applications awarded, or average number of awards received. They differ in that finalists submit more R01 Type 2 applications than do awardees; however, awardees submit more DP1 applications. Finalists received DP1 grants at the same rate as awardees.
- For measures of research impact, finalists had lower journal impact scores for career publications than did awardees; however, their productivity, as measured by the number of publications and average annual publications, was similar to awardees.
- Finalists and awardees have similar co-author networks and display similar degrees of interdisciplinarity in their career publications.

In conclusion, the most significant difference between finalists and awardees is noted for journal impact factors; however, STPI acknowledges the controversies that surround the use of impact factors as a measure of the potential impact of research results in a corpus of publications. Awardees scored higher on the journal impact factors for their career publications than did finalists, suggesting that awardee research overall has the hallmarks of research that is more likely to advance biomedical and bio-behavioral science.

Contents

1. Introduction

The National Institutes of Health (NIH) New Innovator (NI) award program was created in FY 2007 to support promising new investigators who were proposing innovative, high-risk, high-reward (HRHR) research. NI awards are intended for early stage investigators who are defined as investigators within 10 years of their terminal research degree or medical residency and who have not yet received a substantial NIH research grant, such as the NIH R01 grant or equivalent.[1] NIH awarded 115 NI awards in FY 2007–2009. These individuals are designated NI awardees. In this same timeframe, 120 early career investigators submitted NI award applications, scored well in review, but did *not* receive funding. These individuals are designated NI award finalists. The NIH Office of the Director contracted with the IDA Science and Technology Policy Institute (STPI) to assess potential differences between the 2007–2009 NI Award finalists in comparison to the 2007–2009 NI awardees.

This report complements and extends the *Outcome Evaluation of the National Institutes of Health Director's New Innovator Award Program for FY 2007–2009* (hereafter the NI awardee outcomes evaluation) by analyzing career and research indicators for finalists with respect to those measured for awardees.

A. Background on the NI Award Program

The NI award program is the second program within the High Risk Research Initiative operated by the NIH Office of the Director to support innovative biomedical and behavioral research. The NI program was modeled after the successful NIH Director's Pioneer Award (NDPA); however, the NI award is open only to early stage investigators. The NDPA and NI award programs differ from the traditional NIH R01 award in that the NDPA and NI programs' review criteria emphasize the creativity and innovative thinking of the investigator, their applications are relatively brief, neither program requires preliminary data, and their review processes are conducted by ad hoc committees of extramural reviewers rather than the traditional study sections operated by the Center for Scientific Review. Additionally, the NI Award proposals do not require a detailed budget submission, and the funds are disbursed in total at the beginning of the grant. Each NI award allocates the total 5 years of funding ($1.5 million total direct costs) at the time of award. Although the amount of funding is similar in value to 5-year R01 grants, the NI award disbursal

[1] Grants considered equivalents include activity codes R23, R29, R37, and U01.

approach allows for more flexible use of funds and modification of research direction based upon research results. All of these differences are designed to encourage and enable innovative and higher risk biomedical and behavioral research.

B. Scope of this Evaluation

To identify the group of finalists who met the criteria for inclusion in this assessment, The STPI team received a list from the NIH Office of the Director of 135 finalists who applied for NI awards in response to the 2007–2009 NI Funding Opportunity Announcements. From this list, duplicate finalists were removed if they applied for and received finalist consideration for more than one year of the award. Further, all 2007–2009 finalists who subsequently received an NI award were excluded from the finalist group. The STPI team identified 120 NI award finalists from the 2007–2009 cohorts using this procedure.

To determine effects on finalists' and awardees' careers and research, the STPI team used a methodology similar to the one employed in the NI awardee outcomes evaluation. This mixed-methods approach used a survey, bibliometric analysis, and grant analysis to assess the career trajectory, publication patterns, and funding for finalists who *did not* receive the NI award compared to awardees who *did* receive the award. In the team's experience, a mixed methods approach compensates for the limitations inherent in any single method by providing multiple data streams that can be integrated into overarching findings. The team also used the definitions of high risk, innovativeness, and interdisciplinarity established in the NI awardee outcomes evaluation.

An overview of the methods applied to the Finalist cohort is provided in the subsections that follow. Additional details can be found in Chapters 2–4, and methodologies applied to the awardee cohort are detailed in the NI awardee outcomes evaluation.

1. Finalist Survey

The purpose of the survey was to query finalists on their perceptions of their career progression and productivity since they submitted their NI award application. Surveys allow an analyst to collect answers to specific questions that cover a diverse range of topics using multiple formats.

2. Bibliometric Analysis

Bibliometric analyses were performed on all papers published by finalists before their NI award application date plus 1 year (*pre-application* + 1) and one year after their NI award application date through March 2016 (*post-application* – 1). This analysis assessed changes in productivity (e.g., total publications), impact (e.g., SCImago or IPP), coauthor

network (e.g., average coauthor per publication), and interdisciplinarity (unique subject codes).

3. Grant Analysis

To assess the ability of finalists to secure NIH funding after their NI application, the team derived grant information from the IMPAC II database and analyzed all NIH Type 1 (new competitive grants) applications submitted and grants received by finalists, as well as the number of DP1 applications and awards. R01 Type 1 and Type 2 (competitive renewals) applications and awards were also analyzed.

C. Overview of the Report

This report is divided into 5 chapters. Following the introduction (Chapter 1), Chapters 2–4 detail the methods and results for the finalist survey, bibliometric analysis, grant analysis, respectively. Chapter 5 summarizes the findings, and Appendix A contains the finalist survey.

2. Finalist Survey

The finalist survey queried this group of 120 investigators on their perceptions of their career using indicators of laboratory expansion, scientific recognition, and employment. The extent to which finalists *differed* from awardees in terms of these questions is both a subjective and objective matter, as these data are either perspectives and opinions of finalists or information not readily accessible through other means.

Those who completed the survey were designated survey respondents.

A. Methods

The finalist survey contained 14 questions pertaining to career progression that were analogous to questions assessing professional advancement in the awardee survey to allow for comparison of responses. The finalist survey was organized and administered using the approach outlined in Chapter 3 of the NI awardee outcomes evaluation. The finalist survey can be found in Appendix A, and the awardee survey can be found in the NI Awardee Outcomes Evaluation, Appendix D.

Both surveys were created using Survey Gizmo, a web-based survey design suite that allows survey designers to create and administer online surveys.[2] Potential respondents are sent a survey link tailored to a customizable and user-specific survey either through Survey Gizmo's email interface or through pasting the survey link into an email and contacting potential respondents directly.

Four weekly solicitation requests were sent by email to NI finalists and awardees. The first three requests were sent automatically through the Survey Gizmo system. The fourth reminder was a personal reminder sent from a member of the evaluation team. Survey respondents were removed from the reminder list if they completed the survey or declined to participate. Importantly, NI finalists and awardees were unaware of other surveyed groups. That is, finalists were unaware that they were an NI comparison group, and the awardee group was unaware of the finalist comparison group. This approach allows for survey responses to be a more accurate measure of attitudes and opinions without respect to a baseline of comparison.

Chi-square tests were conducted to assess if there were group differences across global job indicators and other career indicators.

[2] For information, go to SurveyGizmo.com, https://www.surveygizmo.com/.

B. Results

In the following sections, statistical analyses are presented for each section of the survey. Statistics are reported in tables, rather than the body of the text, for clarity.

The response rate from finalists, while low, was anticipated as one is asking the finalists to invest time in completing a survey for an award they did *not* receive (Table 1). The 30% finalist response rate is still within acceptable range for survey responses (detailed in STPI analysis on survey response rates and reported in the NIH NI Award briefing #6, 08 January 2015).

Table 1. Response Rates by Group

Group	Number Contacted (Population)	Number Agreeing to Participate (Response Rate)	Number Declining to Participate (Declination Rate)	Number That Did Not Respond (No Response Rate)
Finalists	120	36 (30%)	10 (9%)	74 (62%)
Awardees	115	49 (43%)	11 (9%)	52 (45%)

C. Perspectives on Career Advancement

1. Current Employment

There were no statistically significant differences in current employment between finalists and awardees, $\chi^2_{(1)} = 0.67$, $p = .414$, $\varphi = .09$ (Table 2).

Table 2. Current Employment by Group

Current Employment	Finalists	Awardees
Academic Institution	69%	80%
Medical Institution (University Affiliation)	19%	10%
Other*	11%	10%

* National Laboratories, medical affiliations not associated with a university, industry.

2. Laboratory Indicators

There were no statistically significant group differences in the percent of finalists and awardees who reported expanding their research laboratories, forming new collaborations, or expanding the focus of their laboratories to new scientific disciplines (Table 3).

Table 3. Laboratory Indicators by Group

Laboratory Indicator	Finalists	Awardees	χ^2	p	φ
Expanded Research Lab	78%	92%	2.32	.127	.17
Formed New Collaborations	97%	100%	2.42	.876	.02
Expanded Focus of Lab to new Disciplines	81%	90%	0.80	.371	.10

3. Career Indicators

There was a statistically significant group difference between finalists and awardees who reported being featured on a journal cover, as a larger percentage of awardees reported having their research featured on a journal cover. There were no statistically significant group differences in the percent of respondents who reported receiving an honor/award, popular press media coverage, or being asked to serve as a regular reviewer (Table 4).

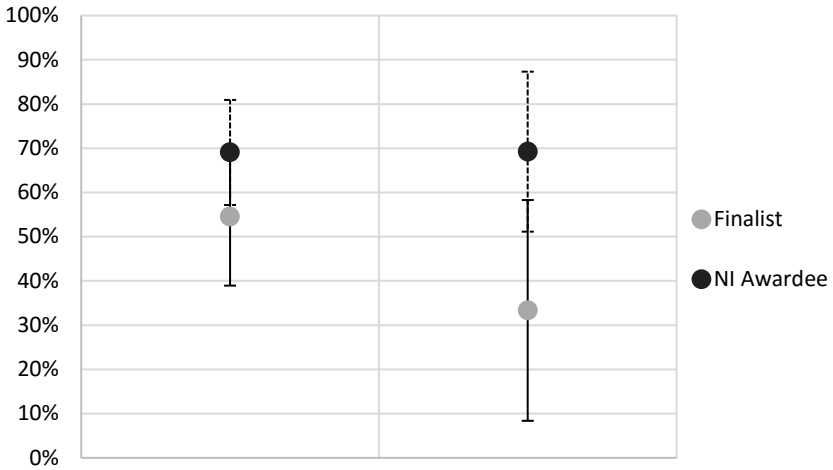
Table 4. Career Indicators by Group

Career Indicator	Finalists	Awardees	χ^2	p	φ
Received Honor/ Award	69%	86%	2.39	0.122	0.17
Popular Press Media Coverage	56%	76%	2.89	0.089	0.18
Journal Cover Feature	**17%**	**41%**	**4.62**	**0.032**	**0.23**
Asked to Serve as Regular Reviewer	75%	82%	0.22	0.638	0.05
Changed Institutions	24%	26%	<0.001	0.999	<0.001

Note: Bolding indicates statistical significance.

$p < .05$

There was no statistically significant difference between finalists and awardees in the percentages applying for or receiving, tenure since their submission of the NI application or receipt of the NI award (Figure 1).



NI Awardee *n; Finalist n*:	33; 42	13; 15
Observed Power:	0.25	0.47
Effect Size *Phi*:	0.15	0.36
p:	0.294	0.130
χ^2:	1.09	2.30

Figure 1. Tenure Status of Finalists and Awardees at Tenure-Granting Institutions

4. Summary of Career Indicators

Overall, there were few statistically significant differences between the finalist and awardee groups regarding career and laboratory indicators. A larger percentage of the awardee group reported having their research featured on a journal cover than the finalist group.

3. Bibliometric Analysis

The statistical assessment of scholarly publications and books, bibliometric analysis, has long been a cornerstone in program evaluations (Narin 1987). Unlike surveys, bibliometric analysis provides an alternative way to quantify research outputs without expert reviewers. The bibliometric analysis was performed on the 115 NI and 120 NI finalists.

The STPI team created four broad categories of analysis for each awardee's research portfolio: *productivity*, *impact*, *coauthor network*, and *interdisciplinarity*. Productivity measures the general output of research products by a researcher. Impact is meant to tap into the "information dissemination" factor and indicates the perception of research quality by the two "gates" of peer-review—publishers (journal prestige) and peer researchers (citations). The rationale behind these metrics is that prestigious journals will inevitably reach a wider audience and publications with high citations counts have inherently been read by many. Interdisciplinarity captures the breadth of knowledge being engaged by an awardee's research. Lastly, analysis of each awardee's coauthor network measures the spread of their collaboration network across individuals, institutions, and countries, indicating their ability to broker collaboration networks.

Bibliometric analysis assesses the effect of applying for or receiving the NI award on finalists' and awardees' careers by comparing an individual's career publications before and after the NI award decision, that decision being to award funding or decline to fund (henceforth referred to as *pre-decision* and *post-decision* publications).

While bibliometric analysis provides a method for more objectively evaluating career publications, they do have some notable caveats (Ismail et al. 2009):

1. *Publication data can be messy and incomplete*. Not only do the range of publications and journals vary based on the chosen dataset, but identifying correct author names and affiliations can also be difficult. Particularly with common names (e.g., John Smith), multiple authors may be publishing under the same name, making the task of identifying the correct set of publications attributed to the author of interest difficult and time-consuming.
2. *Citation counts and other bibliometric analyses are not necessarily unbiased*. Studies have shown that citation count measures can be biased against early researchers, who lack the established record of publications to gain significant citation counts. Additionally, researchers cite other papers for a broad range of

reasons and the consistency in citation behavior (e.g., providing background, criticizing previous work, and paying "homage" to field pioneers) can vary from researcher to researcher. Lastly, researchers have noted that bibliometric analysis can often struggle to entirely capture the "quality" of papers.

To reduce error in the publication sets, the team followed a consistent methodology, as detailed in the next section.

A. Methods

1. Career Publication Analysis

Career publication analysis allows for the analysis of an awardees' entire publication portfolio and has the advantage of a pre-decision and post-decision analysis and analysis by group. Further, the effects of applying for or receiving the NI award can be considered in terms of the change in research quality pre- and post-decision.

2. Programming Language

The STPI team used *R* (R Core Team 2016), a programming language and environment for statistical computing and graphics. Based on the *S* language and environment, the software is part of the GNU Project. R also has the advantage of being designed specifically for data handling and data manipulation and for possessing a diverse library of open-source packages intended to supplement and enhance the baseline capabilities of the language. *R* was used to ingest publication metadata and perform relevant analyses.

3. Obtaining Correct Scopus Author IDs and Publication Sets

Career publications and finalist and awardee names and institutions were queried against the Scopus publication database. When searching authors using name and affiliated institution, Scopus occasionally returns multiple author IDs. It is possible for an author's publication set to be split into two or more author IDs, particularly if the author has switched institutions or published under a different name. The STPI team determined which author IDs were correct for each author of interest.

A multistep process was followed using the *R* programming environment:

1. Searches that returned a single author ID were assumed correct.
2. Searches that returned multiple author IDs were assumed correct if all the returned institutions for the author were the same.

3. Searches that returned multiple author IDs with non-identical institutions were assumed correct if all the returned institutions could be matched to the authors' affiliated institutions found in the finalist/awardee database.

4. Remaining search results with multiple author IDs were checked by hand. The STPI team conducted an online search to determine which returned author IDs were correct.

The correct author IDs were then compiled into a list that was then used to query the Scopus application program interface (API) for all publications affiliated with those authors. [3] Each author ID query returned publications in XML files, which were then parsed using *R*.

4. Qualities Assessed

Seeking to quantify the four measured research qualities—productivity, impact, coauthor network, and interdisciplinarity—the STPI team leveraged a range of bibliometric techniques. Table 5 outlines the metrics included in each of these research qualities.

[3] For information, see Esevier.com, "Scopus APIs," https://www.elsevier.com/solutions/scopus/features/api.

Table 5. Research Quality Categories and Associated Metrics

Research Quality	Metric	Description
N/A	Total Publications	Raw count of publications.
	Publication Delay Relative to Award	Time lag between award start and publication date.
	Annual Publications	Time-normalized rate of publication in the form of average publications per year.
Productivity & Impact	Average Citations per Publication	Average count of citations per publication.
	H-Index	A metric proposed by Hirsch (2005) that is defined as the number of papers (*h*) with at least *h* citations each.
	Impact per Publication (IPP)	Also known as raw impact per paper, this number denotes the average number of citations per paper published in a journal (Moed 2010). These data are provided by Scopus for each journal.
	Journal Source-Normalized Impact per Publication (SNIP)	Similar to IPP, but normalized to account for differences in citation rates between fields of study (Moed 2010). These data are provided by Scopus for each journal.
	SCImago Journal Ranking (SJR)	A computed ranking score that is calculated using citation weighting schemes and eigenvector centrality (González-Pereira, Guerrero-Bote, and Moya-Anegón 2010). These data are provided by Scopus for each journal.
Coauthor Network	Average Coauthors per Publication	Average number of other authors on a given publication.
	Unique Coauthors	Count of unique authors that awardee has published with.
	Unique Coauthor Affiliations	Count of unique coauthor institutions and countries. Captures how many different countries and institutions have been collaborated with.
Interdisciplinarity	Unique Journal Subject Codes	Count of unique journal subject matter/field indicators, as provided by Scopus.

a. Career Publication Analysis

An analysis on career publications is presented for each research output and quality metric. These analyses were conducted as within-subject, doubly multivariate GLM-repeated measures analyses, with two within subject variables (*group*: *awardee*, *finalist*; *time*: *pre-decision* + 1, *post-decision* + 1)[4] across all measures of research quality and

[4] A one-year lag was introduced to ensure that publications in press or preparation before the NI decision were counted as pre-decision publications. Ultimately, finalists did not receive the NI award, while awardees received the NI award.

outputs. *pre-decision* + 1 publications refer to all publications published before one year after receipt of award. *Post-decision* +1 publications refer to all publications published at least one year following the award decision. Due to severe positive skew for several bibliometric analyses that likely violate the assumption of normality, the data were transformed using a natural log transformation. Thus, all career publication analyses are presented in log units.

A doubly multivariate GLM-repeated measures analysis allows for the estimation of several effects, including the main effects for *group* and *time,* as well as the group-by-time interaction. A statistically significant main effect of *group*, ignoring other main effects and the interaction, indicates statistically significant group differences on a bibliometric outcome. A statistically significant effect of *time*, in the absence of other effects, indicates statistically significant increases or decreases in a bibliometric outcome from *pre-decision* + 1 to *post-decision* + 1. A statistically significant *group*-by-*time* interaction indicates group differences in bibliometric outcomes that vary from *pre-decision* + 1 to *post-decision* + 1. For example, it may be the case that awardees have a number of publications similar to that of finalists awardees before receiving their award, but had significantly more publications following the award than did finalists. In the presence of a statistically significant interaction, main effects are omitted.

B. Results

In the following sections, statistical analyses are presented for each of the research qualities for career publications.

1. Research Productivity and Impact

a. Number of Publications

The STPI team analyzed the total number of publications to understand researcher productivity—defined as the raw production of research outputs.

Overall, there was no statistically significant effect of *group*, $F_{(1, 228)} = 0.15$, $p = .697$, $\eta^2_p = .001$. There was a statistically significant effect of *time* $F_{(1, 228)} = 62.53$, $p < .001$, $\eta^2_p = .215$; awardees and finalists had more total publications *post-decision* + 1 compared to *pre-decision* + 1, $M_{\log(post\text{-}decision + 1) - \log(pre\text{-}decision + 1)} = 0.339$, 95% CI [0.225, 0.424]. There was no statistically significant *group*-by-*time* interaction for total career publications, indicating that group differences in total publications did not vary significantly over time (Figure 2).

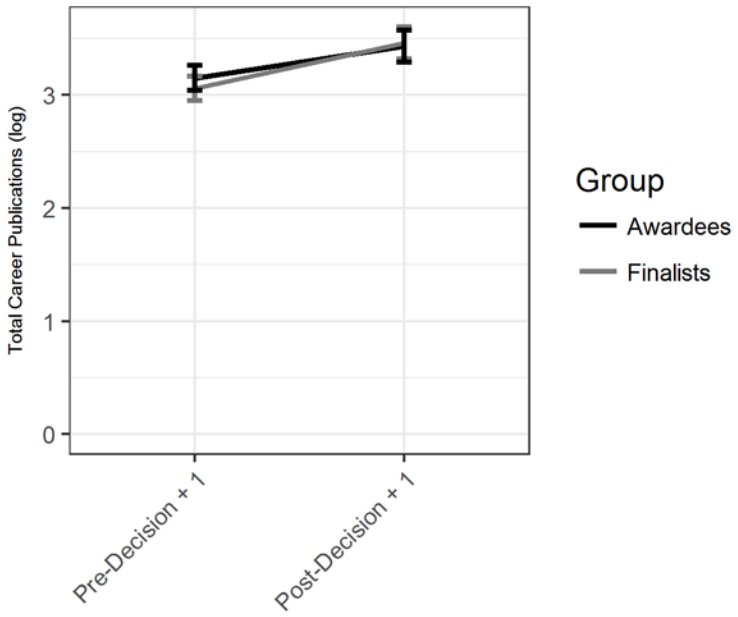


Figure 2. Total Career Publications

b. Annual Publication Production

There was a statistically significant *group*-by-*time* interaction for average annual publications, $F_{(1, 228)} = 8.288$, $p = .004$, $\eta^2_p = .035$, indicating that group differences in annual publications varied from *pre-decision* + 1 to *post-decision* + 1 publications. Follow up simple effects analyses were conducted to tease apart this interaction. Regarding average annual publications, compared to finalists NIA awardees had slightly fewer, though not significantly, *pre-decision* + 1 average annual publications, $M_{\log(awardee) - \log(finalist)} = -0.049$, $p = .123$, 95% CI [–0.135, 0.037], but slightly more, though not significantly, *post-decision* + 1 average annual publications, $M_{\log(awardee) - \log(finalist)} = 0.115$, $p = .123$, 95% CI [–0.031, 0.261] (Figure 3).

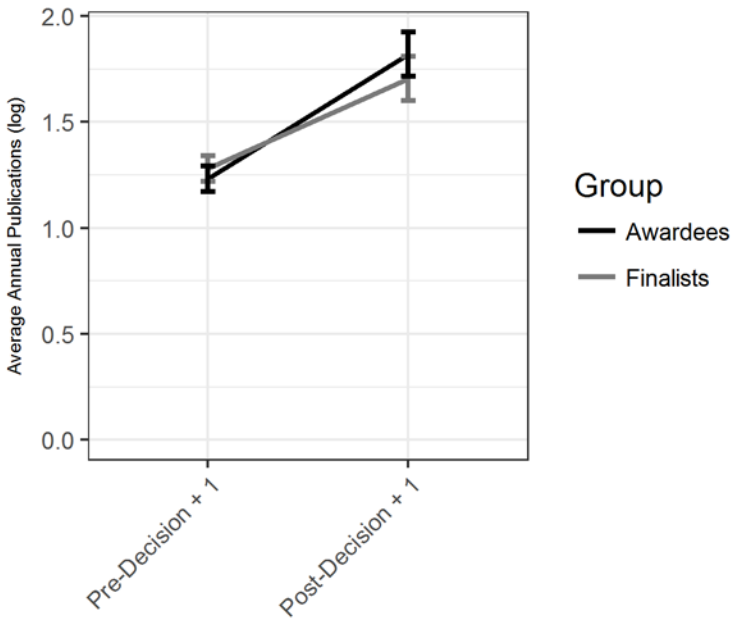


Figure 3. Average Annual Publications

The team used citations and journal ranking metrics to better understand the impact of research produced by finalists and awardees. Both metrics provide a proxy for understanding of the relevance and quality of the published research—citations indicate reception among fellow researchers, while journal rankings indicate the perception of the research by academic publishers.

c. Citation Count

There was a statistically significant *group*-by-*time* interaction for average number of citations per publications, $F_{(1, 228)} = 9.216$, $p = .003$, $\eta^2_p = .039$, indicating that group differences in average citation rates varied for *pre-decision* + 1 and *post-decision* + 1 publications. Follow up simple effects analyses were conducted to tease apart this interaction. Awardees tended to have more average citations per publication than finalists for *pre-decision* + 1 publications, $M_{\log(awardee) - \log(finalist)} = 0.338$, $p < .001$, 95% CI [0.139, 0.538], but there was no statistically significant *group* difference in average citations per publications for *post-decision* + 1 publications, $M_{\log(post\text{-}decision + 1) - \log(pre\text{-}decision + 1)} = 0.063$, $p = .505$, 95% CI [–0.124, 0.250] (Figure 4).

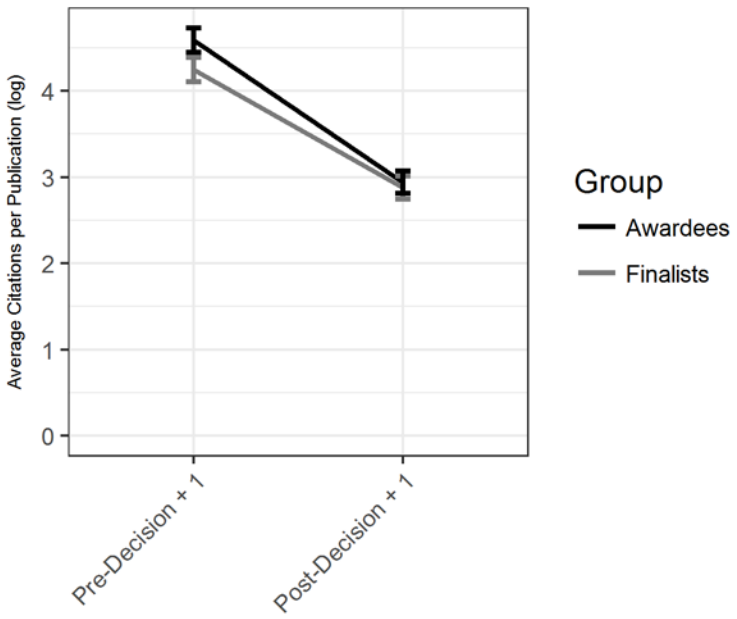


Figure 4. Average Citations per Publication

d. H Index

There was a statistically significant *group*-by-*time* interaction, $F_{(1, 228)} = 28.899$, $p < .001$, $\eta^2_p = .112$, indicating that group differences in H-indexes significantly varied from *pre-decision* + 1 to *post-decision* + 1. Follow up simple effects analyses were conducted to tease apart this interaction. Compared to finalists, awardee H-indexes were marginally higher at *pre-decision* + 1, $M_{\log(awardee) - \log(finalist)} = 0.109$, $p = .069$, 95% CI [–0.009, 0.226], but significantly lower at *post-decision* + 1, $M_{\log(awardee) - \log(finalist)} = –0.292$, $p < .001$, 95% CI [–0.453, –0.131] (Figure 5).

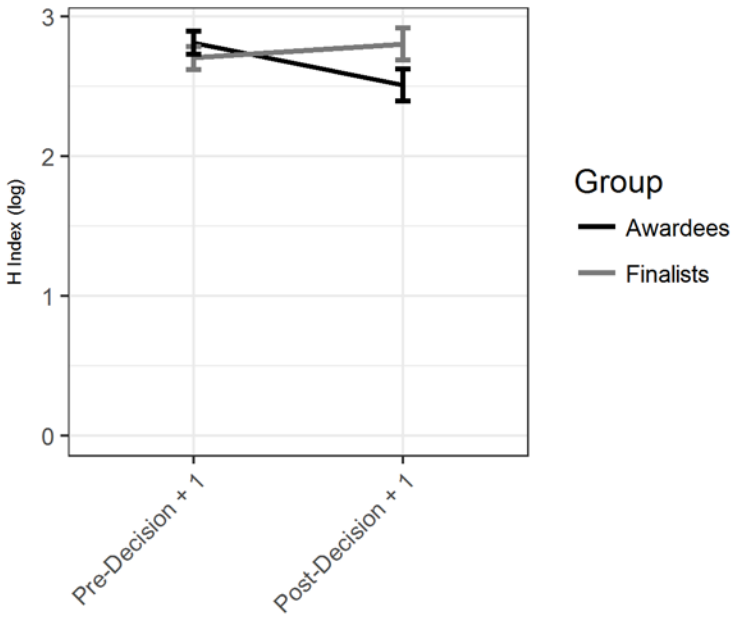


Figure 5. H-Index

2. Journal Impact Factor and Ranking

The STPI team calculated the average journal impact factor of each finalist and awardee. The team used three journal impact factors: (1) *Impact Per Publication (IPP)*, which measures the average number of citations per journal publication, and (2) *Source-Normalized Impact Per Publication (SNIP)*, which normalizes the IPP metric to account for differences between research fields and (3) *SCImago Journal Ranking (SJR)*, which emphasizes the sources used by prestigious journals and creates weights associated with levels of prestige.

a. IPP Journal Metric

Overall, awardees tended to publish in journals with larger IPPs than did finalists, $F_{(1, 228)} = 23.287$, $p < .001$, $\eta^2_p = .093$, $M_{\log(awardee) - \log(finalist)} = 0.264$, 95% CI [0.156, 0.372]. Further, there was a statistically significant effect of *time*, $F_{(1, 228)} = 20.949$, $p < .001$, $\eta^2_p = .084$, such that finalists and awardees tended to publish *post-decision* + 1 publications in journals with smaller IPPs, $M_{\log(post\text{-}decision\ +1) - \log(pre\text{-}decision\ +1)} = -0.113$, 95% CI [–0.162, –0.064]. There was no statistically significant *group*-by-*time* interaction, $F_{(1, 228)} = 0.731$, $p = .393$, $\eta^2_p = .003$, indicating that group differences in IPP did not vary significantly over time (Figure 6).

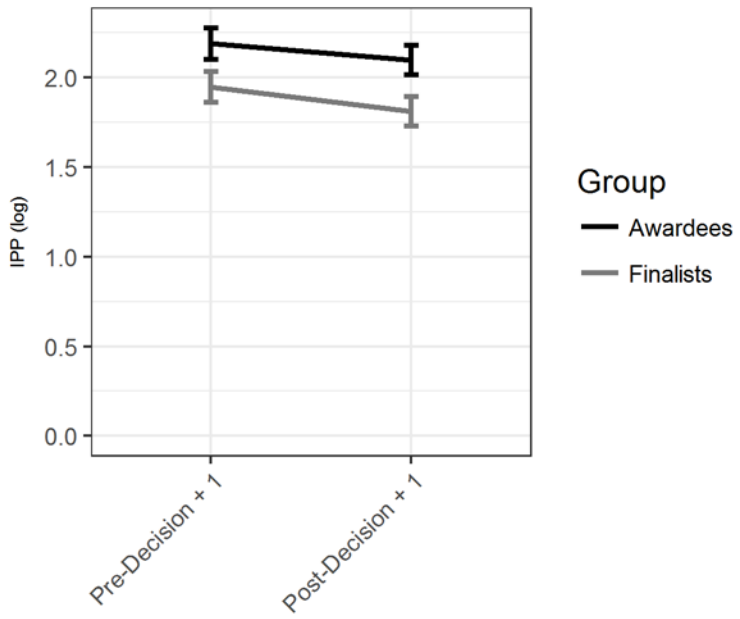


Figure 6. Average Impact per Publication (IPP)

b. SNIP Journal Metric

There was a statistically significant effect of *g*roup, $F_{(1, 228)} = 15.541$, $p < .001$, $\eta^2_p = .064$, such that awardees tended to publish in journals with larger SNIPs than did finalists, $M_{\log(awardee) - \log(finalist)} = 0.121$, 95% CI [0.061, 0.181]. Further, there was a statistically significant effect of *time*, $F_{(1, 228)} = 29.511$, $p < .001$, $\eta^2_p = .115$, such that finalists and awardees tended to publish *post-decision* + 1 publications in journals with smaller SNIPs, $M_{\log(post\text{-}decision\ +1) - \log(pre\text{-}decision\ +1)} = -0.090$, 95% CI [–0.123, –0.058]. There was no statistically significant *group*-by-*time* interaction, $F_{(1, 228)} = 0.371$, $p = .543$, $\eta^2_p = .002$, indicating that *group* differences in SNIP did not vary significantly over time (Figure 7).

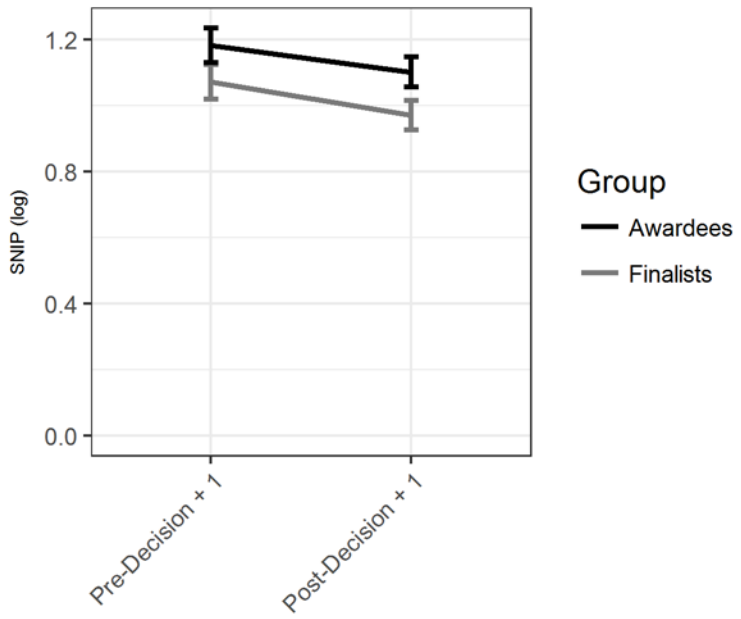


Figure 7. Average Source-Normalized Impact per Publication (SNIP)

c. SCImago Journal Ranking (SJR)

There was a statistically significant effect of *group*, $F_{(1, 228)} = 5.372$, $p = .021$, $\eta^2_p = .023$, such that awardees tended to publish in journals with larger SJRs than did finalists, $M_{\log(awardee) - \log(finalist)} = 0.145$, 95% CI [0.022, 0.268]. Further, there was a statistically significant effect of *time*, $F_{(1, 228)} = 23.346$, $p < .001$, $\eta^2_p = .093$, such that finalists and awardees tended to publish *post-decision* + 1 publications in journals with smaller SJRs, $M_{\log(post\text{-}decision\ +1) - \log(pre\text{-}decision\ +1)} = –0.119$, 95% CI [–0.168, –0.071]. There was no statistically significant *group*-by-*time* interaction, $F_{(1, 228)} = 0.933$, $p = .335$, $\eta^2_p = .004$, indicating that *group* differences in SJRs did not vary significantly over *time* (Figure 8).

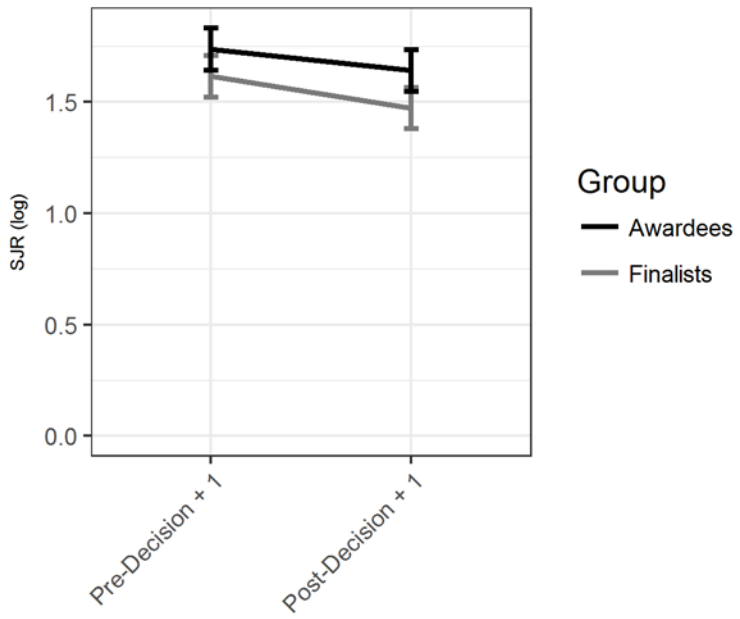


Figure 8. Average SCImago Journal Ranking (SJR)

d. Summary of Findings: Research Productivity and Impact

The results from the bibliometric analysis on productivity metrics indicate that both finalists and awardees increased publications over time. Additionally, finalists and awardees had similar annual career publications following the award.

The results from the bibliometric analysis on impact metrics indicate that awardees had more citations per publication than finalists for publications predating the NI award decision, but the *group*s had similar citation rates for publications published after the NI decision. Finalists and awardees also differed significantly in the degree to which their publication H-indexes changed over time; finalists and awardees had similar H-indexes *pre decision* + 1, while finalists had larger *post-decision* + 1 decision H-indexes. Main effects for most measures of impact suggest that awardees published more impactful research both pre- and post-decision compared to finalists.

3. Collaboration

To better understand size and breadth of research collaborations, the STPI team analyzed the coauthor networks displayed by finalist's and awardee's career publications.

a. Average Authors per Paper

Finalists and awardees did not differ significantly in average number of coauthors per paper, $F_{(1, 228)} = 1.753$, $p = .187$, $\eta^2_p < .008$. There was a statistically significant effect of

time, $F_{(1, 228)} = 67.399$, $p < .001$, $\eta^2_p = .228$, such that both finalists and awardees tended to have more coauthors per publication on *post-decision* + 1 publications, $M_{\log(\textit{post-decision} +1) - \log(\textit{pre-decision} +1)} = 0.242$, 95% CI [0.184, 0.300]. There was no statistically significant *group*-by-*time* interaction, $F_{(1, 228)} = 2.648$, $p = .105$, $\eta^2_p = .011$, indicating that the relationship between *group* and average co-authors per publication did not vary significantly across *time* (Figure 9).

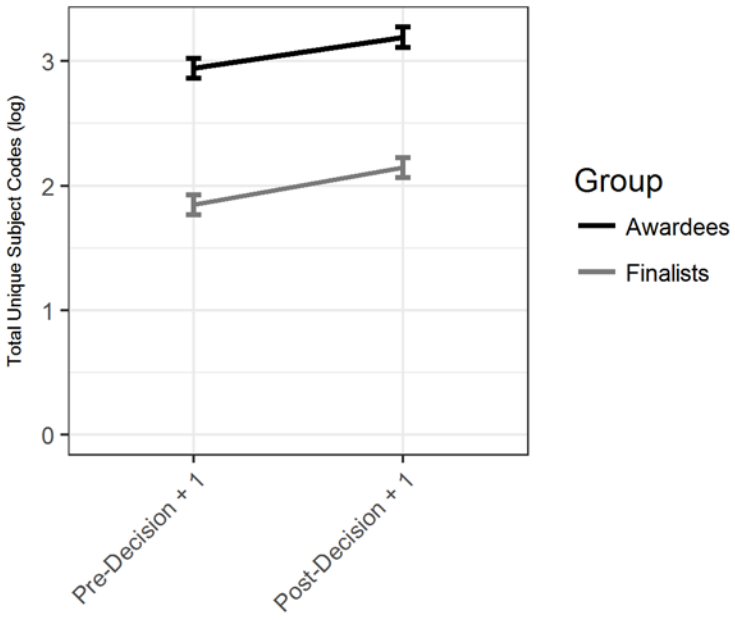


Figure 9. Unique Journal Subject Codes

b. Number of Unique Coauthors

There was a statistically significant *group*-by-*time* interaction, $F_{(1, 228)} = 9.346$, $p = .003$, $\eta^2_p = .039$, indicating that group differences in the number of unique coauthors significantly varied from *pre-decision* + 1 to *post-decision* + 1. Follow-up simple effects analyses were conducted to tease apart this interaction. The number of unique coauthors was significantly higher for awardees compared to finalists at *pre-decision* + 1, $M_{\log(\textit{awardee}) - \log(\textit{finalist})} = 0.266$, $p = .009$, 95% CI [0.068, 0.465], but there was no significant *post-decision* + 1 difference, $M_{\log(\textit{awardee}) - \log(\textit{finalist})} = –0.043$, $p = .739$, 95% CI [–0.296, 0.210] (Figure 10).

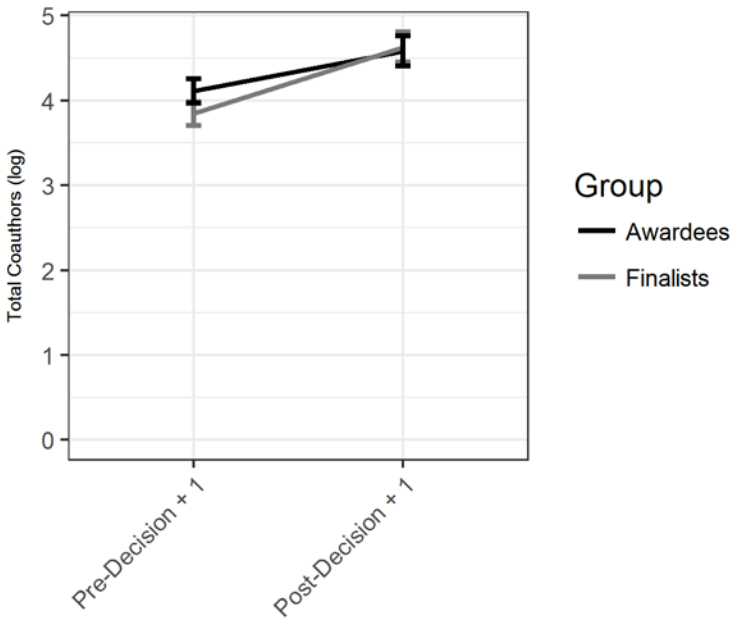


Figure 10. Number of Unique Coauthors.

c. Coauthor Affiliations

The STPI team evaluated the institutions and countries in each finalist's and awardee's coauthor network as a measure of the size and breadth of their research collaborations.

d. Number of institutions engaged in grant supported research

1) Total Number of Institutions

There was a statistically significant *group*-by-*time* interaction, $F_{(1, 228)} = 6.517$, $p = .011$, $\eta^2_p = .028$, indicating that *group* differences in the number of total institutions significantly varied from *pre-decision* + 1 to *post-decision* + 1. Follow-up simple effects analyses were conducted to tease apart this interaction. Compared to finalists, the number of unique institutions was slightly, though not significantly higher for awardees at *pre-decision* + 1, $M_{\log(awardee) - \log(finalist)} = 0.134$, $p = .121$, 95% CI [–0.036, 0.304], but slightly, though not significantly, lower for awardees at *post-decision* + 1, $M_{\log(awardee) - \log(finalist)} = -0.125$, $p = .319$, 95% CI [–0.370, 0.121] (Figure 11).

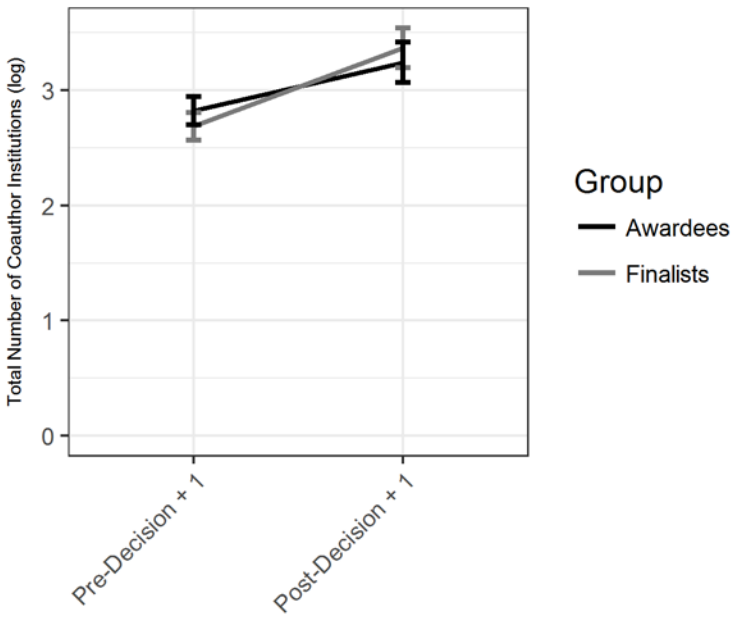


Figure 11. Number of Unique Institutions in Coauthor Network

2) Average Number of Institutions

There was no statistically significant effect of *group*, $F_{(1, 228)} = .951$, $p = .330$, $\eta^2_p < .004$ on number of institutions. There was a statistically significant effect of *time*, $F_{(1, 228)} = 100.895$, $p < .001$, $\eta^2_p = .307$, such that finalists and awardees tended to have a higher average number of institutions in their network following the award, $M_{\log(post\text{-}decision\ +1)\ -\ \log(pre\text{-}decision\ +1)} = 0.170$, 95% CI [0.136, 0.203]. There was no statistically significant *group*-by-*time* interaction, $F_{(1, 228)} = 2.499$, $p = .115$, $\eta^2_p = .011$, indicating that the relationship between *group* and average number of institutions did not vary significantly from *pre-decision* + 1 to *post-decision* + 1 (Figure 12).

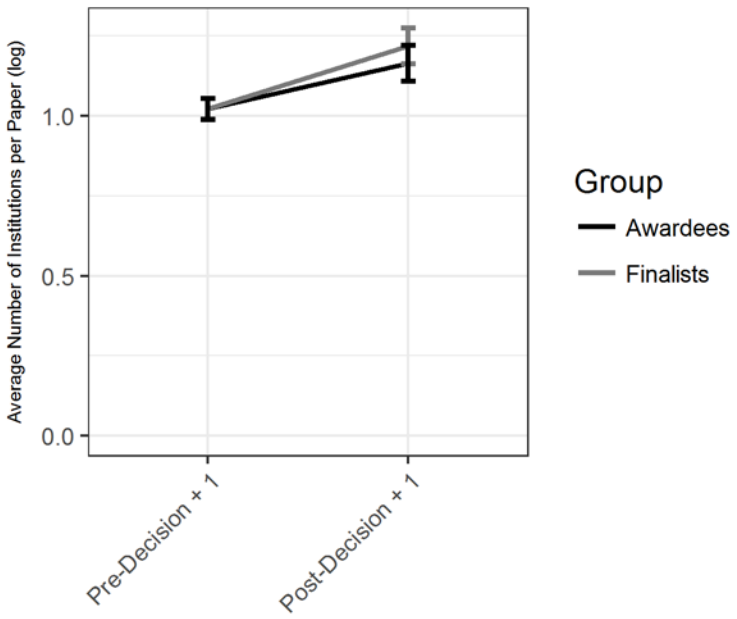


Figure 12. Average Number of Institutions in Coauthor Network

e. Number of countries engaged in research

1) Number of Unique Countries

There was a statistically significant *group*-by-*time* interaction, $F_{(1, 228)} = 5.441$, p = .021, $\eta^2_p = .023$, indicating that *group* differences in the number of total countries significantly varied from *pre-decision* + 1 to *post-decision* + 1. Follow-up simple effects analyses were conducted to tease apart this interaction. Compared to finalists, the number of unique countries was slightly, though not significantly, higher for awardees at *pre-decision* + 1, $M_{\log(awardee) - \log(finalist)} = 0.134$, $p = .121$, 95% CI [–0.036, 0.304], but slightly, though not significantly, lower at *post-decision* + 1, $M_{\log(awardee) - \log(finalist)} = –0.125$, $p = .319$, 95% CI [–0.370, 0.121] (Figure 13).

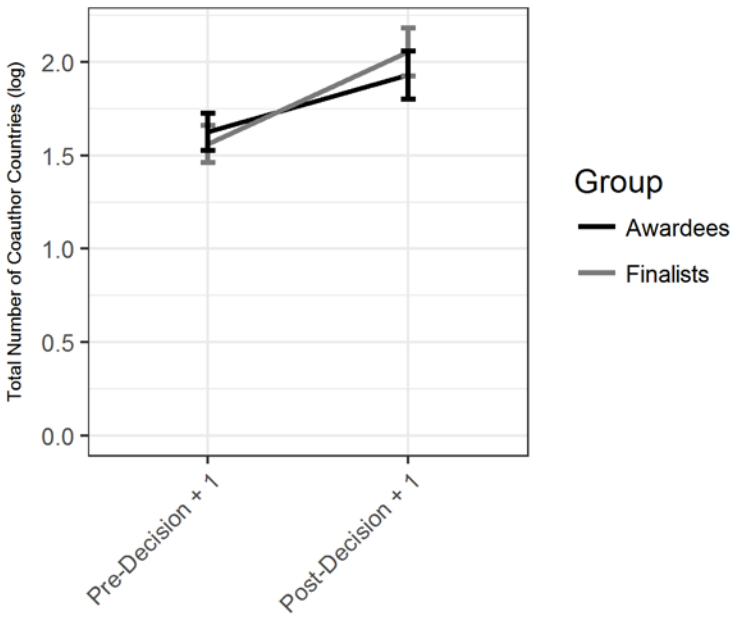


Figure 13. Number of Unique Countries in Coauthor Network

2) Average Number of Countries

There was a statistically significant effect of *group*, $F_{(1, 228)} = 6.251$, p = .013, η^2_p = .027, indicating that awardee research engaged fewer countries on average than did finalist research, $M_{\log(awardee) - \log(finalist)} = -0.038$, 95% CI [–0.068, –0.008]. There was also a statistically significant effect of *time*, $F_{(1, 228)} = 46.808$, $p < .001$, $\eta^2_p = .017$, such that finalists and awardees tended to have more countries in their network following the award, $M_{\log(post\text{-}decision +1) - \log(pre\text{-}decision +1)} = 0.066$, 95% CI [0.047, 0.084]. There was no statistically significant *group*-by-*time* interaction, $F_{(1, 228)} = 2.175$, $p = .142$, $\eta^2_p = .009$, indicating that the relationship between *group* and total countries did not vary significantly from *pre-decision* + 1 to *post-decision* + 1 (Figure 14).

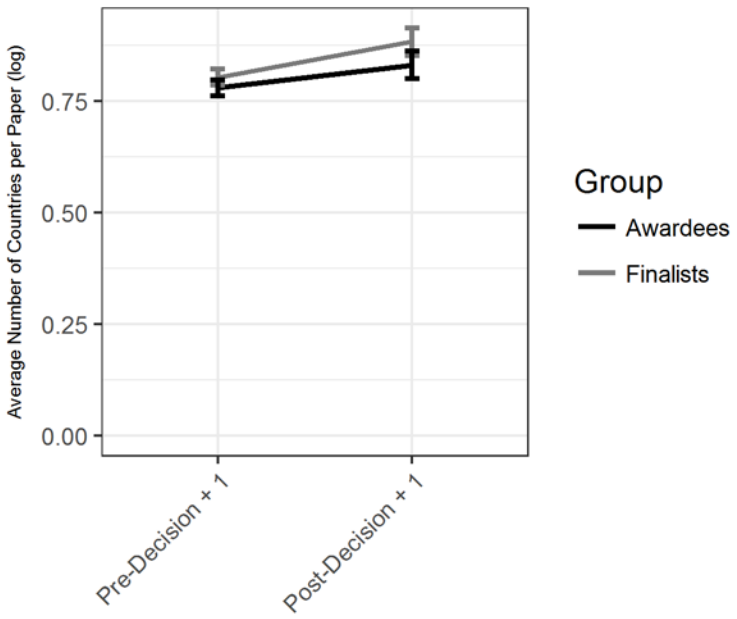


Figure 14. Average Number of Countries in Coauthor Network

f. Summary of Findings: Co-author Network

Awardees had more authors per paper on average than finalists both *pre and post-decision* +1 suggesting a broader array of research collaborators. Awardees had more total co-authors *pre-decision* + 1 but the groups had similar numbers of total co-authors post-decision. Finalists tended to have more countries per publication than awardees, while total co-author institutions and countries were comparable for the two groups.

4. Interdisciplinarity

a. Journal Subject Codes

There was a statistically significant effect of *group*, $F_{(1, 228)} = 444.529$, $p < .001$, $\eta^2_p = .661$ on the number of unique subject codes, such that awardee publications had more unique subject codes than did finalist publications, $M_{\log(awardee) - \log(finalist)} = 1.071$, 95% CI [0.971, 1.171]. There was also a statistically significant effect of *time* ($F_{(1, 228)} = 100.996$, $p < .001$, $\eta^2_p = .307$), such that both finalists and awardees tended to have more total subject codes *post-Decision* + 1, $M_{\log(post\text{-}decision\ +1) - \log(pre\text{-}decision\ +1)} = 0.274$, 95% CI [0.221, 0.328]. There was no statistically significant *group*-by-*time* interaction, $F_{(1, 228)} = 0.821$, $p = .366$, $\eta^2_p = .004$, indicating that the relationship between *group* and total unique subject codes did not vary significantly from *pre-decision* + 1 to *post-decision* + 1.

b. Summary of Findings: Interdisciplinarity

Awardee research had more total subject codes both *pre-* and *post-decision* + 1 than finalists. Overall, total subject codes increased from *pre-decision* +1 to *post-decision* + 1 (Figure 15).

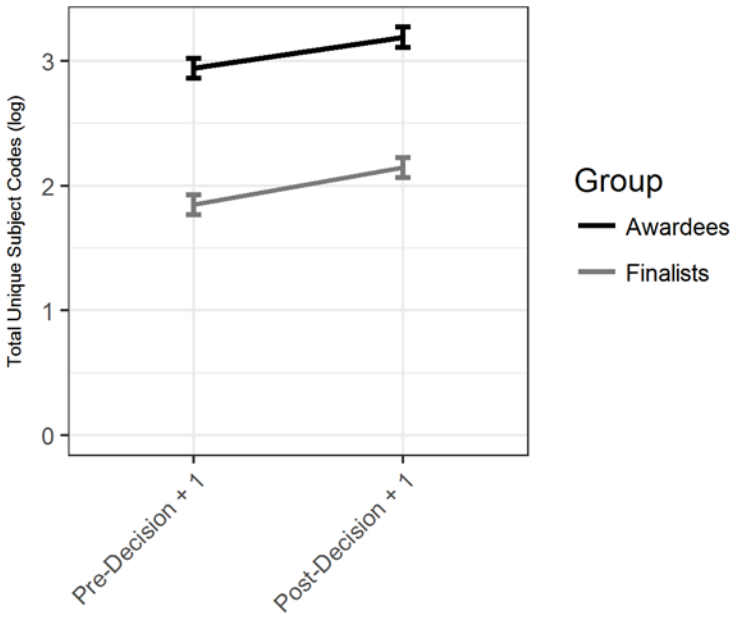


Figure 15. Subject Codes

C. Summary of Bibliometric Findings

Overall, findings from the bibliometric analysis provided mixed results. In terms of research impact, awardees tended have more impactful publications both p*re-* and *post-decision* + 1, with the exception of H-index, whereas finalists had larger *post-decision* + 1 H-indexes than awardees. Awardees and finalists co-author networks were similar in terms of total co-authors, institutions, and countries involved in research. Awardees tended to have more co-authors on a per paper basis for *pre-decision* + 1 publications, while finalists had more co-author countries on a per paper basis than awardees. Awardee research had more total subject codes both *pre-* and *post-decision* + 1 than did finalists.

4. Grant Funding Analysis

The ability to compete successfully for grant funding is often necessary for the continuation of biomedical and biobehavioral research. To examine the finalist's and awardee's ongoing funding status, The STPI team analyzed the number of grant applications submitted by the NI awardees and NI finalists over a period of 8 years following the award decision and the number of those applications that were funded.

A. Methodology

Finalist and awardee grant information was obtained from the IMPAC II database. The STPI team used the *R* software environment to extract records for applications on which the 120 finalists and 115 NI awardees were listed as Principle Investigators (PIs). Records of 2,411 grant applications remained after (1) restricting analyses to Type 1 and Type 2 competitive applications, (2) removing Type 1 applications for the original project for which the investigator applied, (3) removing applications submitted before the original application project start date or after 8 years of the original application project start date, (4) keeping one record per distinct awardee, type, and project (i.e., resubmissions were not counted as a new application).

The STPI team then compared (1) the proportion of the finalist and awardee groups that applied; (2) the average number of applications submitted by finalists and awardees; (3) the rate at which each groups' applications were awarded; (4) the average number of awards received by finalists and awardees; and (5) the proportion of each awardee group that received one or more awards. These comparisons were made for Type 1 applications for any NIH grant, Type 1 applications for DP1 grants, and Type 1, Type 2, and Type 1 and 2 combined for R01 applications.

To test significant differences between the proportion of awardees who applied and were awarded funding, the team used binomial proportion tests. Two sample proportion tests and Fisher's Exact tests (for small expected frequencies) assessed the degree to which the finalist and awardee group variable was related to the proportion of applications awarded. Wilcoxon rank-sum tests for independent samples assessed differences in the number of applications submitted and awarded for each group. All tests were two-tailed with α critical = 0.05. Significance levels were not adjusted for multiple comparisons.

B. Results: NI Awardee and Finalist Post-Decision Grant Applications and Awards

1. All NIH NI Awardee and Finalist Applications and Awards

a. Applied for Funding

The STPI team first examined all Type 1 applications for any NIH grant submitted by finalists and awardees. Each comparison is illustrated in Figure 16, and descriptive statistics and statistical test results are provided in Table 6. Finalists and awardees were equally likely to apply for an NIH grant, as there was no significant difference in the proportion of each awardee group that submitted at least one application. Finalists and awardees also submitted a similar number of applications.

b. Received Funding

Finalist and awardee applications were awarded at a similar rate. Thus, finalists and awardees also received a similar number of awards. The resulting proportion of each group who were funded did not differ significantly.

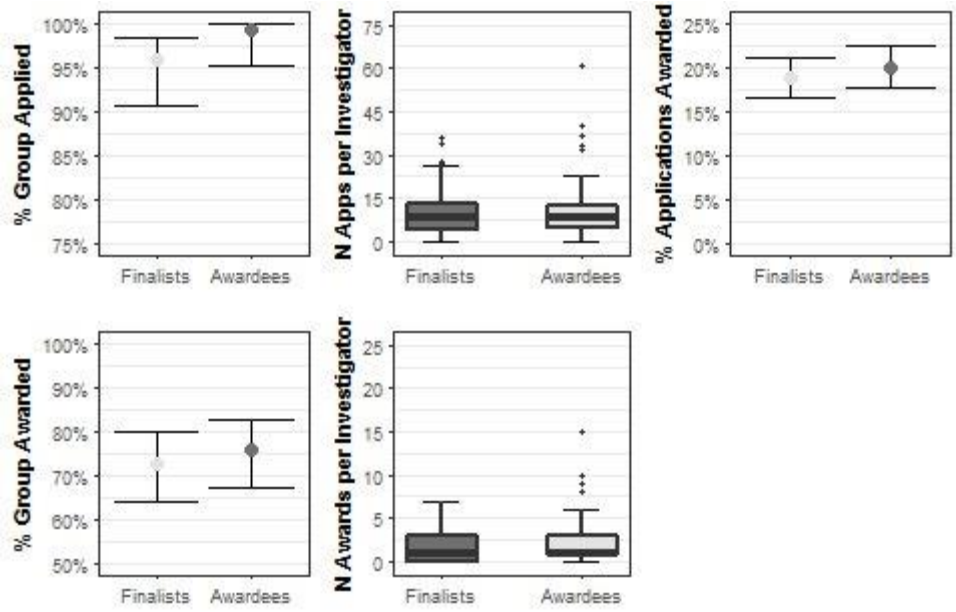


Figure 16. All NIH Grants Applied for and Received by Finalists and Awardees

Table 6. All NIH Grant Applications and Awards

All NIH Grants	NI Finalists		NI Awardees		Test Statistic	*p* Value	Effect Size
	Statistic	95% CI	Statistic	95% CI			
Applications							
Mean (SD)	9.55 (7.21)	[8.22, 10.80]†	10.17 (8.70)	[8.50, 11.64]†			
Median	8	[7.00, 9.00]†	8.00	[6.00, 9.00]†	$W = 6725.00$	.737	$r = 0.02$
Proportion of Group Applied	95.83% (115/120)	[90.62%, 98.21%]‡	99.13% (114/115)	[95.24%, 99.96%]‡	$\chi^2_{(df=1)} = 1.41$	.235	*Phi* = 0.10
Awards							
Mean (SD)	1.78 (1.75)	[1.46, 2.09]†	2.03 (2.23)	[1.59, 2.41]†			
Median	1	[0.00, 1.00]†	1.00	[0.00, 1.00]†	$W = 6560.00$	.505	$r = 0.04$
Percent of Applications Awarded	18.67% (214/1146)	[16.52%, 21.03%]‡	19.93% (233/1169)	[17.74%, 22.32%]‡	$\chi^2_{(df=1)} = 0.51$	.475	*Phi* = 0.02
Percent of Group Awarded	72.50% (87/120)	[63.91%, 79.70%]‡	75.65% (87/115)	[67.06%, 82.58%]‡	$\chi^2_{(df=1)} = 0.16$	.688	*Phi* = 0.04

† Bootstrapped Basic confidence intervals.

‡ Wilson score-test-based binomial confidence intervals.

2. DP1 Grants

a. Applied for Funding

Regarding DP1 applications, a significantly higher proportion of NI awardees than finalists applied. In addition to being more likely to apply, NI awardees also submitted significantly more applications. Comparisons are illustrated in Figure 17, and all descriptive statistics and statistical test results are provided in Table 7.

b. Received Funding

DP1 applications were awarded at a similar rate for each awardee group. NI awardees received significantly more awards than did finalists due to their higher rate of application submissions, though there was no significant difference in the proportion of finalists and awardees who received DP1 funding.

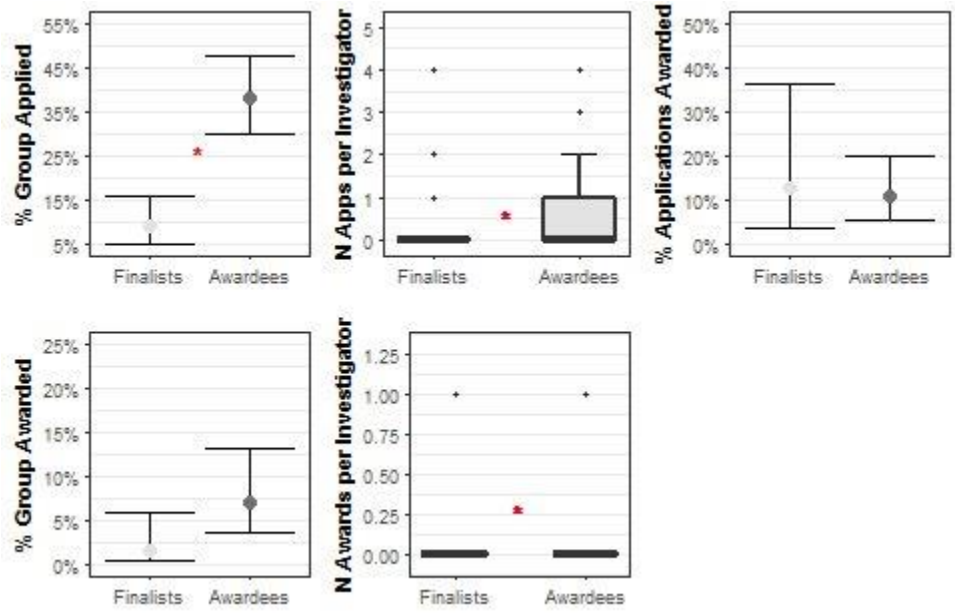


Figure 17. DP1 Grants Applied for and Received by Finalists and Awardees

Table 7. DP1 Applications and Awards

DP1	NI Finalists		NI Awardees		Test Statistic	*p* Value	Effect Size
	Statistic	**95% CI**	**Statistic**	**95% CI**			
Applications							
Mean (SD)	0.13 (0.50)	[0.03, 0.21]†	0.64 (1.00)	[0.45, 0.82]†			
Median	0.00	[0.00, 0.00]†	0.00	[0.00, 0.00]†	W = **4854.00**	**<.001**	r = **0.35**
Proportion of Group Applied	9.17% (11/120)	[5.20%, 15.67%]‡	38.26% (44/115)	[29.89%, 47.39%]‡	$\chi^2_{(df = 1)}$ = **26.13**	**<.001**	*Phi* = **0.34**
Awards							
Mean (SD)	0.02 (0.13)	[–0.01, 0.03]†	0.07 (0.26)	[0.02, 0.11]†			
Median	0.00	[0.00, 0.00]†	0.00	[0.00, 0.00]†	W = **6535.00**	**.045**	r = **0.13**
Percent of Applications Awarded	12.50% (2/16)	[3.50%, 36.02%]‡	10.81% (8/74)	[5.58%, 19.91%]‡	$\chi^2_{(df = 1)}$ = 0.00	>.999	*Phi* = 0.02
Percent of Group Awarded	1.67% (2/120)	[0.46%, 5.87%]‡	6.96% (8/115)	[3.57%, 13.13%]‡	$\chi^2_{(df = 1)}$ = 2.84	.092	*Phi* = 0.13

Note: Bolded results are significant.

† Bootstrapped Basic confidence intervals.

‡ Wilson score-test-based binomial confidence intervals.

3. R01 Grants

STPI team members analyzed differences in several combinations of R01 Type 1 and Type 2 applications and awards in order to understand the finalist and awardee post-award application and award landscape. All comparisons are illustrated in Figures 18a and 18b, and descriptive statistics and results for each comparison are shown in Tables 8a, 8b, and 8c.

a. Applied for Funding

There was no statistically significant difference in the proportion of the finalist and awardee groups who applied for R01 Type 1 grants, nor in the number of R01 Type 1 applications submitted by each investigator.

The finalist group applied for R01 Type 2 grants at a significantly higher rate and submitted significantly more R01 Type 2 applications than did awardees. However, considering R01 Type 1 and Type 2 applications together, a significantly larger proportion of the awardee group applied for both types of R01 grants than did the finalist group, though there was no significant different in the number of R01 Type 1 and Type 2 applications submitted.

b. Received Funding

R01 applications were awarded at a similar rate for both groups regardless of type, suggesting that finalists and awardees were likely to be successful in receiving R01 funding. There were no statistically significant differences in the number of awards received by investigators in each group. Finally, there was no statistically significant difference in the proportion of each group that received an award.

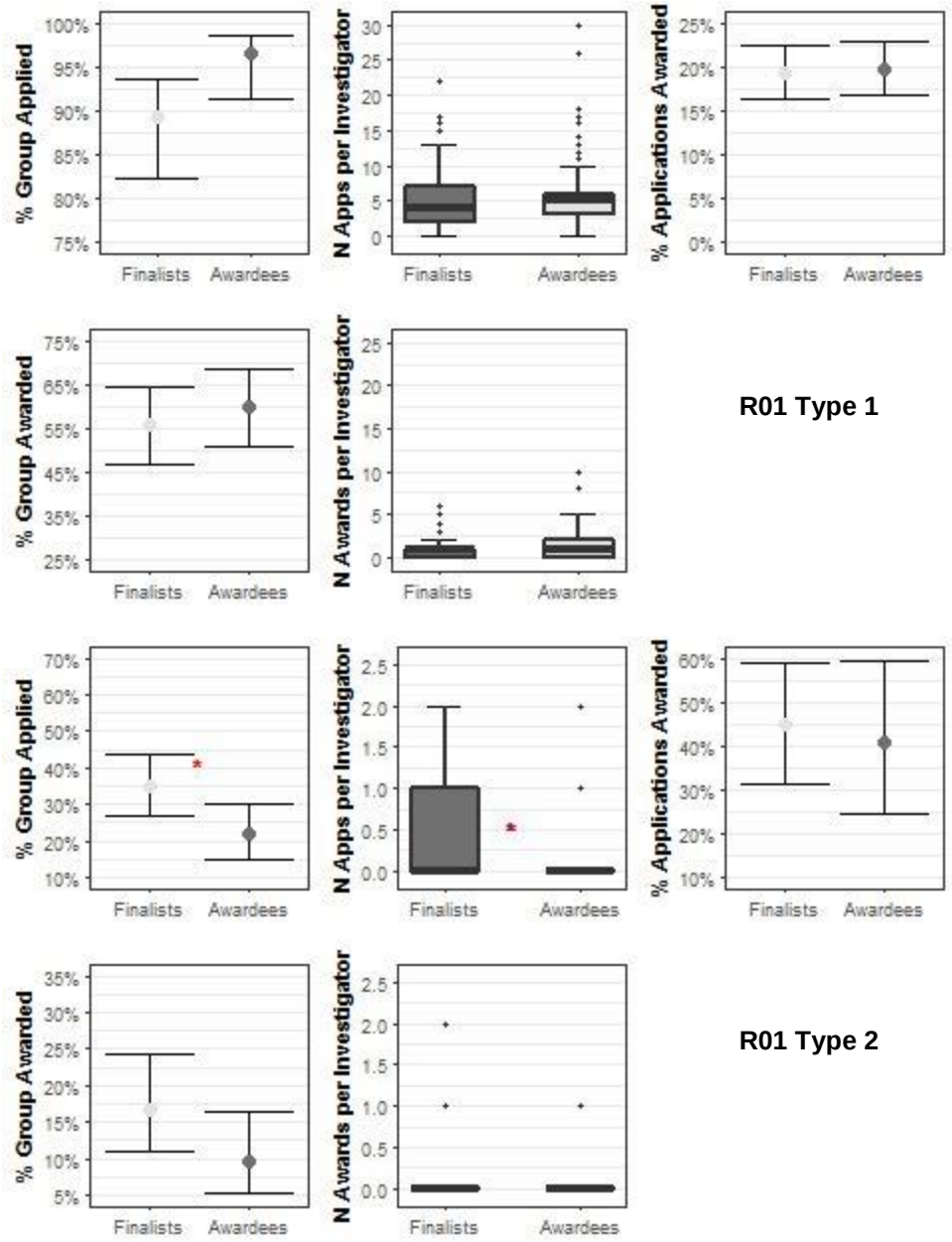


Figure 18a. R01 Type 1 (top panel) and Type 2 (bottom panel) Grants Applied for and Received by Finalists and Awardees

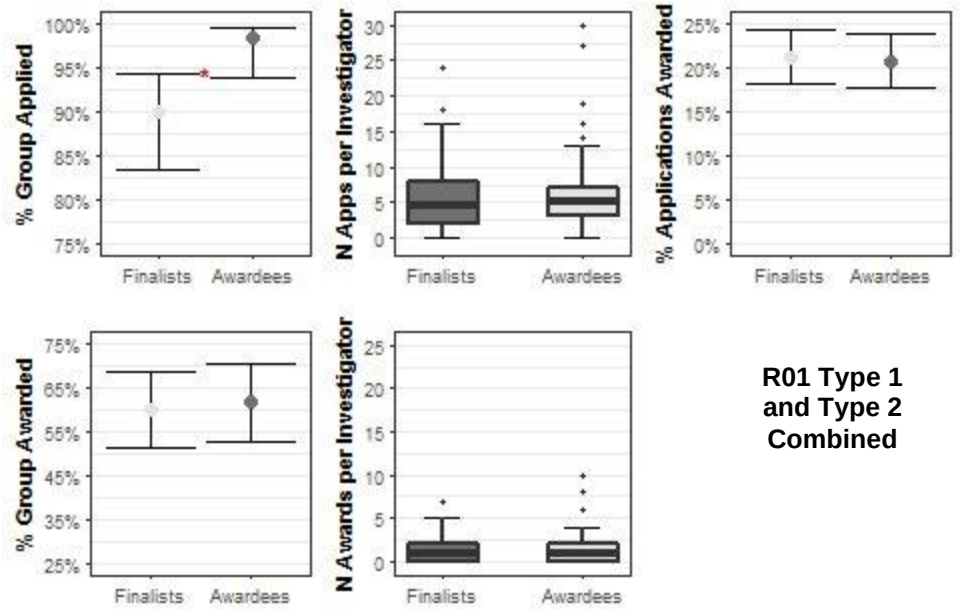


Figure 18b. R01 Types 1 and 2 Grants Applied for and Received by Finalists and Awardees

Table 8a. R01 Type 1 Applications and Awards

R01 Type 1	NI Finalists		NI Awardees				
	Statistic	95% CI	Statistic	95% CI	Test Statistic	*p* Value	Effect Size
Applications							
Mean (SD)	5.01 (4.10)	[4.26, 5.72]†	5.61 (4.70)	[4.70, 6.42]†			
Median	4.00	[3.00, 5.00]†	5.00	[5.00, 6.00]†	W = 6365.50	.303	r = 0.07
Proportion of Group Applied	89.17% (107/120)	[82.34%, 93.56%]‡	96.52% (111/115)	[91.40%, 98.64%]‡	$\chi^2_{(df = 1)}$ = 3.70	.054	*Phi* = 0.14
Awards							
Mean (SD)	0.96 (1.16)	[0.74, 1.16]†	1.10 (1.48)	[0.82, 1.36]†			
Median	1.00	[1.00, 2.00]†	1.00	[1.00, 1.00]†	W = 6583.00	.519	r = 0.04
Percent of Applications Awarded	19.13% (115/601)	[16.19%, 22.47%]‡	19.69% (127/645)	[16.80%, 22.93%]‡	$\chi^2_{(df = 1)}$ = 0.03	.860	*Phi* = 0.01
Percent of Group Awarded	55.83% (67/120)	[46.90%, 64.40%]‡	60.00% (69/115)	[50.86%, 68.49%]‡	$\chi^2_{(df = 1)}$ = 0.26	.607	*Phi* = 0.04

† Bootstrapped Basic confidence intervals,

‡ Wilson score-test-based binomial confidence intervals,

Table 8b. R01 Type 2 Applications and Awards

R01 Type 2	NI Finalists		NI Awardees				
	Statistic	**95% CI**	**Statistic**	**95% CI**	**Test Statistic**	***p* Value**	**Effect Size**
Applications							
Mean (SD)	0.39 (0.57)	[0.29, 0.49]†	0.23 (0.47)	[0.15, 0.31]†			
Median	0.00	[0.00, 0.00]†	0.00	[0.00, 0.00]†	W = **7835.50**	**.022**	r =**.–0.15**
Proportion of Group Applied	35.00% (42/120)	[27.05%, 43.88%]‡	21.74% (25/115)	[15.18%, 30.12%]‡	$\chi^2_{(df=1)}$ = **4.44**	**.035**	*Phi* = **0.15**
Awards							
Mean (SD)	0.18 (0.40)	[0.10, 0.24]†	0.10 (0.30)	[0.03, 0.15]†			
Median	0.00	[0.00, 0.00]†	0.00	[0.00, 0.00]†	W = 7395.5	.105	r = 0.11
Percent of Applications Awarded	44.68% (21/47)	[31.41%, 58.75%]‡	40.74% (11/27)	[24.51%, 59.27%]‡	$\chi^2_{(df=1)}$ = 0.01	.932	*Phi* = 0.04
Percent of Group Awarded	16.67% (20/120)	[11.06%, 24.35%]‡	9.57% (11/115)	[5.43%, 16.32%]‡	$\chi^2_{(df=1)}$ = 2.00	.157	*Phi* = 0.10

Note. Bolded results are significant; *OR* = Odds Ratio.

† Bootstrapped Basic confidence intervals,

‡ Wilson score-test-based binomial confidence intervals,

Table 8c. R01 Types 1 and 2 Applications and Awards

R01 Type 1 and Type 2 Combined	NI Finalists		NI Awardees		Test Statistic	*p* Value	Effect Size
	Statistic	95% CI	Statistic	95% CI			
Applications							
Mean (SD)	5.40 (4.34)	[4.60, 6.15]†	5.84 (4.78)	[4.92, 6.67]†			
Median	4.50	[3.00, 5.00]†	5.00	[5.00, 6.00]†	W = 6541.50	.490	r = 0.05
Proportion of Group Applied	90.00% (108/120)	[83.33%, 94.19%]‡	98.26% (113/115)	[93.88%, 99.52%]‡	$\chi^2_{(df=1)}$ = **5.75**	**.016**	*Phi* = **0.17**
Awards							
Mean (SD)	1.13 (1.33)	[0.89, 1.37]†	1.20 (1.56)	[0.90, 1.46]†			
Median	1.00	[1.00, 1.00]†	1.00	[1.00, 1.00]†	W =6.799.50	.840	r = 0.01
Percent of Applications Awarded	20.99% (136/648)	[18.03%, 24.29%]‡	20.54% (138/672)	[17.65%, 23.75%]‡	$\chi^2_{(df=1)}$ = 0.02	.893	*Phi* = 0.01
Percent of Group Awarded	60.00% (72/120)	[51.06%, 68.32%]‡	61.74% (71/115)	[52.61%, 70.11%]‡	$\chi^2_{(df=1)}$ = 0.02	.889	*Phi* = 0.02

Note: Bolded results are significant; *OR* = Odds Ratio.

† Bootstrapped Basic confidence intervals.

‡ Wilson score-test-based binomial confidence intervals.

C. Summary of Grant Funding Findings

Overall, the finalist and awardee groups were similarly likely to apply for *post-decision* + 1 funding. Awardees were more likely to submit DP1 and R01 Type 1 applications, whereas finalists were more likely to submit R01 Type 2 applications. With the exception of R01 Type 2 grants, awardees also consistently submitted more applications. Generally, applications were awarded at the same rate, but awardees tended to receive more awards and were generally more likely to be funded. Finalists were better positioned to submit R01 Type 2 applications because the NI award does not allow for competitive renewal; however, awardees seemed to compensate with more R01 Type 1 applications.

5. Summary Findings

This chapter contains integrated data from the surveys, bibliometric analyses, and grant analyses and organizes the data into characteristics of professional advancement, funding, and career publications for finalists and awardees before and after application submission or award receipt.

A. Professional Advancement

The STPI team analyzed finalist and awardee indicators of laboratory and research expansion, professional recognition, employment status, and tenure as measures of professional advancement.

With one exception, there were no statistically significant differences in finalist and awardee perceptions of their professional status as measured by the research and laboratory indicators employed in STPI's surveys, including the receipt of tenure (Tables 9 and 10). Awardees reported recognition through a journal cover more than finalists, a finding that achieved statistical significance. There were no statistically significant differences in employment status at the time the surveys were conducted (Table 11).

Conclusion: Overall, finalists and awardees were similar in their career status.

Table 9. Survey Results: Research and Laboratory Indicators

Survey Item	Survey
Expanded Research Laboratory	
Formed New Collaborations	
Expanded Focus of Laboratory to New Disciplines	

Finalists > awardees	No statistically significant difference	*Awardees > finalists*

Table 10. Survey Results: Honors, Awards, and Recognition

Survey Item	Survey
Received Honor/Award	
Popular Press Media Coverage	
Journal Cover Feature	
Asked to Serve as Regular Reviewer	
Changed Institutions	
Tenure	

Finalists > awardees	No statistically significant difference	*Awardees > finalists*

Table 11. Survey Results: Current Employment

Survey Item	Survey
Academic Institution	
Medical Institution (university affiliation)	
Other*	

Finalists > awardees	No statistically significant difference	*Awardees > finalists*

* National Laboratories, medical affiliations not associated with a university, and industry.

B. Ability to Obtain New Funding

To evaluate the ability of finalists and awardees to obtain NIH funding following application submission or award receipt, the STPI team examined their R01 Type 1 and Type 2 grant histories as reported in the IMPAC II database from their dates of application submission or award receipt, plus 8 years (Table 12).

Table 12. Summary of the Finalist and Awardee Grant Analysis

	All NIH Type 1	DP1 Type 1	R01 Type 1	R01 Type 2	Finalist R01 Type 1 & 2 and Awardee R01 Type 1
Proportion of group applying					
Average number of applications submitted					
Proportion of group funded					
Percent of applications awarded					
Average number of awards received					

Finalists > awardees	No statistically significant difference	*Awardees > finalists*

The STPI team found no statistical difference in the overall proportion of finalists and awardees submitting all NIH applications. When specific award mechanisms are considered, a larger proportion of finalists than awardees applied for R01 Type 2 awards, whereas a lower percentage applied for all other grant mechanisms and combinations assessed. Although finalists submitted a higher average number of R01 Type 2 and a lower average number of DP1 applications, there was no statistical difference in the proportion of the group funded or the average number of awards received.

Conclusion: Finalists and awardees differ in the pattern of their grant application submissions but were similar in the proportion of the group funded, percent of applications awarded, or average number of awards received. Finalists received DP1 grants at the same rate as awardees.

C. Career Publication Record

The STPI team used bibliometric approaches to compare several characteristics of finalist and awardee career publications, that is, all *pre-decision* + 1 publications and all *post-decision* + 1 publications. The team assessed impact and productivity of career publications, as well as interdisciplinarity, and, as a measure of collaboration, co-author networks.

1. Research Impact

The STPI team assessed the papers published by finalists and awardees in peer-reviewed journals to estimate the potential scientific impact of their research. Impact is

frequently analyzed by average citations per publication and a variety of journal impact factors such as the H-index, which is based on the number of papers and citations, or IPP, which is based on the number of citations per paper published in a journal.

The team found that finalists had fewer pre-application/award *average citations per publication* than did awardees; however, there was no post-application/award difference in finalist and awardee citation rates. For three of the four journal-based measures of research impact, Finalists had lower impact scores than did awardees, both pre- and post-application/award (Table 13).

Table 13. Bibliometric Analysis: Citation Rates and Journal Impact Factors

	Pre-decision + 1	Post-decision + 1
Average Citations per Publication		
IPP		
SNIP		
SJR		
H-Index		

Finalists > awardees	No statistically significant difference	*Awardees > finalists*

Productivity is closely linked to impact as a measure of the general output of research. It can be assessed by the number of publications in a given time period and the average number of publications per year. The STPI team identified no statistical difference in the number of pre- and post-decision publications for finalists and awardees, nor in average number of annual publications (Table 14).

Conclusion: Overall, finalists had lower journal impact scores for career publications than did awardees; however, their productivity was similar to awardees.

Table 14. Bibliometric Analysis: Number and Timing of Publications

	Pre-decision + 1	Post-decision + 1
Number of publications		
Average annual publications		

Finalists > awardees	No statistically significant difference	*Awardees > finalists*

2. Co-author networks

Co-author networks provide insight into the breadth and type of collaborations developed by a researcher. Networks can be assessed through the number of individuals, institutions, and countries with whom the awardee is collaborating and publishing.

Awardees have a larger number of unique co-authors prior to their NI award; however, *post-decision* + 1 and for all other co-author measures, there were no statistical differences (Table 15).

Conclusion: Finalists and awardees have similar collaborative networks.

Table 15. Bibliometric Analysis: Co-author Networks

	Pre-decision + 1	Post-decision + 1
Average number of authors per publication		
Unique coauthors		
Average number of coauthor institutions		
Unique coauthor countries		

Finalists > awardees	No statistically significant difference	*Awardees > finalists*

3. Interdisciplinarity

Interdisciplinarity is considered a characteristic of innovation and a mode of research that solves complex problems whose solutions are beyond the scope of a single field of research practice.[5] As a proxy for the interdisciplinarity of finalist's and awardees' research, the STPI team analyzed the unique subject codes assigned by Scopus to journals in which finalists and awardees published their career papers.

The team determined that the number of unique subject codes assigned to journals containing pre- and post-decision career publications was not statistically different for finalists and awardees (Table 16).

Conclusion: Finalists and awardees display similar degrees of interdisciplinarity in their career publications.

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5 A.F. Blackwell, *Radical Innovation: Crossing Knowledge Boundaries with Interdisciplinary Teams.* University of Cambridge Technical Report No. 760.

Table 16. Bibliometric Analysis: Interdisciplinarity

	Pre-decision + 1	Post-decision + 1
Total unique subject codes		

Finalists > awardees	No statistically significant difference	*Awardees > finalists*

4. Summary of Career Analyses

Integrated findings for finalists' and awardees' career status demonstrate that Finalists were not statistically different from awardees on most measures of professional advancement, funding, and career publications. Finalists were statistically less likely to report that their research was highlighted on a journal cover than were awardees and had lower journal impact factors prior to and after their NI application. Finalists were similar to awardees in their productivity and in grant awards received. Finalists' and awardees' collaborative networks are similar in size, and their career publications display similar degrees of interdisciplinarity.

D. Summary Conclusions

New Innovator award finalists and awardees are early stage investigators who identified the NI Award as an opportunity to propose innovative, high risk research for their first major NIH grant. While both groups scored well enough to be reviewed by a panel of specially-convened reviewers, the awardees scored better than the finalists in this review and received funding. Finalists did not receive NI award funding.

The most significant difference between finalists and awardees is noted for journal impact factors, a measure of the potential impact of research results. Awardees scored higher on the journal impact factors for their career publications than did finalists, suggesting that awardee research overall has the hallmarks of research that is more likely to advance biomedical and bio-behavioral science.

Appendix A. New Innovator Award Finalist Survey

NIA Finalists Survey

Page One

NIH New Innovator Evaluation

Welcome and thank you for taking part in this survey provided to you by the IDA Science and Technology Policy Institute (STPI) on behalf of the National Institutes of Health (NIH). STPI is a federally funded research and development center that has been contracted by the NIH to assess the NIH's New Innovator Award (NIA) program. Your feedback is an invaluable component of this process.

Purpose of the Survey
You have been contacted because you were a finalist for the New Innovator Award. We would like to know about your perspectives on the research proposed in your NIA application, other NIH funding you may have received, and significant career events following your NIA application.

Confidentiality Statement
STPI is independent of the NIH and has been contracted to collect these data. All responses will be kept confidential and protected to the extent possible by law.

Only aggregate data will be presented to the NIH. Your decision to participate is voluntary and will have no effect on your current or future relationship with the NIH.

Instructions for the Survey
The survey is divided into four sections:

Section 1 - Funding: You will be asked to provide information on NIH funding you received for research that was substantially the same as your NIA proposed research.
Section 2 - Career Progression: You will be asked to provide information about your career progression since applying for the NIA.
Section 3 - Expert Selection: You will be asked to provide the names of experts in your field who could assist STPI in its review of research proposed in your NIA application.
Section 4 - Additional Comments (Optional): You will have the option to provide any other comments on the NIA program.

This survey is estimated to require 20 minutes to complete.

If you would like to review the NIA Funding Opportunity Announcement, please see the

following link: http://commonfund.nih.gov/newinnovator

Follow-Up Interview
After submission, STPI staff may call you for a short (~30 minute) phone interview to discuss your responses.

Inquiries and Concerns
If you have questions or concerns about completing this survey, please contact us at NIAoutcomes@ida.org.

Thank you for your valuable contribution to this process.

*

- Yes, I wish to participate
- No, I do not want to participate

(untitled)

1. Did your research have preliminary data when you submitted your NIA application? *

- Yes, I had preliminary data.
- No, I did not have preliminary data.

(untitled)

2. In this section you will be asked to report any NIH grant awards you received for research that was substantially the same as the research proposed in your NIA application. "Substantially the same" means that your funded research had similar hypotheses and/or methods to your NIA proposal.

Since your submitted your NIA application, have you been awarded other NIH grants awards that are substantially the same as the research proposed in your NIA application. *

- ○ Yes, I have received other NIH grants.
- ○ No, I have not received other NIH grants.

3. Please provide the following information for each NIH Grant award received. If you have multiple awards to report, select "Add additional award" for each award and enter the requested information *

Grant Award Number

Did this new research proposal have more preliminary data than your NIA application?

- ○ Yes, I had more preliminary data.
- ○ No, I did not have more preliminary data.

If your grant was eligible for competitive renewal, was the funding competitively renewed?

- ○ Yes, the funding was renewed.
- ○ No, the funding was not renewed.
- ○ The grant was not eligible for competitive renewal.

Add additional award

4. Have you received any awards greater than $50,000 that are **not** substantially similar to your NIA proposed research?

- ○ Yes, I have received additional awards.
- ○ No, I have not received additional awards.

5. Please provide the following information for each award received. If you have multiple awards to report, select "Add additional award" for each award and enter the requested information *

Funding Agency

Agency Type

Public agency ○

Private agency ○

Grant Number

Estimated Award Amount

$

Award Date

Add additional award

(untitled)

6. Which of the following best describes your current employment?

- ○ I am employed by an **academic institution**.
- ○ I am employed by a **medical institution** affiliated with a University.
- ○ I am employed by a **medical institution** that is **not** affiliated with a University.
- ○ I am employed by a **private foundation** or **non-governmental organization**.
- ○ I am employed in **industry** or work for a **corporation**.
- ○ Other-Please Specify

*

7. What is your current job title? Please include academic rank, if applicable. *

Title:

8. Are you in the same scientific discipline reported on your NIA application? *

- ○ Yes, I am in the same discipline.
- ○ No, I am not in the same discipline.

9. What is your new discipline and what caused this transition? *

(untitled)

10. Below is a list of changes that may have occurred since your NIA application; please indicate whether or not the change took place for you. *

	Yes, this occurred	No, this did not occur
I received an award/honor.	○	○
I was promoted.	○	○
I received tenure.	○	○
I am applying for tenure.	○	○
I expanded my research lab.	○	○
I formed new partnerships/collaborations.	○	○
I expanded my research focus to new disciplines.	○	○
I changed institutions.	○	○
My research has been featured in the popular press/media.	○	○
My research has been featured on the cover of an academic journal.	○	○
I have been invited to serve as a regular reviewer for a journal.	○	○
I have been invited to serve as a journal or book editor.	○	○

11.

Other Career Development (Optional)

Add Another

12. Please list the awards/honors you received. If you have multiple awards/honors to report, select "Add another award" to enter each award.

Award

Add another award

(untitled)

13. An important component of the NIA evaluation is the expert review panel and STPI will identify reviewers who can contribute a knowledgeable and complete review of your NIA research. These individuals will represent a mix of perspectives on your field of research.

If you would like to provide the names and contact information for possible reviewers, please do so in the space provided below.

	First Name	Last Name	Email
Expert One			
Expert Two			
Expert Three			
Expert Four			
Expert Five			

(untitled)

14. In the space provided, please provide any additional perspectives on the NIA program. This section is optional.

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Abbreviations

API	application programming interface
DP1	NIH Director's Pioneer Award (Activity Code)
FY	fiscal year
ID	identification
IDA	Institute for Defense Analyses
IPP	Impact per Publication
NDPA	NIH Director's Pioneer Award
NI	New Innovator
NIH	National Institutes of Health
R01	Research Project Grant (Activity Code)
SJR	SCImago Journal Ranking
SNIP	Source-Normalized Impact per Publication
STPI	Science and Technology Policy Institute
XML	Extensible Markup Language

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14. ABSTRACT

This paper provides the results of an analysis of career and research indicators for finalists who scored well on review but did not receive funding with respect to those measured for recipients of funding from the National Institutes of Health Director's New Innovator Award program in fiscal years 2007–2009. A team of STPI researchers used a mixed-methods approach to assess the career trajectory, publication patterns, and funding for finalists compared to awardees. Survey data, bibliometric analyses, and grant analyses provided insight on characteristics of professional advancement, funding, and career publications of finalists and awardees before and after the application submission or award receipt. The data indicate, among other findings, that awardees scored higher on journal impact factors for their career publications than did finalists, suggesting that awardee research overall has the hallmarks of research that is more likely to advance biomedical and biobehavioral science. A companion to this paper, IDA Paper P-8478, provides an outcome evaluation of the New Innovator Award program for the same period.

15. SUBJECT TERMS

outcome evaluation; early stage investigators; New Innovator Award program; National Institutes of Health (NIH); high risk research; career trajectory; biomedical research; biobehavioral research

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