Outcome Evaluation of the NCI/DCCPS Behavioral Research Program – Small Grant Program (BRP-SGP)

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Executive Summary

The National Cancer Institute (NCI) Behavioral Research Program (BRP) issues an annual Small Grants Program (SGP) announcement to attract behavioral scientists to the field of cancer control. To fund this research, the BRP-SGP uses the R03 mechanism, which is intended to fund pilot and feasibility projects, development and/or testing of new methodologies, and secondary analyses that may serve as the cornerstone of a more comprehensive research program. The BRP-SGP has provided more than $39 million in funding to 247 awardees during fiscal years 1999 to 2011.

This evaluation built on the recommendations of a 2005 program assessment, and incorporates quantitative measures to answer the following three questions:

1. Is the BRP-SGP R03 encouraging investigators from a variety of academic, scientific, and public health disciplines to apply their skills to behavioral research investigations in cancer control?
2. Is the BRP-SGP R03 facilitating the transition from the R03 funding mechanism to mechanisms that support more comprehensive research programs?
3. Is the BRP-SGP R03 promoting the long-term career development of early stage investigators in the field of behavioral research in cancer control?

Findings

Who is applying to the BRP-SGP program?

- A total of 666 applications were received and 247 awards were made through five Program Announcements (PARs) spanning the years 1999 through 2008. The majority of applicants applied to only one PAR.
- The majority of applicants and awardees were women and held PhDs. There was a wide range in PhD field of study among applicants. The most common fields were clinical psychology, epidemiology, public health, social psychology, and nursing science.
- The program is attracting early career investigators, with awardees having a median age of 38, and most are applying within 3 to 8 years of receiving their qualifying degree.
- The majority of applicants did not have prior NIH support. Those who did have prior support were typically funded by NIH Institutes and Centers (ICs) other than NCI.
- The majority of applications and awards were made to individuals at institutions with an NCI Cancer Center designation. The majority of BRP-SGP awards were to individuals at institutions with $10 million to $100 million in annual NCI funding.
- The submitting departments of applicants and awardees represented a broad range of disciplines covering both the medical sciences and public health. The most common departments represented were Psychology, Medicine (Other), Psychiatry, Oncology, Nursing Science, and Public Health.
- Applications and awards were distributed fairly evenly across the U.S., although there was a higher concentration on the East coast and the Great Lakes region.

What are the subsequent career outcomes and activities of BRP-SGP applicants?

- BRP-SGP awardees are more likely than non-awardees to apply for and receive subsequent funding from NIH and NCI, particularly R01 or other RPG opportunities, indicating transitions to more comprehensive research programs following the R03.
- A small number of BRP-SGP applicants were matched to subsequent research awards from other federal sources or foundations, in particular the Lance Armstrong Foundation (LAF).
- BRP-SGP awardees were more likely than non-awardees to author publications post-study, and typically published within the first 3 years following receipt of the BRP-SGP award. The average citation rate of awardee publications was higher than non-awardees when compared to a benchmark.
- Compared to other NCI-sponsored R03 programs in epidemiology and cancer prevention, the publication count per BRP-SGP grant is lower. This could be attributed to factors such as a lack of availability of appropriate journals or non-publication modes of communicating findings within the field.
- The majority of BRP-SGP awardees for whom subsequent appointment data were available held Assistant or Associate Professor rankings. A qualitative analysis of subsequent appointments for individuals with no post-award/application NIH outcomes indicated that the majority of individuals were still engaged in science-related careers.
- Few BRP-SGP applicants participate on subsequent BRP-SGP review panels, regardless of funding status.

Conclusions and Recommendations

The BRP-SGP program is attracting the intended applicants and has had a measurable impact on the subsequent research careers of awardees. The program is successful in recruiting researchers from diverse disciplines to the emerging field of cancer prevention and control. Although the findings of this evaluation indicate that the BRP-SGP is meeting its goals, there are several opportunities to adjust program policy and future evaluations, including:

- Actively recording and tracking the PhD field of study, medical specialty, and submitting department of applicants to identify the academic departments that program staff should target for program outreach.
- Text matching of the title and abstract of funded BRP-SGP applications to subsequent NIH grant applications and awards and publications to determine whether the R03 research is being used to continue a more comprehensive research program.
- Comparing BRP-SGP awardees to K07 awardees could help managers of both programs tease out features that help foster research in the area of cancer prevention and control.
- Exploring opportunities to encourage collaboration between funded BRP-SGP researchers and non-federal programs that sponsor research in cancer prevention and control, similar to the success seen between the cancer survivorship program and the Lance Armstrong Foundation.

1.0 Introduction

1.1 Overview of the NCI Behavioral Research Program

In 1998, the Behavioral Research Program (BRP) was created within the National Cancer Institute's Division of Cancer Control and Population Sciences (DCCPS) with the goal of advancing cancer prevention and control research and practice. The BRP initiates, supports, and evaluates a comprehensive program of behavioral research by providing resources and extramural funding opportunities in the social and behavioral sciences. BRP has five branches: Applied Cancer Screening, Basic and Biobehavioral Research, Health Communications and Informatics, Health Promotion, and Tobacco Control.

To attract behavioral scientists to the field of cancer control and build research capacity among new investigators, the BRP issues a Small Grants Program (SGP) Announcement on an annual basis. The mission of the BRP-SGP is to facilitate the growth of a nationwide cohort of scientists with a high level of research expertise in behavioral research related to cancer control. The program utilizes the NIH R03 mechanism, which is intended to fund pilot and feasibility projects, development and/or testing of new methodologies, and secondary analyses that could provide a basis for more comprehensive research. BRP-SGP grants have a maximum allowable funding and timeframe of $100,000 over 2 years. Eligible applicants are either new investigators who have not been funded previously by NCI as Principal Investigators (PIs) on cancer control research grants (i.e., through an R03, R01, U01, P01, or R21), or are established behavioral scientists who are refocusing their work on cancer prevention and control. To allow for short turnaround, BRP-SGP grant applications are reviewed by a special NCI study section that includes behavioral and prevention scientists with a primary interest in behavioral cancer control research.

BRP Targeted Research Fields

- Anthropology
- Economics
- Epidemiology
- Health Communications and Informatics
- Health Education and Sociology
- Health Policy
- Health Promotion
- Health Services Research
- Medicine
- Nursing Research
- Nutrition
- Psychology
- Public Health
- Social Work

The BRP-SGP is designed to foster a successful first funding experience with the NIH grant program, and it has in fact introduced many investigators from other fields to behavioral research in cancer control (see **sidebar**). From 1999 to 2011, 247 awardees have received more than $39 million in funding through this program.

The BRP-SGP includes features intended to foster the development and retention of investigators who will advance the field of behavioral research and cancer prevention and control. This includes mandatory attendance at a 2-day meeting sponsored by the Behavioral Research Program intended to promote career development in cancer control research upon completion of Year 1 funding. These meetings, along with the special study section, are key components of the BRP-SGP program, which has four goals:

Short-term outcomes:

- To facilitate the collection of pilot data by investigators new to the field of behavioral research in cancer control.
- To encourage investigators from a variety of academic, scientific, and public health disciplines to apply their skills to behavioral research investigations in cancer control.

Long-term outcomes:

- To facilitate the transition from a small grant (i.e., R03) to a funding mechanism that supports investigators in conducting more comprehensive research.
- To promote the long-term career development of early-stage investigators in the field of behavioral research in cancer control.

In 2010, the DCCPS Behavioral Research Program contracted with Discovery Logic to assess the extent to which the Small Grants Program is meeting its goals. This report provides an in-depth discussion of the evaluation's objectives and design, as well as a description of the study population, the data sources and methodologies used, study findings, and policy implications.

2.0 Program Evaluation

2.1 Evaluation History

The BRP-SGP was first evaluated in December of 2005 by the Battelle Centers for Public Health Research and Evaluation[1]. To determine the impact of the R03 Program on the careers of new investigators in the field of behavioral research in cancer control, the study examined awardees' research, publications, presentations, and professional interactions within the field of behavioral research in cancer control.[2] This previous qualitative process evaluation was limited to the outcomes of the BRP-SGP grantees funded under the earliest program announcement (i.e., PAR 99-006; N = 64) because this cohort had the longest post-grant time in the field when data collection began in 2004. Based on information from three sources (i.e., grantee surveys, grantee curricula vitae [CVs], and mentor interviews), the evaluation concluded that,"...the BRP-SGP facilitated additional independent research opportunities and fulfilled the NIH's goals for supporting early career investigators and stimulating promising new areas of cancer research."[3] Participating grantees viewed the program as having an important career impact, especially

[1] The final version of the 2005 evaluation report is accessible online at: http://cancercontrol.cancer.gov/smallgrants/NCI_FinalEvaluation_15Dec05.pdf. Last accessed November 3, 2011.
[2] At the time of the evaluation, 39 awards had been made under PAR 02-037, 64 under PAR 99-006, and 17 under PAR 04-020, for a total of 120.
[3] Chollette VY, Crowley K (2007). National Cancer Institute's Small Grants Program for Behavioral Research in Cancer Control Boosts Careers for New Investigators and Fulfills NIH Research Priorities. Cancer Epidemiol Biomarkers Prev 16(11).

because BRP-SGP provided funding opportunities at an early career stage and allowed researchers to become familiar with the NIH grant application process. They described this grant mechanism as an ideal "bridge" for junior investigators to perform well-defined, short-term projects that have the potential to develop into R01 research programs. The most significant impact of the BRP-SGP was determined to be the opportunity to collect pilot data, which has become increasingly important for writing a strong R01 proposal. An overwhelming majority of grantees (96%) said they would recommend that others apply for an R03.

Recommendations were made for future evaluation approaches, such as identifying specific measures for each of the broad goals of the program and establishing a comparison group of unfunded grantees.

2.2 Current Evaluation

The current evaluation was initiated by NCI to coincide with a re-issue of the BRP-SGP Program Announcement. It was determined that an updated evaluation of BRP-SGP applicants would help NCI focus the direction of the program going forward.

There are several substantive differences between the 2005 study described in section 2.1 and the current evaluation. The former evaluation was qualitative in nature, relying on grantee and mentor surveys and CV review. As recommended, the current survey incorporated an experimental design that includes a matched comparison group to help establish program impact.

The current evaluation is a quantitative study of 247 funded and 295 unfunded program applicants. In addition to examining the demographic composition of the full cohort, a comparison cohort comprised of applicants with similar priority scores and an equal chance of being funded or not funded was used to measure program impact and outcomes. A detailed description of the methodologies used is found in section 2.2.4.

2.2.1 Evaluation Objectives and Design

The evaluation is based on applicants to five BRP-SGP program announcements published in the NIH Guide from 1999 to 2009, as listed in **Table 1**.

PAR Number	Application Period
PAR99-006	1999 - 2000
PAR02-037*	2002 - 2003
PAR04-020#	2004 - 2005
PAR06-073^	2006
PAR06-458$	2006 - 2008

Table 1. BRP-SGP PARs and application periods included in the evaluation.
* indicates replaced PAR99-006; # indicates replaced PAR02-037; ^ indicates replaced PAR04-020; and $ indicates replaced PAR06-073.

The logic model shown in **Figure 1** categorizes the critical components to be measured and analyzed in the evaluation. The model incorporates applicant/awardee and institutional characteristics, research conducted under the grant, and other external factors that contribute to subsequent researcher productivity and funding. Program impact is measured as (a) the long-term career development of BRP-SGP funded researchers in the field of cancer control, and (b) increased comprehensive cancer research resulting from participation in the BRP-SGP.

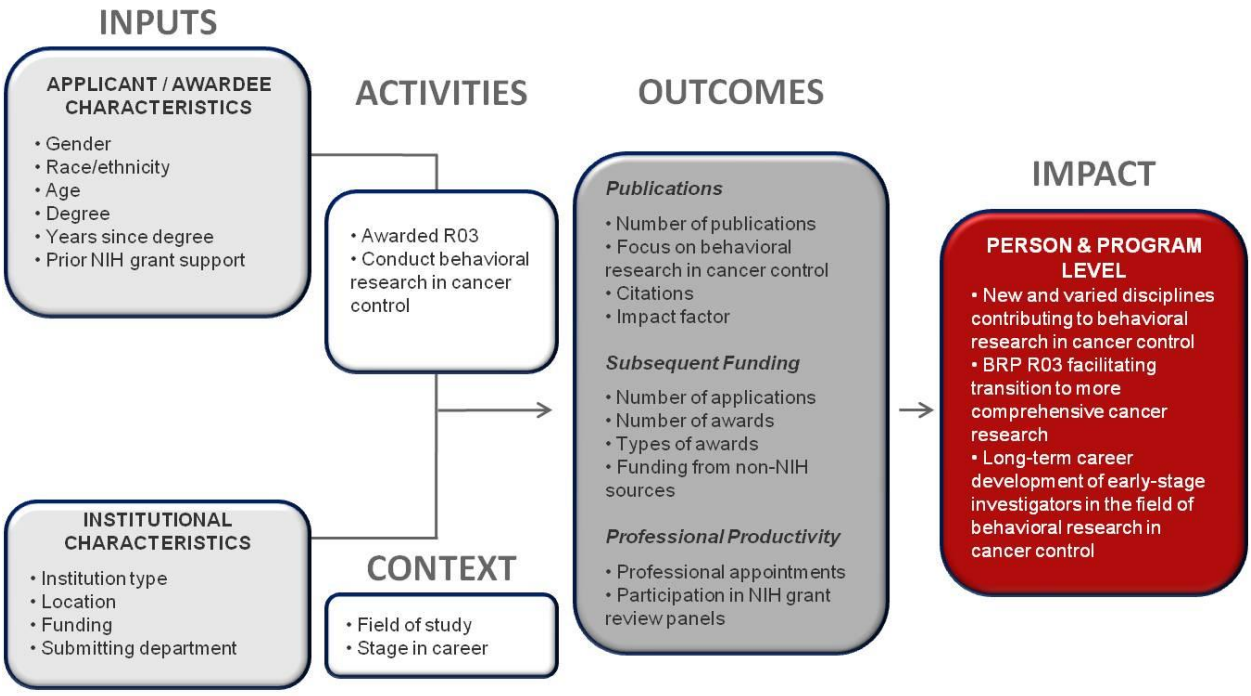

Figure 1. BRP-SGP outcome evaluation logic model.

This evaluation addresses three major questions:

Q1. Is the BRP R03 encouraging investigators from a variety of academic, scientific, and public health disciplines to apply their skills to behavioral research investigations in cancer control?

- What are the academic, scientific, and public health disciplines of BRP R03 awardees? How do grantees' disciplines, as determined by the National Science Foundation's Doctoral Records File (DRF)[4] degree field or Association of American Medical Colleges Faculty Roster[5] specialty area compare with those of applicants who were not funded?
- What are the general demographic characteristics (e.g., gender, race/ethnicity, age at application, prior NIH support) of the BRP R03 applicants? Are there notable differences between awardee and matched non-awardee groups?

[4] Data from the National Science Foundation Survey of Earned Doctorates matched to IMPAC II person profiles.
[5] Data from the Association of American Medical Colleges Faculty Roster matched to IMPAC II person profiles.

Q2. Is the BRP R03 facilitating the transition from the R03 funding mechanism to mechanisms that support more comprehensive research?

- What proportion of BRP R03 awardees apply for subsequent NCI funding?
- What grant mechanisms and funding opportunity announcements (FOAs) are represented?
- What is the average time to first NCI R01 award?
- How many BRP R03 awardees received subsequent funding from non-NIH sources and in what area(s) of research? How many were from the Department of Defense (DoD) or NSF programs? How many were from cancer-related foundations, such as the American Cancer Society, Susan G. Komen Breast Cancer Foundation, the Breast Cancer Research Foundation, or the Lance Armstrong Foundation?

Q3. Is the BRP R03 promoting the long-term career development of early-stage investigators in the field of behavioral research in cancer control?

- What is the publication and citation activity after receipt of a BRP R03 award in Behavioral Cancer Control Research?
- To what extent do BRP R03 awardees remain in or receive appointments to academic positions in cancer control settings?
- To what extent do BRP R03 awardees participate in NIH Grant Review Panels, including, but not limited to, the NCI special review for the Small Grants Program for Behavioral Research in Cancer Control?
- To what extent do BRP R03 awardees participate in professional associations related to cancer research?

2.2.2 Description of the Study Population

This study examined BRP applicants from 1999 onward who responded to SGP program announcements PAR 99-006, PAR 02-037, PAR 04-020, PAR 06-073 and PAR 06-458, and included both successful and unsuccessful applicants. For these program announcements, there were 247 funded applicant records and 295 unfunded applicant records in the NIH Information for Management, Planning, Analysis, and Coordination (IMPAC II)[6] grants database. We restricted the PAR 06-458 sample to awards made from 2006 to 2007 (N=39 individuals, or about half of awardees) to ensure that applicants had at least 2 years of post-grant award time in the field. This evaluation includes applicants from the first evaluation, allowing for some comparison with the results of the first evaluation.

2.2.3 Data Sources[7]

Key data sources for this evaluation included IMPAC II; the electronic Scientific Portfolio Assistant (eSPA)[8]; MEDLINE; the National Science Foundation's Doctoral Record File (DRF); the American

[6] http://era.nih.gov/impacii/index.cfm

[7] All data were obtained and reported in compliance with NIH policies, the Privacy Act of 1974, and the Department of Health and Human Services Information Systems Security Program (AISSP) Handbook.

Association of Medical Colleges' (AAMC) Faculty Roster; the International Cancer Research Portfolio (ICRP), which includes NCI and non-profit funding organizations, such as the American Cancer Society and the Susan G. Komen Breast Cancer Foundation; and the Lance Armstrong Foundation (LAF). Together, these sources provided information on race, ethnicity, gender, qualifying degree, degree field, age, years since degree, degree institution, geographic location, institution type, application submission date, institutional NIH funding rank, prior NIH support, service on NIH review panels, faculty appointments, prior and subsequent funding, and overall program success rates.

In addition to IMPAC II and related tables and external sources, we drew upon the resources of Thomson Reuters Journal Citation Reports® (JCR) and Web of Science™ (WoS) to obtain publication and citation information for program applicants, and used ScienceWire® (SW) to obtain information on subsequent federal funding support from the National Science Foundation and Department of Defense. Web searches using Google, LinkedIn, and other search engines helped us obtain current position information for applicants with no subsequent records in IMPAC II. **Appendix 5.1** provides a complete list of study variables and data sources.

Figure 2. Data sources used for the evaluation.
Items marked with an asterisk indicate data sources only used for obtaining outcomes information for a subset of NCI BRP-SGP applicants (~50 individuals) for whom no subsequent grant application or award information was available in IMPAC II.

2.2.4 Demographics of the Full Cohort

To determine whether the BRP-SGP is encouraging investigators from a variety of academic, scientific, and public health disciplines to apply their skills to behavioral research investigations in cancer control, we used the IMPAC II database to obtain information on individual characteristics (i.e., gender, race/ethnicity, age, degree, degree institution, years since degree), institutional characteristics (i.e., institution type, location, funding), and prior NIH grant support. Data were supplemented with information from the DRF and the AAMC Faculty Roster.

2.2.4.1. Applications and Applicants by PAR

The total population of applications and applicants was obtained by matching the five PARs of interest with IMPAC II records. Although **Table 2** shows applications, applicants, awardees, and non-awardees by individual PAR, all demographic analyses were performed on the combined pools. Across the five PARs, there were 666 applications, 542 distinct applicants, and 247 awardees.

[8] eSPA enables analysis of project portfolios by evaluating a database of grants and building scatter charts, histograms, networks, and other graphs to visualize results of grantee activities.

PAR Number	Total Applications	Total Applicants	Total Awards	Total Awardees	Total Non-Awardees	% Awarded
PAR02-037	116	107	42	42	65	36.2%
PAR04-020	160	144	50	50	94	31.3%
PAR06-073	24	24	16	16	8	66.7%
PAR06-458	196	174	77	77	97	39.3%
PAR99-006	170	139	62	62	77	36.5%
Totals	666	542*	247	247	341	37.1%

Table 2. BRP-SGP applications and awards, by PAR number.
*The total number of individual applicants is 542. There were 497 individuals who applied to one PAR, 44 who applied to two PARs, and 1 who applied to three PARs, representing a total of 588 Person – PAR interactions. Data Source: IMPAC II.

2.2.4.2 Applicants by Degree Type

Examination of the qualifying degrees of the BRP-SGP applicants allows for inferences regarding the type of training and research backgrounds of applicants. Initial degree information was obtained from IMPAC II and supplemented with data from the NSF Doctoral Record File and AAMC Faculty Register as necessary. The overwhelming majority of the applicant pool – nearly 80% of awardees and nearly 70% of non-awardees – held PhD degrees. Approximately 10% of awardees and 15% of non-awardees held MD or MD/PhDs[9] (**Figure 3**). Interestingly, both the awardee and non-awardee groups had approximately a 5% representation of individuals with degrees categorized as "Note," such as a Masters degrees or professional certifications. For a full list of Note degrees, see **Appendix 5.2**.

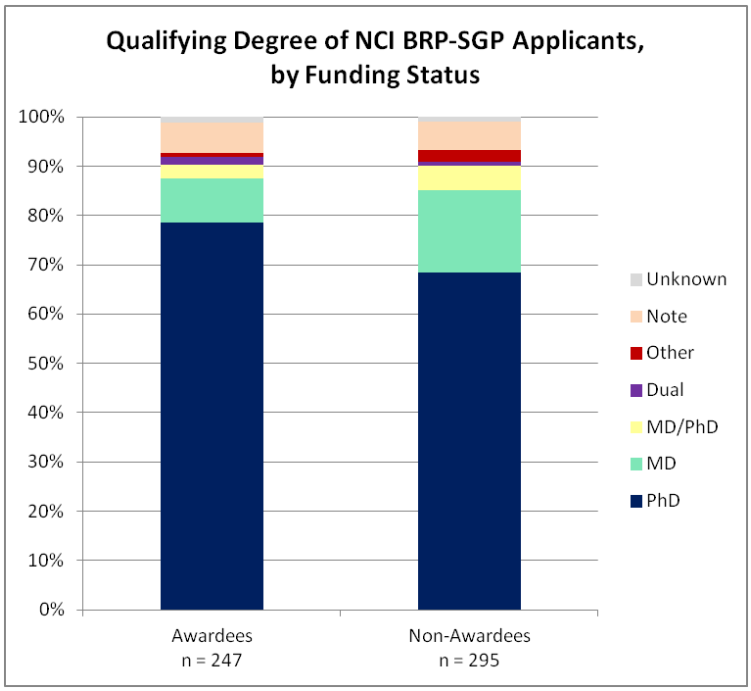

Figure 3. Qualifying degree of BRP-SGP applicants, by funding status. Data Sources: IMPAC II, AAMC Faculty Roster, DRF.

[9] MD/PhDs are defined as individuals with at least one MD degree and one PhD degree. Individuals in the "Dual" degree category hold at least one PhD *or* at least one MD, but not both, and at least one "Other" degree (except FAAN, RN, and OTH). A detailed list of degrees included in each category is available in Appendix 5.2.

For applicants with a PhD, we were able to use the DRF to obtain information about the PhD Field of Study. Two levels of PhD Field of Study were explored for this study – the Tier 2 level, which includes broad categorizations, such as biology, engineering, psychology, and sociology; and the Tier 3 level, which breaks the Tier 2 categories into specific fields, such as genetics and cell biology. Of the 247 awardees, 201 held a PhD (either a PhD only or MD/PhD) and of those, Field of Study data were available for 163 (81%).

Table 3 shows the top five Tier 3 PhD Fields of Study for BRP-SGP applicants with PhD or MD/PhD degrees. While the majority of the applicants matched to DRF Field of Study data held degrees in Clinical Psychology, overall, the range of fields represented was broad, including biomedical and health fields, those focused on psychology and counseling, and education and communications. A total of 66 Fields of Study were matched to BRP-SGP applicants. A complete list of fields can be found in **Appendix 5.3**.

PhD Field of Study - Tier 3	Awardees	% of Awardees with PhD or MD/PhD n = 201 n matched = 163 (81%)	Non-Awardees	% of Non-Awardees with PhD or MD/PhD n = 217 n matched = 161 (74%)
Clinical Psychology	56	34.4%	18	11.2%
Epidemiology	12	7.4%	9	5.6%
Public Health	10	6.1%	14	8.7%
Social Psychology	10	6.1%	8	5.0%
Nursing Science	8	4.9%	10	6.2%

Table 3. Top 5 Tier 3 PhD Fields of Study, by funding status.
Only those applicants holding PhDs (PhDs or MD/PhDs) were included in this analysis. The percentage of awardees or non-awardees with PhD matched figures represent the percentage of PhDs matched to the DRF versus the total number of PhD or MD/PhD awardees or non-awardees for the BRP-SGP program. Data source: DRF.

2.2.4.3 Applicants by Gender

To analyze the gender distribution among BRP-SGP applicants, we used IMPAC II data to determine the number of men and women applicants.[10] We found that over 60% of awardees and over 50% of non-awardees were female (**Figure 4**).

[10] Those applicants/awardees who did not specify gender on their applications were classified as "unknown".

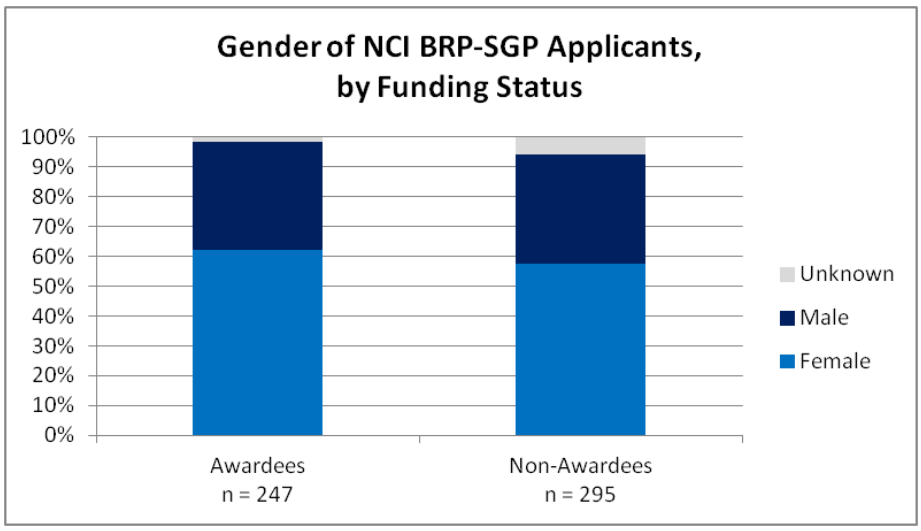

Figure 4. Gender of BRP-SGP applicants, by funding status. Data Source: IMPAC II, AAMC Faculty Roster, DRF.

The National Science Foundation's *Science and Engineering Indicators 2010*, reports that on average, since 2000, men have received 52.6% of biological sciences PhDs, while women have received 47.4%.[11] During 2007, the year in which the most recent data are available, the proportion of men to women receiving PhDs was 50.6% to 49.4%, respectively.[12] Similarly, the American Association of Medical Colleges reported in 2008 that 55.8% of MD degrees were earned by men and 44.2% by women[13]

However, to more closely match the BRP-SGP applicant pool, we examined the rates of degree conferral for PhDs in the medical sciences, social/behavioral sciences, and psychology. Per the NSF *Science and Engineering Indicators 2010*, over the period from 2000 to 2010, 57% of medical sciences PhDs, 58% of social/behavioral sciences PhDs, and 70% of psychology PhDs were granted to women.[14] Therefore, the gender distribution among BRP-SGP applicants is commensurate with national trends.

2.2.4.4 Applicants by Race and Ethnicity

During the time period from 2000 to 2007, Hispanics received 4.5% of biological sciences PhD degrees, Blacks 3.4%, Asians 11.6%, Native Americans 0.4%, and Whites 76.2%.[15] Because race and ethnicity are voluntarily reported and may not be consistently provided, a combination of sources was used to compile the race and ethnicity data for BRP-SGP program applicants. IMPAC II was the primary data source, supplemented by the DRF and AAMC Faculty Roster (see **Appendix 5.1**). Those applicants who

[11] National Science Foundation. *Science and Engineering Indicators*. (2010). Available at: http://www.nsf.gov/statistics/seind10/c2/c2h.htm. Numbers reflect those for U.S. citizens/permanent residents. (Last accessed October 18, 2011).
[12] Ibid.
[13] American Association of Medical College. *2008 Physician Specialty Data.* (2008). Available at: https://www.aamc.org/download/47352/data/specialtydata.pdf (Last accessed August 5, 2011).
[14] National Science Foundation. *Science and Engineering Indicators.* (2010). Available at: http://www.nsf.gov/statistics/seind10/c2/c2s3.htm#s5. Numbers reflect percentage of total for each category for the years 2000 through 2007. (Last accessed November 10, 2011).
[15] National Science Foundation. *Science and Engineering Indicators*. (2010). Available at: http://www.nsf.gov/statistics/seind10/c2/c2s3.htm (Last Accessed October 18, 2011)

listed more than one race or listed race(s) not included in the evaluation categories were categorized as "Other," and the "Unknown" category was used for applicants who did not report race/ethnicity.

Table 4 summarizes the race and ethnicity data for BRP-SGP applicants by funding status. Due to the relatively large proportion of individuals with unknown race and ethnicity, trends are difficult to determine. Of those reported, the majority – over 60% of awardees and 50% of non-awardees – were White. Other racial/ethnic groups each had a share of less than 10% of the applicant pool.

Race/Ethnicity	Applicants	Awardees	Non-Awardees
White	306 (56%)	156 (63%)	150 (51%)
Asian	45 (8%)	20 (8%)	25 (8%)
Black	20 (4%)	5 (2%)	15 (5%)
Hispanic	23 (4%)	10 (4%)	13 (4%)
Native American	*	*	*
Other	6 (1%)	1 (0.4%)	5 (2%)
Unknown	140 (26%)	54(22%)	86 (29%)

Table 4. Race and ethnicity of BRP-SGP applicants, by funding status.
The Other category represents selection of a race/ethnicity not included in the list or selection of multiple race/ethnicities. The Unknown category indicates that no race/ethnicity was found in any of the data sources utilized. An asterisk indicates a field in which data was suppressed due to low (>25) total applicant numbers. Data Source: IMPAC II, AAMC Faculty Roster, DRF.

2.2.4.5 Applicant Age at Time of First Application

As stated in Section 1.0, one of the goals of the NCI BRP-SGP is to provide funding opportunities for early-stage investigators pursuing behavioral research related to cancer control, or to encourage established investigators to engage in this field of research. **Figure 5** shows the distribution of applicant age by funding status. Of the 232 awardees for whom age data was available, the average age at first application was 42.4 years and the mean was 38 years. The raw data indicate two spikes in applicant age – the first occurring in the mid-thirties, consistent with the program's goal to recruit early-career investigators, and the second was at 42 years, which could represent applicants seeking to transition to behavioral research related to cancer control.

Similar trends were seen among the non-awardees,[16] although there was a general shift to the first application occurring at a later age. Among non-awardees, the average age at application was 43.9 years and the median was 42 years. In fact, more non-awardees than awardees were likely to apply to the program throughout their late forties, fifties, and sixties. Specific rules used by the study for determining age at application are found in **Appendix 5.4.1**.

[16] Age data were available for 271 of the BRP-SGP non-awardees.

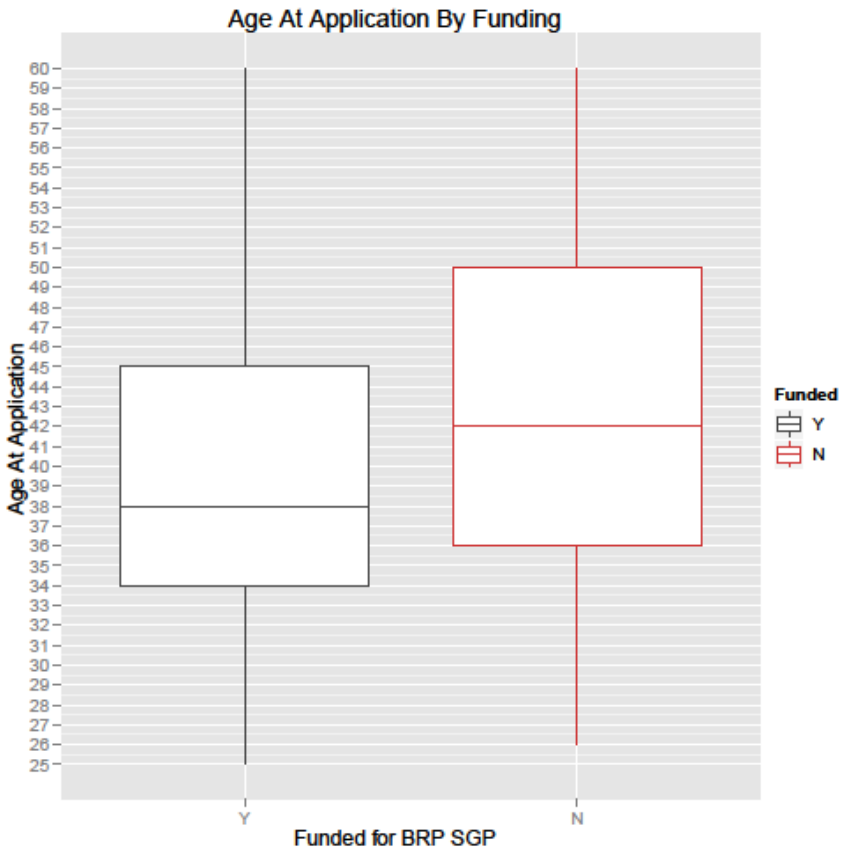

Figure 5. Applicant age at time of first NCI BRP-SGP application, by funding status.
In this representation, the box represents the inter-quartile range (IQR) with the middle horizontal line of the box representing the median, the lower horizontal line of the box representing the first quartile, and the upper horizontal line of the box representing the third quartile. The lower line (whisker) represents the first quartile – 1.5x the inter-quartile range, and the upper line (whisker) represents the third quartile + 1.5x the inter-quartile range. Data Source: IMPAC II, AAMC Faculty Roster, DRF.

2.2.4.6 Years Since Applicants' Qualifying Degree

The number of years that passed since an applicant received his or her qualifying degree serves as a proxy for career stage.[17] **Figure 6** indicates that the median years since degree of awardees (5) is about 2 years less than that for non-awardees (7). The majority of awardees applied to the program 3 to 8 years after receiving their degree (mean = 7.3 years), while non-awardees range from 3 to 11 years (mean = 11.0 years). These ranges indicate that awardees tend to be investigators who are early in their careers. There are some distinct outliers in the awardee group; these individuals might represent applicants that are established in another field and pursue the BRP-SGP mechanism as a way of moving into behavioral research related to cancer prevention and control.

[17] Years Since Degree data were available for 226 BRP-SGP awardees and 229 BRP-SGP non-awardees.

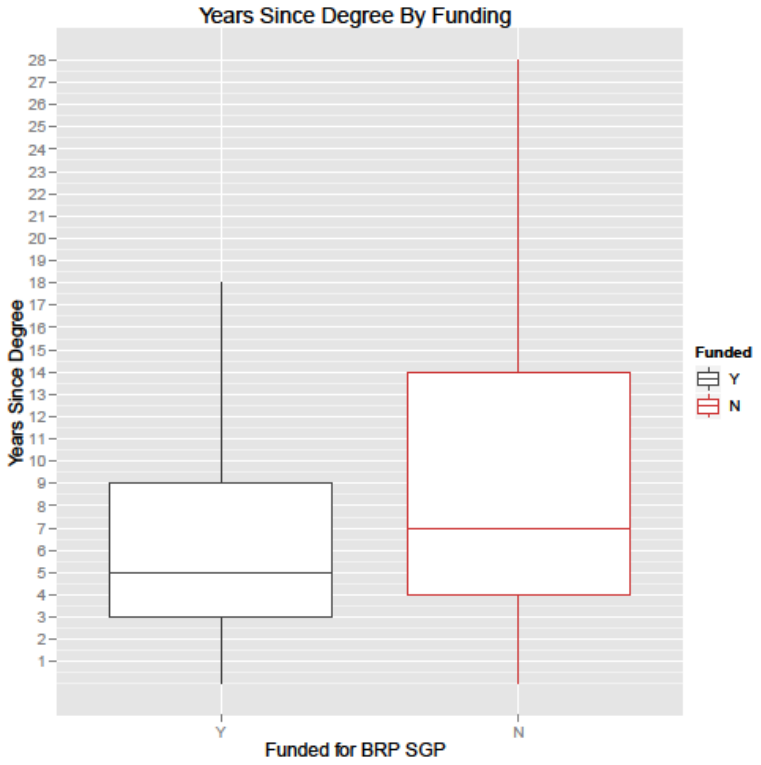

Figure 6. Years since degree of BRP-SGP applicants, by funding status.
In this representation, the box represents the inter-quartile range (IQR) with the middle horizontal line of the box representing the median, the lower horizontal line of the box representing the first quartile, and the upper horizontal line of the box representing the third quartile. The lower line (whisker) represents the first quartile – 1.5x the inter-quartile range, and the upper line (whisker) represents the third quartile + 1.5x the inter-quartile range. Outlying data points have been suppressed due to low total numbers. Data Source: IMPAC II, AAMC Faculty Roster, DRF.

Years-since-degree data were also used to categorize applicants into two career stages – "Early Stage" (0 to 10 years since degree) and "Later Stage" (11+ years since degree) – for certain outcomes described in Section 4.0 of this report. Rules used in this study for the determination of years since degree are found in **Appendix 5.4.2**.

2.2.4.7 Prior NIH Support of Applicants

The BRP-SGP program is intended to bring in applicants who have not received prior cancer control research grants. In addition to revealing whether this program goal is being met, exploration of prior NIH support an individual had at the time of application to the BRP-SGP could provide insight about the type of training received, the amount of expertise with NIH-sponsored research projects and the NIH review process, and other previous NIH interactions. IMPAC II was used to determine prior support of applicants by NIH Institute or Center (IC), and applicants were then broadly characterized into four groups representing prior support - Both NCI and Non-NCI; NCI Only; Non-NCI Only; and No Prior Support – with results shown in **Table 5**.

Prior Support NIH-IC Affinity Category	Applicants n = 542	Awardees n = 247	Non-Awardees n = 295
Both NCI and Non-NCI Only	33 (6.2%)	18 (7.3%)	15 (5.1%)
NCI Only	62 (11.5%)	28 (11.3%)	34 (11.5%)
Non-NCI Only	133 (24.6%)	64 (25.9%)	69 (23.4%)
No Prior Support	314 (57.7%)	137 (55.5%)	177 (60.0%)

Table 5. Prior support by NIH-IC affinity.
Percentages represent the proportion within each group, e.g., applicants, awardees, non-awardees. Data Source: IMPAC II.

IMPAC II data was used to perform a more detailed evaluation of prior NIH support, specifically examining whether applicants received previous NIH-supported training (institutional or T; fellowship or F; loan repayment or L; and career development or K), an RPG, a combination of a training grant and RPG, or other support prior to applying for or being awarded a BRP-SGP award (**Table 6**). The majority of applicants, whether funded or not, did not have prior NIH support. Of those who had prior NIH funding, the most common was T support (20% of awardees and 14% of non-awardees) and RPG support (15% of awardees and 18% of non-awardees). Only 13% of awardees and 4% of non-awardees had prior L support.

Prior support from non-NIH organizations, such as the Lance Armstrong Foundation, National Science Foundation, and International Cancer Research Portfolio partner organizations (see **Appendix 5.6**) was explored, however the overall match rate was very low (data not shown).

Prior NIH Support	Applicants n = 542	Awardees n = 247	Non-Awardees n = 295
Had T Support	89 (16%)	49 (20%)	40 (14%)
Had F Support	25 (5%)	16 (6%)	9 (3%)
Had K Support	27 (5%)	15 (6%)	12 (4%)
Had L Support	43 (8%)	31 (13%)	12 (4%)
Had RPG Support	89 (16%)	37 (15%)	52 (18%)
Had Multiple T, F, L Support	23 (4%)	17 (7%)	6 (2%)
Had Multiple Support, including RPG	19 (3%)	10 (4%)	9 (3%)
Had Only Other Support	27 (5%)	7 (3%)	20 (7%)
No Prior Support	314 (58%)	137 (55%)	177 (60%)

Table 6. Prior NIH support of BRP-SGP applicants, by funding status.
Percentage representation within each group (applicant, awardee, or non-awardee) shown in parentheses. Data Source: IMPAC II.

2.2.4.8 Characteristics of Applicant Institution

In addition to gathering information about applicants to the BRP-SGP, we examined the characteristics of the institutions from which applications were received and awards granted. Specifically, we looked at whether an applicant's institution was an NCI-designated Cancer Center, the level of cumulative NCI funding received, geographic location, and the submitting department.

Institutions classified as NCI-designated Cancer Centers have a demonstrated capability to integrate diverse research and clinical approaches to the study of cancer, playing a vital role in the national goal of reducing cancer-related deaths.[18] Currently, 66 U.S. institutions are classified as NCI-designated Cancer Centers – 40 Comprehensive and 26 Basic. To determine the proportion of BRP-SGP applications from and awards to researchers at NCI-designated Cancer Centers, the institutions of the applicants were matched to a current and an archival list of Cancer Centers.

Table 7 shows the distribution of applications and awards by Cancer Center status. The majority of BRP-SGP applications (52.3%) and awards (58.7%) were received from or made to applicants based at institutions with an NCI Cancer Center designation (either Comprehensive or Basic).

NCI-Designated Cancer Centers (69 Institutions)		Institutions that are not NCI-Designated Cancer Centers (160 Institutions)	
Applications	**Awards**	**Applications**	**Awards**
348 (52.3%)	145 (58.7%)	318 (47.8%)	102 (41.3%)

Table 7. BRP-SGP applications and awards, by NCI cancer center designation.

We next looked at the average annual NCI funding for the applicants' institutions. Average annual funding was broken down into three categories, as shown in **Table 8**. While institutions with an average annual funding level of $1 million to $10 million represent the largest proportion of applications to the BRP-SGP, they are ranked second to the top funding level ($10 million to <$100 million) in proportion of awards. Approximately one-fifth of applications, and 17% of awards, were from institutions with up to $1 million in annual funding.

Funding Level: $10 Million to <$100 Million (41 Institutions)		Funding Level: $1 Million to <$10 Million (82 Institutions)		Funding Level: $0 to <$1 Million (84 Institutions)	
Applications	**Awards**	**Applications**	**Awards**	**Applications**	**Awards**
241 (36%)	114 (46%)	270 (41%)	92 (37%)	130 (20%)	41 (17%)

Table 8. BRP-SGP applications and awards, by average annual NCI funding level[19].
The total number of applications and awards (as well as the percentage of the total for each) are listed. There were also 22 institutions that never received NCI funding, accounting for 25 applications (3.7%) and 0 awards.

[18] The list of current NCI Cancer Centers can be found at: http://cancercenters.cancer.gov/cancer_centers/index.html. This list may not reflect the Cancer Center status of an institution a t the time of application. Last accessed November 4, 2011.
[19] Time period for computing average annual NCI funding was 1970 through 2011.

When we analyzed the NCI-designated Cancer Center status combined with funding levels (**Table 9**), it was clear that the majority of the highest funded institutions with BRP-SGP applicants are NCI-designated Cancer Centers, although there were four institutions in the highest funding category that were not Cancer Centers.

Annual NCI Funding Range	NCI-designated Comprehensive Cancer Center	NCI-designated Cancer Center	Not an NCI-designated Cancer Center
$ 10 Million to < $ 100 Million	30	7	4
$ 1 Million to < $ 10 Million	11	21	50
$ 0 to < $ 1 Million	0	0	84
No NCI funding	0	0	22

Table 9. NCI-designated Cancer Center status of applicant institutions, by cumulative NCI funding.

Next we examined the geographic distribution of BRP-SGP applications and awards. For this analysis, we used the U.S. Department of Health and Human Services' regions (**Figure 7**) as a means of classifying geographic location.

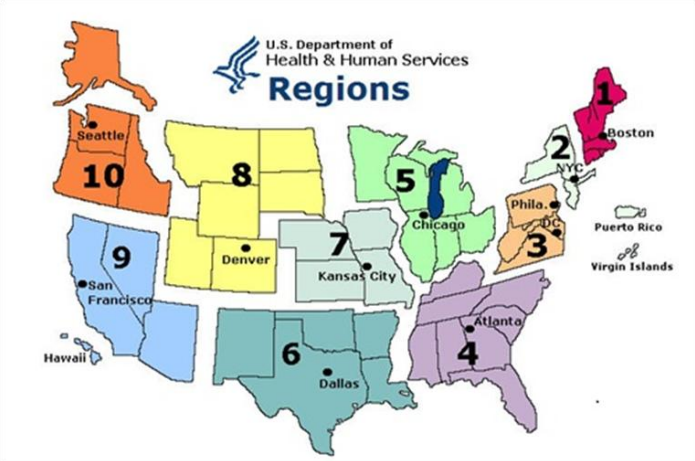

Figure 7. Map showing the U.S. Department of Health and Human Services geographic regions.

In general, the distribution of applications across the 10 regions was fairly even, although there was a slightly higher distribution of both applications and awards in Regions 1 through 5, representing the East Coast and Chicago (**Table 10**). The least represented regions were 8 (Denver), 10 (Seattle), and 7 (Kansas City), which include the states that receive the least NIH funding. **Appendix 5.7** provides a breakdown of BRP-SGP applications and awards by state to provide a more refined geographic analysis.

HHS Region	Applications	Percent of Total Applications	Awards	Percent of Total Awards
1. Boston	72	10.8%	31	12.5%
2. New York City	82	12.3%	35	14.2%
3. Philadelphia	91	13.7%	36	14.6%
4. Atlanta	112	16.8%	36	14.6%
5. Chicago	114	17.1%	42	17.0%
6. Dallas	63	9.5%	16	6.5%
7. Kansas City	36	5.4%	15	6.1%
8. Denver	15	2.3%	6	2.4%
9. San Francisco	64	9.6%	22	8.9%
10. Seattle	17	2.5%	8	3.2%

Table 10. Distribution of BRP-SGP applications and awards, by HHS region.

2.2.4.8 Characteristics of Applicants' Submitting Departments

To obtain more information about an applicant's research background and environment, we examined the submitting departments listed on each BRP-SGP application. We were able to obtain some information regarding submitting departments from IMPAC II, which was complemented by NCI staff member collection of departmental information from the cover page of each application and classification into the broader categories of Public Health, Medical, or Other (**Table 11**).

Public Health or Social Science	Medical	Other
Behavioral Sciences	Biology / Biomedical Sciences	Business Administration & Management
Biometrics and Biostatistics	Family Medicine	Other Fields, not classified elsewhere
Cancer Prevention and Control	Health Sciences	No Department Listed
Communication Studies	Hematology	
Community Health	Internal Medicine	
Epidemiology	Medicine, Other	
Health Education	Nursing Science	
Health Systems/Service Administration	Nutritional Sciences	
Kinesiology/Exercise Science	Obstetrics and Gynecology	
Population Sciences	Oncology	
Psychology	Pediatric Medicine	
Public Health or Social Science	Pediatric Oncology	
Social Sciences	Psychiatry	
Social Service	Radiology	
Social Work	Surgery	
Sociology		

Table 11. Categorization of submitting departments of BRP-SGP applicants.

Table 12 shows a more detailed breakdown of the submitting departments in each category and the number of applications for each year included in the evaluation. The largest volume of applications was received from Medicine (Other), Psychology, Psychiatry, Oncology, Nursing Science, and Public Health departments. Overall, applications were balanced between departments categorized as Public Health focus (40%) versus Medical focus (51%). Similar distributions were seen with awards, with 36% being made to Public Health- or Social Science-focused departments and 55% to Medical-focused departments (data not shown).

Submitting Department - Public Health Focus															
Submitting Department	PAR99-006			PAR02-037			PAR04-020			PAR06-073 / PAR06-458			Total		
	Awardees	Non-Awardees	Total Applications in PAR (% total apps)	Awardees	Non-Awardees	Total Applications in PAR (% total apps)	Awardees	Non-Awardees	Total Applications in PAR (% total apps)	Awardees	Non-Awardees	Total Applications in PAR (% total apps)	Awardees	Non-Awardees	Total Applications in PAR (% total apps)
Behavioral Sciences	1	0	1 (0.7%)	2	1	3 (3%)	0	1	1 (0.7%)	2	3	5 (3%)	**5**	**5**	**10 (2%)**
Biometrics and Biostatistics	0	0	0 (0%)	2	1	3 (3%)	1	1	2 (1%)	1	1	2 (1%)	**4**	**3**	**7 (1%)**
Cancer Prevention and Control	3	1	4 (3%)	2	3	5 (5%)	0	2	2 (1%)	5	1	6 (3%)	**10**	**7**	**17 (3%)**
Communication Studies	2	1	3 (2%)	1	5	6 (6%)	1	4	5 (3%)	1	1	2 (1%)	**5**	**11**	**16 (3%)**
Community Health	2	2	4 (3%)	0	2	2 (2%)	3	5	8 (6%)	2	5	7 (4%)	**7**	**14**	**21 (4%)**
Epidemiology	1	1	2 (1%)	2	0	2 (2%)	2	2	4 (3%)	2	4	6 (3%)	**7**	**7**	**14 (2%)**
Health Education	0	2	2 (1%)	0	1	1 (1%)	4	1	5 (3%)	1	4	5 (3%)	**5**	**8**	**13 (2%)**
Health Systems/Service Administration	3	2	5 (4%)	0	1	1 (1%)	1	0	1 (0.7%)	1	2	3 (2%)	**5**	**5**	**10 (2%)**
Kinesiology/Exercise Science	0	1	1 (0.7%)	0	1	1 (1%)	0	0	0 (0%)	2	0	2 (1%)	**2**	**2**	**4 (0.7%)**
Population Sciences	0	0	0 (0%)	0	0	0 (0%)	1	1	2 (1%)	3	2	5 (3%)	**4**	**3**	**7 (1%)**
Psychology	8	11	19 (13%)	4	3	7 (6%)	5	3	8 (6%)	9	11	20 (10%)	**26**	**28**	**54 (9%)**
Public Health	1	6	7 (5%)	3	2	5 (5%)	5	8	13 (9%)	3	6	9 (5%)	**12**	**22**	**34 (6%)**
Social Sciences	0	2	2 (1%)	0	1	1 (1%)	1	3	4 (3%)	3	3	6 (3%)	**4**	**9**	**13 (2%)**
Social Services	0	1	1 (0.7%)	0	1	1 (1%)	0	0	0 (0%)	1	0	1 (0.5%)	**1**	**2**	**3 (0.5%)**
Social Work	0	0	0 (0%)	0	0	0 (0%)	2	1	3 (2%)	1	2	3 (2%)	**3**	**3**	**6 (1%)**
Sociology	0	1	1 (0.7%)	0	1	1 (1%)	0	2	2 (1%)	0	0	0 (0%)	**0**	**4**	**4 (0.7%)**
Total Public Health	**21**	**31**	**52 (37%)**	**16**	**23**	**39 (36%)**	**26**	**34**	**60 (42%)**	**37**	**45**	**82 (42%)**	**100**	**133**	**233 (40%)**

Submitting Department - Medical Focus															
Submitting Department	PAR99-006			PAR02-037			PAR04-020			PAR06-073 / PAR06-458			Total		
	Awardees	Non-Awardees	Total Applications in PAR (% total apps)	Awardees	Non-Awardees	Total Applications in PAR (% total apps)	Awardees	Non-Awardees	Total Applications in PAR (% total apps)	Awardees	Non-Awardees	Total Applications in PAR (% total apps)	Awardees	Non-Awardees	Total Applications in PAR (% total apps)
Biology / Biomedical Sciences	0	0	0 (0%)	0	0	0 (0%)	0	3	3 (2%)	1	2	3 (2%)	1	5	**6 (1%)**
Family Medicine	1	1	2 (1%)	0	3	3 (3%)	0	2	2 (1%)	1	2	3 (2%)	2	8	**10 (2%)**
Health Sciences	4	5	9 (6%)	1	4	5 (5%)	1	3	4 (3%)	3	8	11 (6%)	9	20	**29 (5%)**
Hematology	1	0	1 (0.7%)	1	0	1 (1%)	1	0	1 (0.7%)	0	0	0 (0%)	3	0	**3 (0.5%)**
Internal Medicine	5	3	8 (6%)	3	0	3 (3%)	1	2	3 (2%)	2	2	4 (2%)	11	7	**18 (3%)**
Medicine, Other	7	12	19 (13%)	8	6	14 (13%)	6	11	17 (12%)	13	10	23 (12%)	34	39	**73 (12%)**
Nursing Science	5	1	6 (4%)	2	1	3 (3%)	6	5	11 (8%)	6	3	9 (5%)	19	10	**29 (5%)**
Nutritional Sciences	0	1	1 (0.7%)	1	2	3 (3%)	0	2	2 (1%)	1	2	3 (2%)	2	7	**9 (2%)**
Obstetrics and Gynecology	2	2	4 (3%)	1	0	1 (1%)	1	0	1 (0.7%)	0	0	0 (0%)	4	2	**6 (1%)**
Oncology	7	3	10 (7%)	5	4	9 (8%)	4	5	9 (6%)	7	5	12 (6%)	23	17	**40 (7%)**
Pediatric Medicine	0	1	1 (0.7%)	0	3	3 (3%)	0	3	3 (2%)	0	3	3 (2%)	0	10	**10 (2%)**
Pediatric Oncology	0	0	0 (0%)	1	0	1 (1%)	0	0	0 (0%)	2	1	3 (2%)	3	1	**4 (0.7%)**
Psychiatry	8	0	8 (6%)	5	2	7 (6%)	7	2	9 (6%)	14	4	18 (9%)	34	8	**42 (7%)**
Radiology	0	1	1 (0.7%)	1	1	2 (2%)	0	2	2 (1%)	1	0	1 (0.5%)	2	4	**6 (1%)**
Surgery	0	1	1 (0.7%)	0	2	2 (2%)	0	2	2 (1%)	1	5	6 (3%)	1	10	**11 (2%)**
Total Medical	**40**	**31**	**71 (50%)**	**29**	**28**	**57 (53%)**	**27**	**42**	**69 (48%)**	**52**	**47**	**99 (51%)**	**148**	**148**	**296 (51%)**

Submitting Department - Other															
Submitting Department	PAR99-006			PAR02-037			PAR04-020			PAR06-073 / PAR06-458			Total		
	Awardees	Non-Awardees	Total Applications in PAR (% total apps)	Awardees	Non-Awardees	Total Applications in PAR (% total apps)	Awardees	Non-Awardees	Total Applications in PAR (% total apps)	Awardees	Non-Awardees	Total Applications in PAR (% total apps)	Awardees	Non-Awardees	Total Applications in PAR (% total apps)
Business Administration & Management	2	1	3 (2%)	1	0	1 (1%)	0	0	0 (0%)	0	0	0 (0%)	3	1	**4 (0.7%)**
Other Fields, not classified elsewhere	3	4	7 (5%)	4	3	7 (6%)	6	4	10 (7%)	4	4	8 (4%)	17	15	**32 (5%)**
No Department Listed	2	6	8 (6%)	0	4	4 (4%)	1	4	5 (3%)	1	3	4 (2%)	4	17	**21 (4%)**
Total Other	**7**	**11**	**18 (13%)**	**5**	**7**	**12 (11%)**	**7**	**8**	**15 (10%)**	**5**	**7**	**12 (6%)**	**24**	**33**	**57 (10%)**

Table 12. BRP-SGP applications characterized by submitting department, PAR, and funding status.
Highlighted cells indicate the submitting department with the most applications per PAR for departments with a Public Health/Social Science focus and those with a Medical Focus.

2.3 Summary of Applicant and Awardee Characteristics

Overall, the BRP-SGP program is attracting applicants with appropriate training and specialization. There are no observed differences between recent graduate degree, gender, or race/ethnicity and the BRP-SGP applicant pool.

Awards and Award Rates

- Five NCI BRP-SGP PARs, spanning the years 1999 through 2008, received 666 applications and 247 awards. Combined, 37.1% of applications were awarded. There was no difference in award rate by gender or race/ethnicity.
- The majority of applicants (497) applied to only one PAR, 44 applied to two PARs, and one individual applied to three PARs.

Demographics

- The majority of applicants and awardees were women. This reflects the trends seen among recent medical sciences, social/behavioral sciences, and psychology PhD graduates.
- The average age of awardees was 39.96, and the median was 38 years. Age data also showed two distinct peaks – one in the mid-thirties, representing early career investigators, and the second around age 42, representing investigators seeking to transition to the field of cancer prevention and control.
- The majority of awardees apply to the BRP-SGP 3 to 8 years after receiving their degree (mean = 7.3 years; median = 5 years), indicating that the program is attracting early-career investigators.

Degree and Field of Study

- The overwhelming majority of applicants and awardees held PhDs.
- Applicants had a diverse range of PhD fields of study, covering 66 distinct areas. The most common fields were clinical psychology, epidemiology, public health, social psychology, and nursing science.

Prior Support

- The majority of applicants did not have prior NIH support. Of those BRP-SGP applicants who had prior NIH support, the most common was T grants or RPGs. Prior LRP support was more common among awardees.
- Of those BRP-SGP applicants with prior support, the majority received funding from NIH ICs other than the NCI.

Institutional Characteristics

- More than half of all BRP-SGP applications and 58% of awards were made to individuals at institutions with an NCI Cancer Center designation. Of these, approximately one-third of applications and awards were made to individuals at NCI-designated Comprehensive Cancer Centers.
- While the majority of BRP-SGP applications were received from applicants at institutions with annual NCI funding of $1 Million to $10 Million, nearly half of all awards were to individuals at institutions with the highest annual NCI funding ($10 Million to $100 Million).
- Applicants and Awardees were fairly evenly distributed across public health and medical departments. The most common submitting departments were Psychology, Medicine (Other), Psychiatry, Oncology, Nursing Science, and Public Health.
- BRP-SGP applications and awards were distributed fairly evenly across the U.S., although there was a higher concentration on the East coast and the Great Lakes region.

3.0 Selected Outcomes of Program Applicants and Awardees

3.1 Overview

This section describes our methods and presents findings on the outcomes of NCI BRP-SGP applicants and awardees. Measures of a research career in this evaluation included pursuit of subsequent research funding, time to receipt of first R01, subsequent peer-reviewed publication activity (e.g., publication count, number of citations, top journals, and journal subject categories), progression through faculty ranks, and service on NIH grant review panels.

3.2 Data Sources

IMPAC II served as the primary data source for investigating whether the BRP-SGP facilitated participants' transition from the R03 funding mechanism to mechanisms that support more comprehensive research, such as the R01. Data regarding subsequent research funding from non-NIH sources, such as the Department of Defense Congressionally Directed Medical Research Program (DoD-CDMRP), American Cancer Society, and Breast Cancer Research Foundation, as well as other foundations, was obtained by matching the names of BRP-SGP applicants to the International Cancer Research Portfolio (ICRP) database (rules used by the study are described in **Appendix 5.8**). The Lance Armstrong Foundation also provided name matches to their awardee database for this evaluation. Subsequent funding from the National Science Foundation was obtained via name match to the Thomson Reuters ScienceWire database.

The National Library of Medicine's MEDLINE database and Thomson Reuters' Web of Science (WoS) were used to match publications to the applicant pool and collect associated bibliometric data. Two approaches were used to match applicants to subsequent publications:

- Per-grant publication activity, using publications that directly cite the BRP R03 award; and
- Subsequent publication activity for the period from grant application through 2009 for the approximately 500 BRP R03 applicants, using the author's first and last name and other identifying information (such as middle initial, affiliation, or email address). The total number of articles published after BRP R03 award/application was then identified. From these publications, 2-year citation counts and information regarding WoS journal subject category and Medical Subject Heading (MeSH) terms were also collected.

Other measures of applicant productivity, such as last known professional appointment and participation on NIH grant review panels, were obtained from IMPAC II. Professional appointments data were initially collected from IMPAC II and supplemented by AAMC Faculty Roster for those applicants with faculty appointments at U.S. medical schools. Information regarding academic department was used to determine whether applicants continued to pursue a career in cancer prevention and control. Information about BRP-SGP applicant participation on NIH grant review groups, specifically participation on subsequent grant review panels that review BRP-SGP applications, was also collected from IMPAC II.

Finally, a small-scale test of the utility of collecting career outcomes information from alternative sources was performed, using online CVs and professional networking websites, such as LinkedIn. This manual review was limited to 60 individuals (29 awardees and 31 non-awardees) from the early years of the BRP-SGP program. Web searches were conducted using the Google search engine and applicant name (as recorded in IMPAC II). Depending on the number of hits, the search string was modified to include/exclude middle name or initial, last known degree, or last known institution name.

3.3 Composition and Validation of the Comparison Cohort

A method was developed to identify candidates for the comparison cohorts for each BRP-SGP PAR based on priority score of the application. The comparison cohort is constructed to include applicants who have applications of similar quality, as determined by priority score and an equal likelihood of being funded or not funded. The priority score range in which there is an equal number of awarded and not awarded applications is referred to as the "funding bubble." This priority score range can change from year to year, and thus for each BRP-SGP PAR evaluated, funding bubbles were determined for each fiscal year and combined into a single pool that was used for evaluating career outcomes (**Figure 8**).

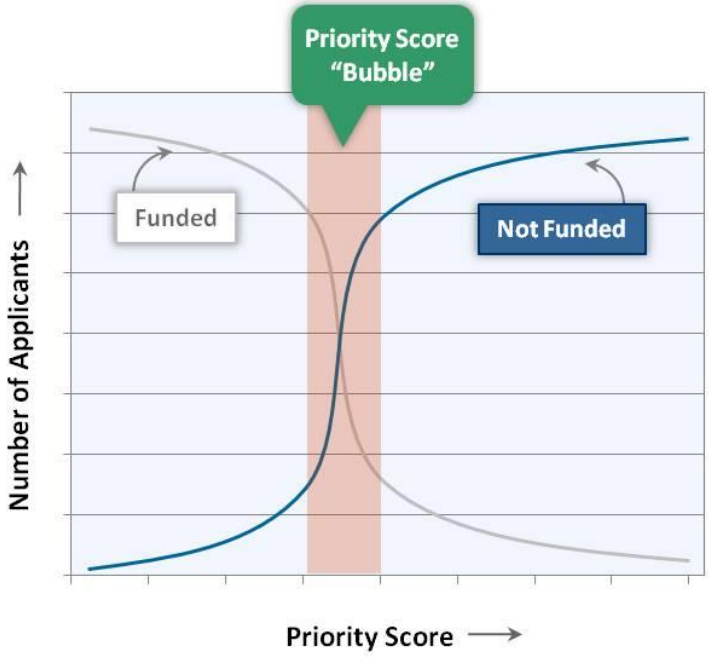

Figure 8. Comparison group methodology.

For each BRP-SGP PAR and each fiscal year included in the evaluation, the priority score range (100 – 500) was divided into equal sized bins, and each bin was populated with the number of funded and not funded applicants, respectively. An ideal funding bubble bin contains an equal number of funded and not funded applicants; one would anticipate that bins at the low end of the priority score range contain mostly funded applicants, while bins at the high end of the priority score range contain mostly unfunded applicants. Bin width, or the range of scores included in a bin, is also an important factor. If the range of included scores is too wide, similarity of application quality is reduced; similarly, if the range of scores is

too narrow, there is a risk of having a small and potentially unbalanced sample. The minimum bin width was a score range of 5 and the maximum allowed bin width was a score range of 80. Ten bin widths were considered for each FY-PAR combination, and the optimal bubble bin was selected using the following set of tie-breaker rules, applied in sequence:

- Highest "bubble usefulness score," calculated as 100% for any balanced bubble with an equal number of awardees and non-awardees and 0% for any unbalanced bubble multiplied by a factor measuring the "density" of applications (number of applications divided by the square root of the score range width)
- Highest score range upper endpoint (closest to 500)
- Smallest score range width (maximum allowed is 50)
- Largest application count (minimum allowed is 4 applications)
- Lowest score range low endpoint (closest to 100)

The optimal bins for each BRP-SGP PAR-FY combination were then pooled into a single comparison cohort to be used for the outcome analysis (**Figure 9**).

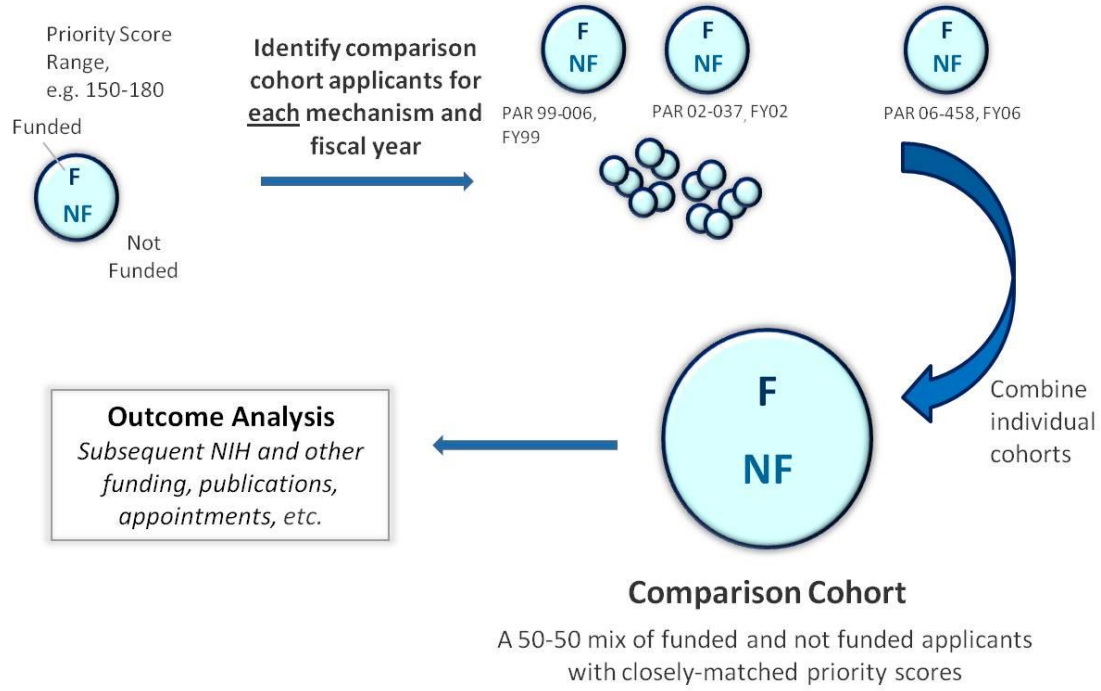

Figure 9. Derivation of the comparison cohort.

The final BRP-SGP comparison cohort contained 184 total applications (92 awardees and 92 non-awardees), and represented 34% of the total study population. Since the comparison cohort is used to assess the impact of participation in the BRP-SGP, it was imperative to ensure that the demographic characteristics of the comparison cohort reflected the study population as a whole. **Table 13** shows the comparison of the study parameters for the full cohort versus those of the comparison cohort.

Parameter	Category	Full Cohort - Applicants n = 542	% Full Cohort	Comparison Cohort - Applicants n = 184	% Comparison Cohort
Degree Type	PhD	396	73%	137	74%
	MD	71	13%	27	15%
	MD/PhD	22	4%	8	4%
	Dual	6	1%	2	1%
	Other	9	2%	2	1%
	Note	32	6%	6	3%
	Unknown	6	1%	2	1%
Gender	Male	197	36%	64	35%
	Female	324	60%	113	61%
	Unknown	21	4%	7	4%
Race/Ethnicity	White	306	56%	100	54%
	Asian	45	8%	14	8%
	Black	20	4%	4	2%
	Hispanic	23	4%	11	6%
	Native American	*	*	*	*
	Other	6	1%	3	2%
	Unknown	140	26%	51	28%
Prior Support	Had T Support	89	16%	41	22%
	Had F Support	25	5%	9	5%
	Had K Support	27	5%	13	7%
	Had L Support	43	8%	20	11%
	Had RPG Support	89	16%	29	16%
	Had Multiple T, F, L Support	23	4%	13	7%
	Had Multiple Support, including RPG	19	4%	5	3%
	Had Only Other Support	27	5%	7	4%
	No Prior Support	314	58%	97	53%
Institution Type	NCI-Designated Comprehensive Cancer Center	188	35%	71	39%
	NCI-Designated Cancer Center	95	18%	34	18%
	Not an NCI-Designated Cancer Center	263	49%	79	43%
Average Age at Application†		42.4 years		41.3 years	
Average Years Since Degree^		9.17 years		8.52 years	

Table 13. Demographic composition of the comparison and full cohorts.

*: Data not shown due to low numbers. †:Age at application n for full cohort = 503; n for comparison cohort = 173. ^: Years Since Degree n for full cohort = 455; n for comparison cohort = 164.
Data Source: IMPAC II, AAMC Faculty Roster, DRF.

3.4 Subsequent NIH and NCI Research Funding

Using IMPAC II, subsequent NIH grant application activity was collected for BRP-SGP awardees and non-awardees in both the full and comparison cohorts. Subsequent grant activity was ordered into tiered achievements, or "high water mark" categories, with each applicant being placed in the category representing their "best" (closest to 1) level attained based on application activity through FY 2011 (**Table 14**). Two sets of high water marks were collected: one representing the best ranking achieved for grant application activity across all NIH ICs (including NCI), and one representing the best ranking achieved for subsequent grant application activity within NCI only.

3.4.1 NIH High Water Marks

The first three high water mark categories in **Table 14** represent the successful receipt of competitive research and training awards across NIH, while categories 4 through 6 reflect application for competitive research and training awards. These categories include grant types 1, 2, and 5. Placement in category 7 indicates receipt of non-competitive research funding (e.g., non-PI role or types 3 or 7), while placement in category 8 indicates that no subsequent NIH applications or awards linked to a BRP-SGP applicant were found in IMPAC II.

High Water Mark Rank	Full Description	Abbreviated Description
1	Awarded a Type 1, 2, or 5 R01 grant	Awarded R01
2	Awarded a Type 1, 2, or 5 RPG grant other than R01	Awarded non-R01 RPG
3	Awarded a Type, 1, 2, or 5 grant that was not an RPG	Awarded other grant
4	Applied for an R01 that was not awarded	Applied for R01 grant (unfunded)
5	Applied for a non-R01 RPG grant that was not awarded	Applied for non-R01 RPG (unfunded)
6	Applied for non-RPG grant that was not awarded	Applied for other grant (unfunded)
7	Some grant application activity not meeting the specifications of levels 1-6	Other future
8	No grant application activity found in the post-BRP period	None found

Table 14. Subsequent NIH high water mark categories.

Approximately 50% of BRP-SGP awardees in the full cohort fell into one of the three NIH high water mark categories representing receipt of subsequent NIH funding (**Figure 10,** left). Nearly 20% were awarded an R01, 10% were awarded a non-R01 RPG, and 20% received other grant funding. Approximately 35% of the awardees applied for, but did not receive subsequent NIH funding, and the majority of the remaining 15% did not have subsequent NIH grant application activity. In contrast, only 30% of the non-awardees in the full cohort received subsequent NIH funding, and approximately 40% had no subsequent NIH grant application activity in IMPAC II. Thus, awardees within the full cohort were 1.4x more likely than non-awardees to pursue and receive NIH funding subsequent to their participation in the BRP-SGP ($p=1.0x10^{-10}$, Welch two sample t-test). Awardees were also 2.1x more likely to receive a subsequent NIH R01 award than non-awardees (p=0.0035, Fisher Exact Test).

We also examined the NIH high water mark for the comparison cohort and the trends seen in the full cohort were generally maintained (**Figure 10**, right). Both the awardees and non-awardees in the comparison cohort had approximately 35% of their respective pools in one of the three "awarded" subsequent high water marks. For awardees, this was fairly evenly distributed among categories 1 through 3, but for non-awardees, there was a larger proportion in category 2 (funded non-R01 RPG). As in the full cohort, a larger proportion of the awardees in the comparison cohort (~80%) were likely to have an NIH application outcome (categories 1 through 6) than non-awardees. Over 30% of the non-awardees in the comparison cohort had no NIH grant application activity subsequent to their BRP-SGP application, but this finding was not significant (p=0.16, Welch two sample t-test). As was seen in the full cohort, BRP awardees were 1.3x more likely to receive a subsequent NIH R01 award, but this finding was not statistically significant (p=0.65, Fisher Exact Test).

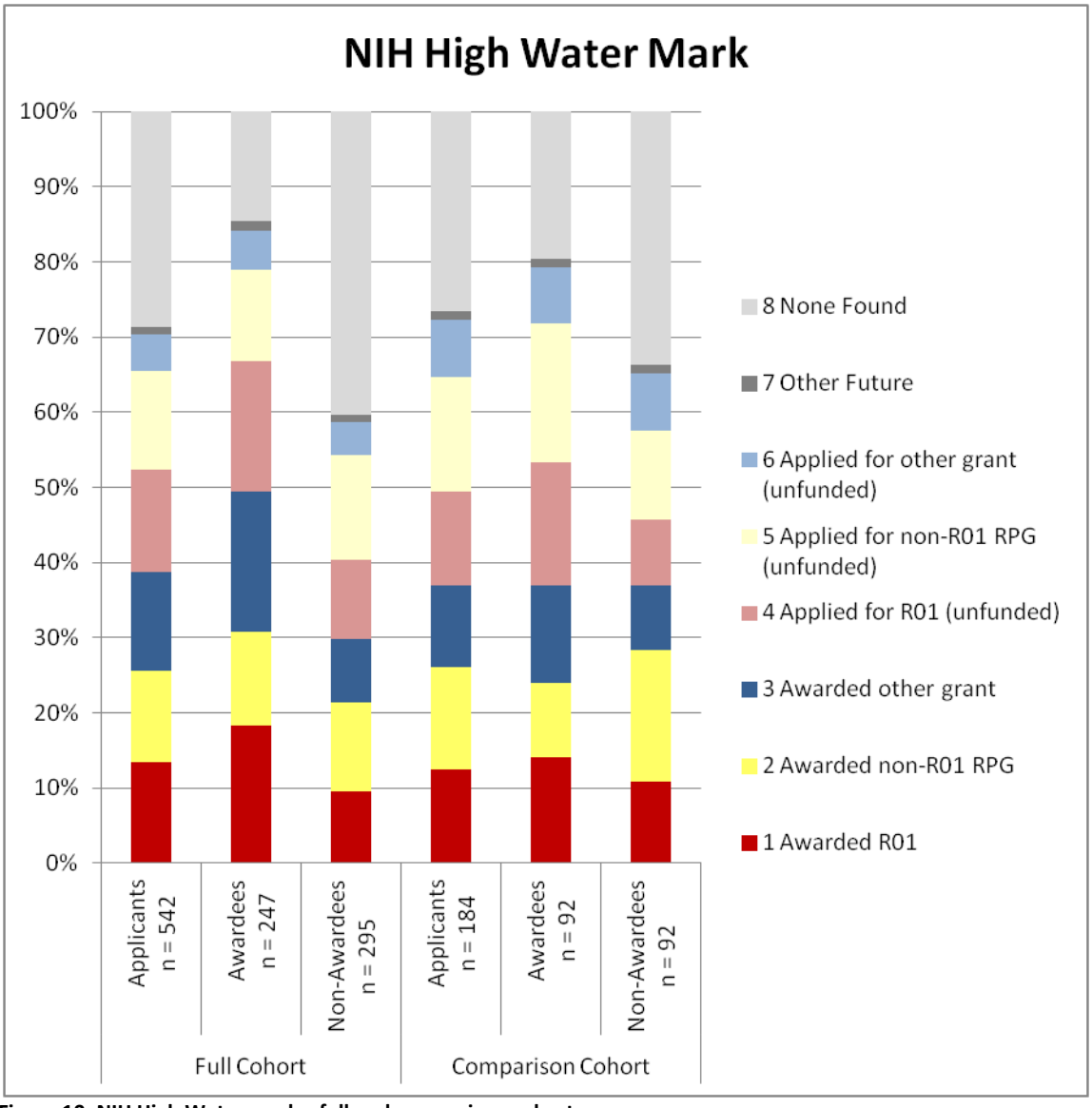

Figure 10. NIH High Water marks, full and comparison cohorts.
Categories 1 – 6 include type 1, 2, and 5 applications. Data Source: IMPAC II.

3.4.2 NCI High Water Marks

One of the goals of the BRP-SGP program is to encourage researchers from the behavioral and social sciences to engage in research related to the prevention and control of cancer. Therefore, in addition to subsequent NIH grant application of BRP-SGP applicants, we examined NCI-specific high water marks. The high water mark ranks and descriptions for this analysis were essentially the same as for NIH, above, except that the activity code designation was restricted to retrieve only NCI applications. Also, category 7 was revised to indicate failure of subsequent application activity to meet the NCI restriction (e.g., applicant may have had subsequent grant activity, but it was not within the NCI) as well as non-competitive (types 3 or 7) or non-PI roles. The NCI-specific high water rankings are shown in **Table 15**.

High Water Mark Rank	Full Description	Abbreviated Description
1	Awarded a Type 1, 2, or 5 NCI R01 grant	Awarded R01
2	Awarded a Type 1, 2, or 5 NCI RPG grant other than R01	Awarded non-R01 RPG
3	Awarded a Type 1, 2, or 5 NCI grant that was not an RPG	Awarded other grant
4	Applied for an NCI R01 that was not awarded	Applied for R01 grant (unfunded)
5	Applied for an NCI non-R01 RPG grant that was not awarded	Applied for non-R01 RPG (unfunded)
6	Applied for NCI non-RPG grant that was not awarded	Applied for other grant (unfunded)
7	Subsequent NIH grant application activity, but failed NCI restriction	Other NCI (failed restriction)
8	No grant application activity found in the post-BRP period	None found

Table 15. High water mark rankings for subsequent NCI-specific grant activity.

NCI-restricted high water marks for the full BRP-SGP cohort are shown in **Figure 11** (left). While the awardees maintain a similar total proportion and distribution among individual rankings as seen in the "All NIH" high water marks displayed previously (**Figure 10**), a much smaller total proportion of the non-awardee population has any subsequent NCI grant application activity, and nearly 60% has no subsequent NCI activity, compared to 40% with no subsequent NIH activity ($p=5.76x10^{-17}$). BRP awardees were 1.3x more likely to receive a subsequent NCI R01 ($p=1.16x10^{-5}$).

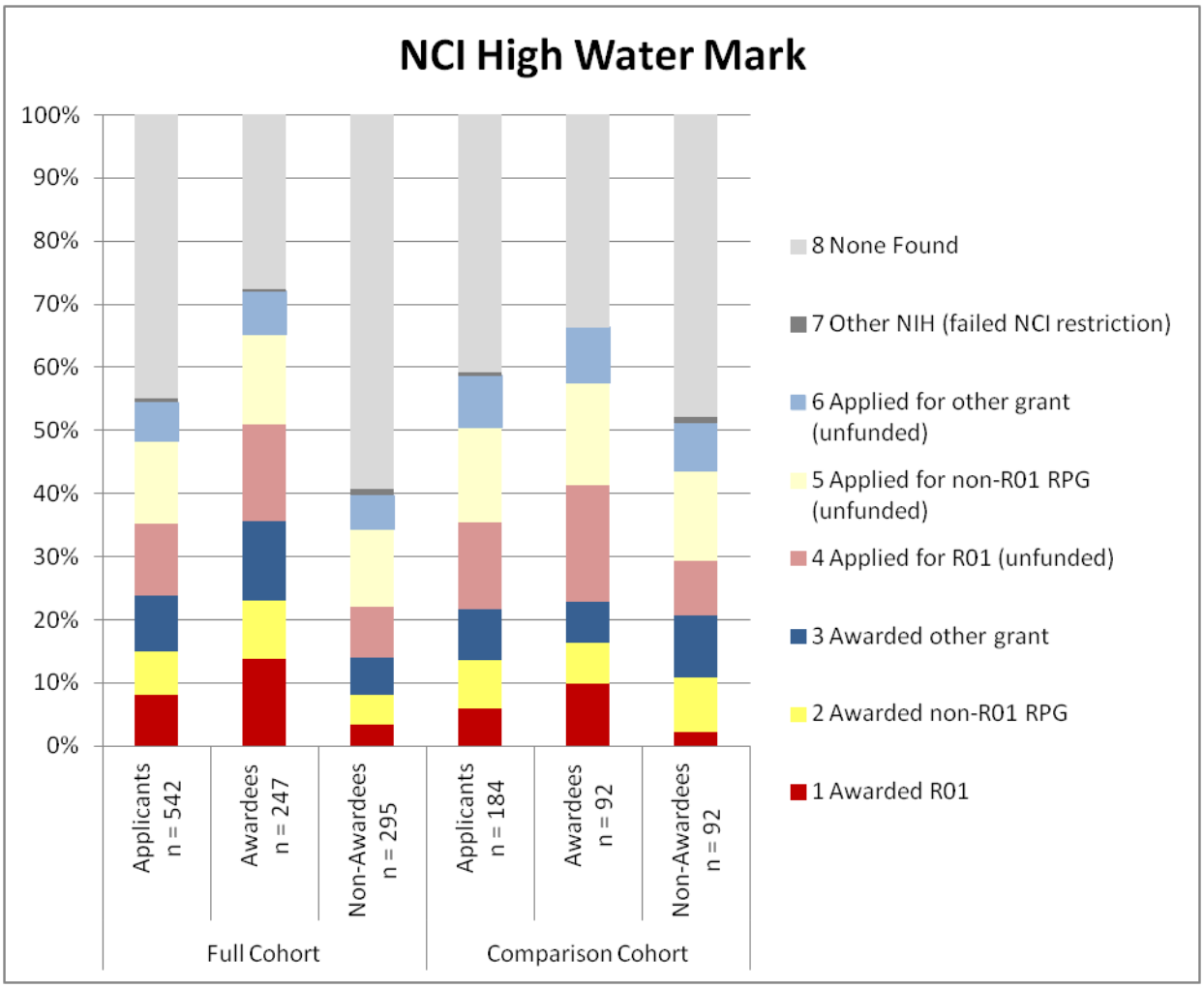

Figure 11. High water mark rankings, restricted to grant activity within the NCI, for the BRP-SGP full and comparison cohorts. Categories 1 through 6 include type 1, 2, and 5 applications. Data Source: IMPAC II.

When we look at the NCI high water mark rankings of the comparison cohort (**Figure 11**, right), we see that approximately 20% of both the awardees and non-awardees receive subsequent NCI funding, however, the majority of the awardees with subsequent funding had R01 funding, while non-awardees received equal proportions of non-R01 RPGs or other NCI grants. More awardees than non-awardees attained high water rank 4 - application for NCI R01 - and similar proportions of awardees and non-awardees applied for, but did not receive non-R01 RPG or other grant funding from the NCI. While the proportion of non-awardees with no subsequent NCI grant application activity decreased about 10% in the comparison cohort, the proportion of awardees in this group had a slight increase when compared to the full cohort (results not significant, p =0.02). Awardees were 4.7x more likely to have received a subsequent NCI R01, but this finding was not significant (p=0.057). Small n values for each high water rank column most likely caused these findings to fail significance tests.

3.4.3 Subsequent NIH and NCI Grant Activity by Gender

Table 16 shows the gender distribution of BRP-SGP awardees and non-awardees in the comparison cohort by subsequent NIH application or award status. As noted in Section 2 of this report, 60% of applicants and awardees to the BRP-SGP program were women. The data presented in Table 16 show that this distribution is largely retained in subsequent NIH grant application activity within the comparison cohort. Interestingly, the proportion of males receiving subsequent awards increased – particularly those who did not receive BRP-SGP funding -bringing the distribution closer to 50:50.

Ever Received BRP Funding?	Subsequent NIH Activity	Total Applicants	Male	Female
Yes	Applications	77	28 (36%)	49 (64%)
No	Applications	61	23 (38%)	38 (62%)
Yes	Awards	37	15 (41%)	22 (59%)
No	Awards	37	16 (43%)	21 (57%)

Table 16. Subsequent NIH grant activity in the comparison cohort, by funding status and gender. Data Source: IMPAC II, AAMC Faculty Roster, DRF.

When we look at the distribution of subsequent NCI activity by gender among the comparison cohort (**Table 17**), however, female applicants and awardees comprise the majority of activity, retaining the 60:40 ratio.

Ever Received BRP Funding?	Subsequent NCI Activity	Total Applicants	Male	Female
Yes	Applications	65	22 (34%)	43 (66%)
No	Applications	47	18 (38%)	29 (62%)
Yes	Awards	21	7 (33%)	14 (67%)
No	Awards	20	7 (35%)	13 (65%)

Table 17. Subsequent NCI grant activity in the comparison cohort, by funding status and gender. Data Source: IMPAC II, AAMC Faculty Roster, DRF.

3.4.4 Subsequent NIH and NCI Grant Activity by Degree

We also examined the distribution of subsequent NIH and NCI grant application activity within the comparison cohort by degree type (**Table 18**). Again, the distributions are similar to the general demographics of the full cohort, with over 70% of all categories holding PhDs. BRP-SGP non-awardees showed a slightly larger distribution of applicants holding MDs, reflecting a trend noted within the larger study population (see **Figure 3**).

Ever Received BRP Funding?	Subsequent NIH Activity	Total Applicants	PhD	MD/PhD	MD	Other
Yes	Applications	73	64 (88%)	0 (0%)	7 (10%)	1 (1%)
No	Applications	60	42 (70%)	3 (5%)	12 (20%)	1 (2%)
Yes	Awards	35	32 (91%)	0 (0%)	3 (9%)	0 (0%)
No	Awards	34	24 (71%)	2 (6%)	6 (18%)	1 (3%)

Table 18. Subsequent NIH grant activity in the comparison cohort, by funding status and degree. Data Source: IMPAC II, AAMC Faculty Roster, DRF.

Overall, these trends held true when we looked at NCI-specific subsequent grant activity in the comparison cohort. Among those who had received BRP-SGP funding, the overwhelming majority (over 90%) held PhDs. While the majority of BRP-SGP non-awardees with subsequent NCI activity were still PhDs, there was an increased representation of MDs (~25%) and MD/PhDs (~10%) among NCI awardees.

Ever Received BRP Funding?	Subsequent NCI Activity	Total Applicants	PhD	MD/PhD	MD	Other
Yes	Applications	61	56 (92%)	0 (0%)	3 (5%)	1 (2%)
No	Applications	47	30 (64%)	3 (6%)	11 (23%)	1 (2%)
Yes	Awards	21	20 (95%)	0 (0%)	1 (5%)	0 (0%)
No	Awards	19	10 (53%)	2 (11%)	5 (26%)	1 (5%)

Table 19. Subsequent NCI grant activity in the comparison cohort, by funding status and degree. Data Source: IMPAC II, AAMC Faculty Roster, DRF

3.4.5 Time to Subsequent NIH Research Funding

To examine how participation in the BRP-SGP might affect an applicant's career progression, we determined the length of time between BRP-SGP application or award and application for subsequent R01 or other RPG funding for both the full and comparison cohort. For both cohorts, we looked at the time to application for all NIH (excluding NCI) R01s and RPGs and NCI-only R01s and RPGs for both funded and unfunded BRP-SGP applicants.

When looking at the full cohort, the data indicate that the median time to subsequent RPG award for BRP-SGP awardees is longer than for non-awardees, with the exception of the NIH R01mechanism (**Figure 12**). This effect could be attributed to BRP-SGP non-awardees choosing to immediately pursue RPG funding to support their research upon decline of their application.

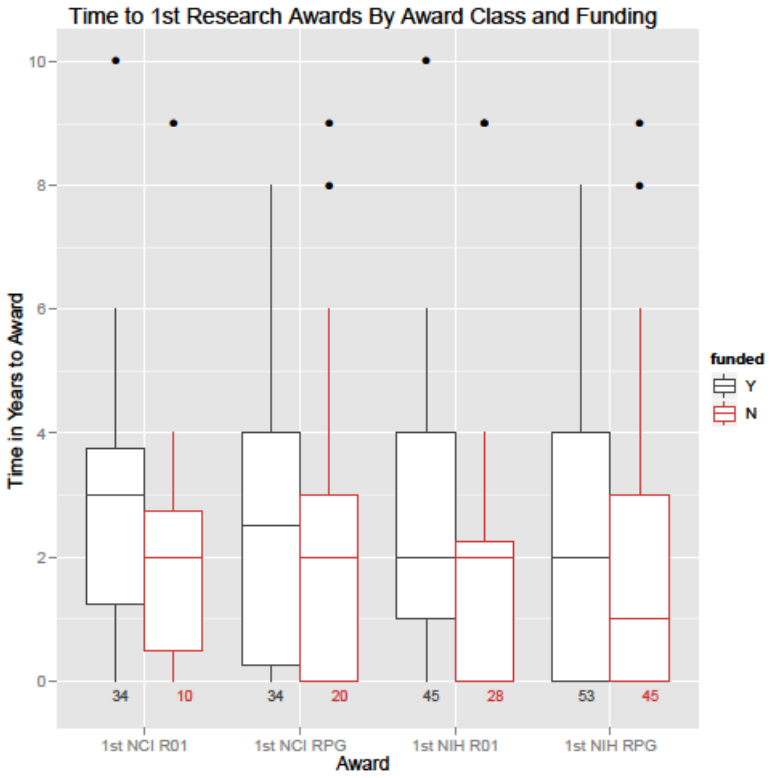

Figure 12. Time to subsequent NIH and NCI research funding following BRP-SGP award or application, full cohort.
In this representation, the box represents the inter-quartile range (IQR) with the middle horizontal line of the box representing the median, the lower horizontal line of the box representing the first quartile, and the upper horizontal line of the box representing the third quartile. The lower line (whisker) represents the first quartile – 1.5x the inter-quartile range, and the upper line (whisker) represents the third quartile + 1.5x the inter-quartile range. Dots above the whiskers represent data points that are considered outliers. Numbers underneath the boxes indicate the total n for each group. Data Source: IMPAC II.

To more clearly determine the effects of BRP-SGP funding status on the pursuit of subsequent NIH or NCI research funding, we conducted the same analysis for the comparison cohort. The data presented in **Figure 13** indicate that while the median times to subsequent NIH research funding are similar for BRP-SGP awardees and non-awardees, the median time for non-awardees to pursue NCI-specific funding is longer than that for awardees. This could indicate that non-awardees choose to pursue funding from ICs other than NCI following rejection of their BRP-SGP applications.

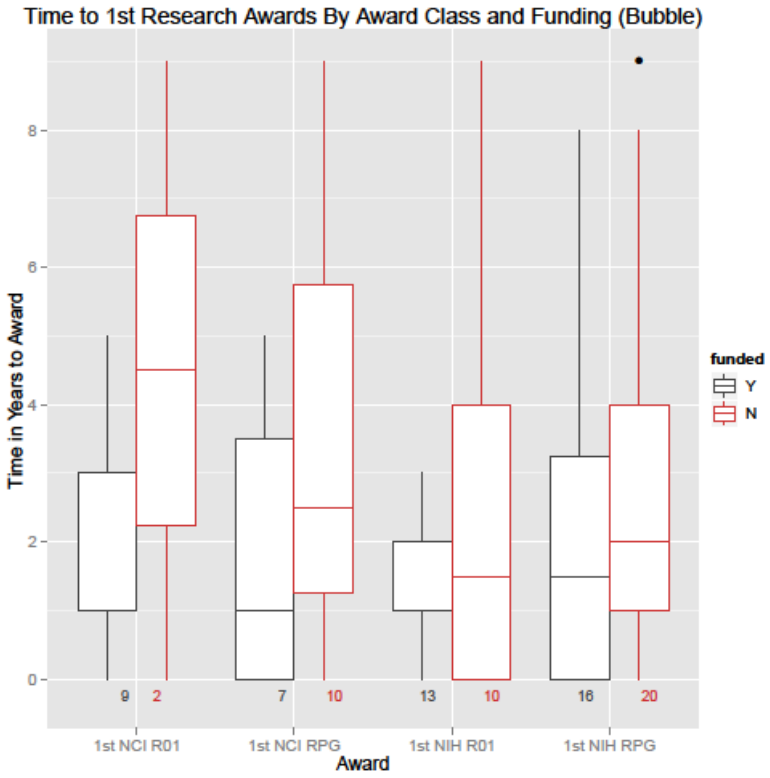

Figure 13. Time to subsequent NIH and NCI research funding following BRP-SGP award or application, comparison cohort. In this representation, the box represents the inter-quartile range (IQR) with the middle horizontal line of the box representing the median, the lower horizontal line of the box representing the first quartile, and the upper horizontal line of the box representing the third quartile. The lower line (whisker) represents the first quartile – 1.5x the inter-quartile range, and the upper line (whisker) represents the third quartile + 1.5x the inter-quartile range. Dots above the whiskers represent data points that are considered outliers. Numbers underneath the boxes indicate the total n for each group. Data Source: IMPAC II.

To more clearly define the career trajectories of NCI-SGP applicants, we examined the years since degree conferral to first research grant for the full and comparison cohorts (**Figures 14** and **15**, respectively). In both the full and comparison cohort, these data indicate that BRP-SGP awardees are generally early career investigators with a few outliers representing investigators attracted to the program as a way of shifting the focus of their research to cancer prevention and control. Non-awardees in both cohorts tended to have a longer time period between degree conferral and receipt of a research award, with the largest gaps for NIH and NCI non-R01 RPGs.

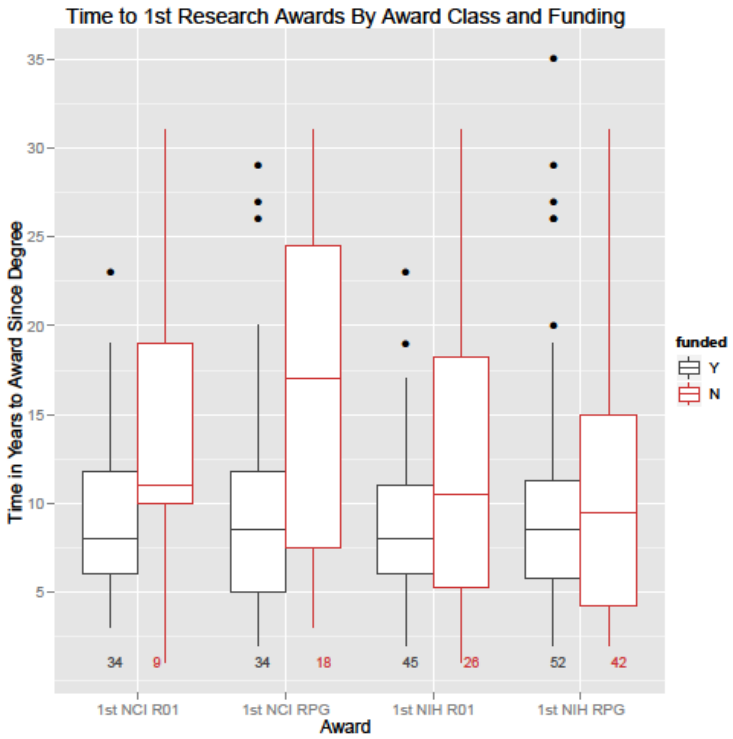

Figure 14. Time to subsequent NIH and NCI research funding since degree conferral by BRP-SGP funding status, full cohort. In this representation, the box represents the inter-quartile range (IQR) with the middle horizontal line of the box representing the median, the lower horizontal line of the box representing the first quartile, and the upper horizontal line of the box representing the third quartile. The lower line (whisker) represents the first quartile – 1.5x the inter-quartile range, and the upper line (whisker) represents the third quartile + 1.5x the inter-quartile range. Dots above the whiskers represent data points that are considered outliers. Numbers beneath the boxes indicate the total n for each group. Data Source: IMPAC II, DRF, AAMCFR.

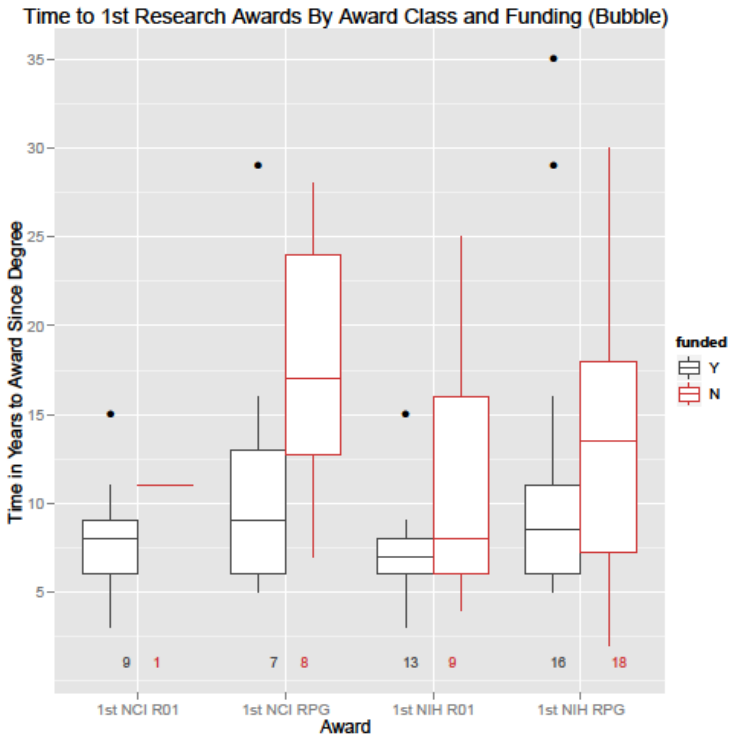

Figure 15. Time to subsequent NIH and NCI research funding since degree conferral by funding status, comparison cohort. In this representation, the box represents the inter-quartile range (IQR) with the middle horizontal line of the box representing the median, the lower horizontal line of the box representing the first quartile, and the upper horizontal line of the box representing the third quartile. The lower line (whisker) represents the first quartile – 1.5x the inter-quartile range, and the upper line (whisker) represents the third quartile + 1.5x the inter-quartile range. Dots above the whiskers represent data points that are considered outliers. Numbers beneath the boxes indicate the total n for each group. Data Source: IMPAC II, DRF, AAMCFR.

3.5 Subsequent External Funding

Pursuit and receipt of subsequent research funding from non-NIH sources was tested as a measure of BRP-SGP impact. For this analysis, we explored the pursuit of non-NIH funds from non-profit organizations focused on cancer research (e.g., American Cancer Society, Susan G. Komen Breast Cancer Foundation, others) using the International Cancer Research Portfolio (ICRP) database[20], the awards database of specific foundations (Lance Armstrong Foundation), or other Federal agencies (Department of Defense Congressionally Directed Medical Research Program via the ICRP database and the National Science Foundation). Names of BRP-SGP applicants were matched to the ICRP, ScienceWire, and Lance Armstrong Foundation awards databases using the name-matching algorithm described in **Appendix 5.8.2**.

Across these three data sources, the match rate to BRP-SGP applicants was very low (**Table 20**). Only 17 unique individuals from the full cohort were matched to 35 subsequent awards from ICRP partner

[20] The list of current International Cancer Research Portfolio partners can be found at http://www.cancerportfolio.org/faq.jsp#cso_partners and Appendix 5.6 (Last Accessed November 30, 2011).

organizations. A total of 15 unique individuals (12 awardees and 3 non-awardees) were matched to 18 awards sponsored by the Lance Armstrong Foundation, and only eight BRP-SGP applicants (3 awardees and 5 non-awardees) were matched to a total of 10 subsequent awards from NSF.

Funding Source	Number of Awards	Number of Unique BRP-SGP Applicants Matched	BRP-SGP Awardees	BRP-SGP Non-Awardees
DoD-CDMRP	27	12	3	9
American Cancer Society	4	3	1	2
Susan G. Komen Breast Cancer Foundation	4	2	0	2
Lance Armstrong Foundation	18	15	12	3
National Science Foundation	8	8	3	5

Table 20. Subsequent funding of BRP-SGP applicants from non-NIH sources. Data Sources: ICRP, ScienceWire, and LAF.

3.6 Publication Productivity and Impact

Publications serve as a relevant measure of subsequent research activity, and can provide information about the fields in which an investigator is working. To most effectively evaluate the impact of the BRP-SGP program, we examined publications matched to the PI via name match, as well as publications matched via acknowledgement of a specific BRP-SGP project number. Additional details regarding the publication productivity analysis can be found in **Appendix 5.9**.

3.6.1. Publications Linked to BRP-SGP Principal Investigators

Of the 542 BRP-SGP applicants in the full evaluation cohort, 384 (71%) of applicants, including 85% of awardees and 59% of non-awardees, were linked to 3,205 distinct publications using name matching algorithms described in **Appendix 5.8.1**. **Table 21** shows the distribution of these applicants and matched publications by funding status. The odds of being published post-study were 3.9x higher for awardees than non-awardees (p = 1.75x10E-11).

Funding Status	Individuals with Publications (Full Cohort)	Total Distinct Publications (Full Cohort)
Awardee	210	1,786
Non-Awardee	174	1,433
Total	384	3,219*

Table 21. Publications linked to BRP-SGP applicants, by funding status.
*Note: Fourteen papers were co-authored by an awardee and a non-awardee. Data Sources: Web of Science and MEDLINE.

Next, we examined the average and median publications per person per year, by BRP-SGP funding status. Interestingly, while the average was higher for BRP-SGP non-awardees, the median was higher for awardees (**Table 22**). In general, however, awardees and non-awardees published at comparable rates (**Figure 16**).

Funding Status	Average Publications Per Person Per Year	Median Publications Per Person Per Year
Awardee	1.78	1.5
Non-Awardee	1.97	1.33

Table 22. Publications per person per year, by funding status. Data Sources: Web of Science and MEDLINE.

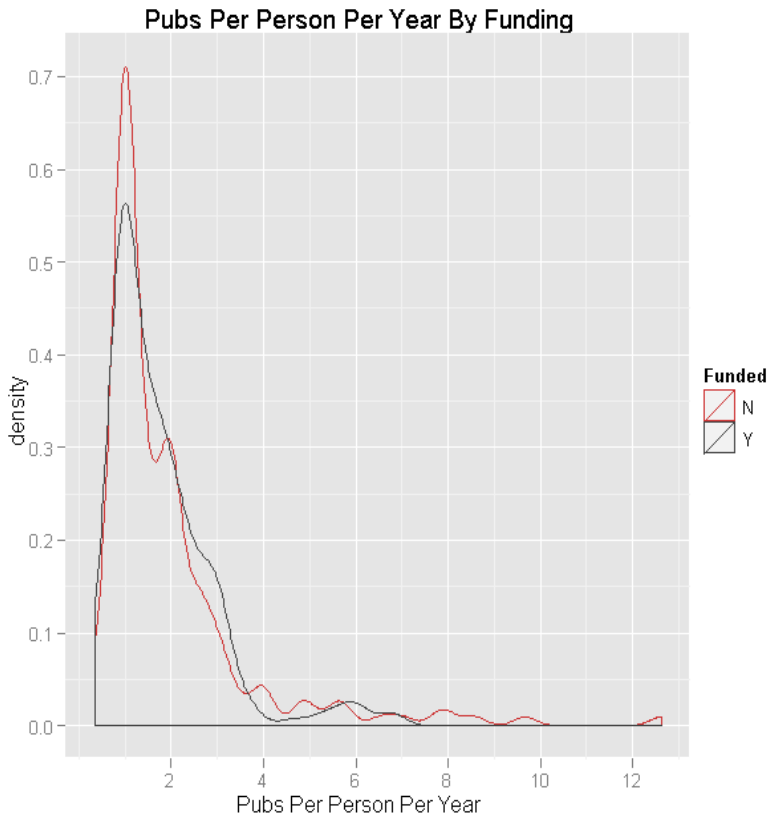

Figure 16. Publications per person per year, by funding status.
Density graph indicates approximate curve fit and treats the measured variable as continuous to a probability density function for that variable. Data Sources: IMPAC II, MEDLINE, Web of Science.

To determine whether the receipt of NCI BRP-SGP funding had a direct effect on publications, we looked at the distribution of PI-matched publications versus the amount of time since the fiscal year of the application or award. As expected, the majority of awardee publications, representing approximately 50% of total authors and 45% of total publications, were published within the first 3 years following award or application (**Table 23**). Non-awardees also published approximately 50% of their total publications within the first 3 years following application to BRP-SGP; however, these publications represent a smaller proportion (~30%) of non-awardee authors in the first 3 year following BRP-SGP

award or application. For those applicants not matched to subsequent publications, non-awardees represented a larger proportion (41%) than awardees (15%).

Number of Fiscal Years Post-BRP-SGP Application	Awardee Authors (% Awardees)	Awardee Publications (% Total Awardee Publications)	Non-Awardee Authors (% Non-Awardees)	Non-Awardee Publications (% Total Non-Awardee Publications)
1	131 (53%)	273 (15%)	114 (39%)	267 (18%)
2	135 (55%)	299 (16%)	93 (32%)	260 (18%)
3	119 (48%)	271 (15%)	78 (26%)	220 (15%)
4	112 (45%)	239 (13%)	62 (21%)	185 (13%)
5	95 (38%)	208 (11%)	59 (20%)	143 (10%)
6	79 (32%)	158 (9%)	43 (15%)	125 (9%)
7	53 (21%)	123 (7%)	29 (10%)	85 (6%)
8	42 (17%)	102 (6%)	19 (6%)	65 (4%)
9	30 (12%)	74 (4%)	13 (4%)	51 (3%)
10	24 (10%)	49 (3%)	10 (3%)	34 (2%)
11	11 (4%)	16 (1%)	7 (2%)	11 (1%)
12	5 (2%)	9 (0.5%)	0 (0%)	0 (0%)

Table 23. Publication volume by years since application, by funding status. Data Source: IMPAC II, Web of Science, MEDLINE.

Although the BRP-SGP is primarily targeted to early-career investigators (0 – 10 years since degree), the program also attracts senior investigators with an interest in applying their expertise to behavioral cancer control research. With that in mind, we examined the publication rates of BRP-SGP applicants by career stage. **Table 24** shows the distribution of BRP-SGPs who are authors by career stage. The majority of publications originated from early stage investigators, regardless of funding status.

Career Stage	Applicants (% total PIs)	Awardees (% total)	Non -Awardees (% total)
Early Stage (0- 10 years since degree)	250 (65%)	165 (79%)	85 (49%)
Later Stage (11+ years since degree)	103 (27%)	35 (17%)	68 (39%)
Years Since Degree Data Unavailable	31 (8%)	10 (5%)	21 (12%)
Totals	384	210	174

Table 24. Applicants who authored publications, by career stage and funding status. Data Source: IMPAC II, AAMC Faculty Roster, DRF.

Table 25 compares the average number of publications per author per year by BRP-SGP funding status and career stage. BRP-SGP awardees in both the early and later career stages published at a slightly lower rate than non-awardees during 2000 - 2011.

Career Stage	Funding Status	Average Publications Per Person Per Year
Early Stage (0- 10 years since degree)	Awardee	1.77
Early Stage (0- 10 years since degree)	Non-Awardee	2.03
Later Stage (11+ years since degree)	Awardee	1.78
Later Stage (11+ years since degree)	Non-Awardee	2.06

Table 25. Average number of publications per BRP-SGP author, by funding status and career stage. Data Source: IMPAC II, AAMC Faculty Roster, DRF, Web of Science, MEDLINE.

One explanation could be that, as the BRP-SGP awards offer the opportunity for investigators to pursue pilot studies that could lead to a larger study funded by a subsequent research project grant, preliminary findings are folded into a larger study funded by a subsequent grant. To test this, we looked at the overall impact of publications, as measured by citation rates and comparison to a benchmark citation rate representative of the research area. The Citation Benchmark is intended to be a standard against which to measure the actual citations received by a given publication. The Citation Benchmark is the median of the total number of citations at 24 months after publication of articles that share the following characteristics with those of a given publication:

1. Have the same article type (abstract, article, review, note, etc.),
2. Are published in the same journal,
3. Are published within six months (before or after) of the date of the study article, and
4. Include the given article.

The count of actual citations received in the first 24 months is divided by the Citation Benchmark to obtain a ratio that can be used to compare citation performance among different types of publications. Although **Table 26** shows that the average 2-year citation rate of BRP-SGP awardees is lower than that of non-awardees, and that the average citation to benchmark ratios are higher for awardees versus non-awardees, closer examination of the data indicated that these effects are due to extreme outliers, and that there are no differences in the medians between awardees and non-awardees (data not shown).

Funding Status	Average Citations in 2 Years	Average Non-self Citations in 2 Years	Average Citation to Benchmark Ratio	Average Non-self Citation to Benchmark Ratio
Awardee	23	18	0.84	0.91
Non-Awardee	33	27	0.79	0.83

Table 26. Average citation rate of publications linked to BRP-SGP applicants, by funding status.
The benchmark ratio is a derivative of the "expected citations" metric, and is calculated by taking median citation counts for similar publications (same publication type, published in the same journal, and published within 6 months of article of interest). Data Source: IMPAC II, Web of Science, MEDLINE.

When we examine the distribution of citation count per paper, we find that awardees are more likely to have higher citation counts than the non-awardees (**Figure 17**).

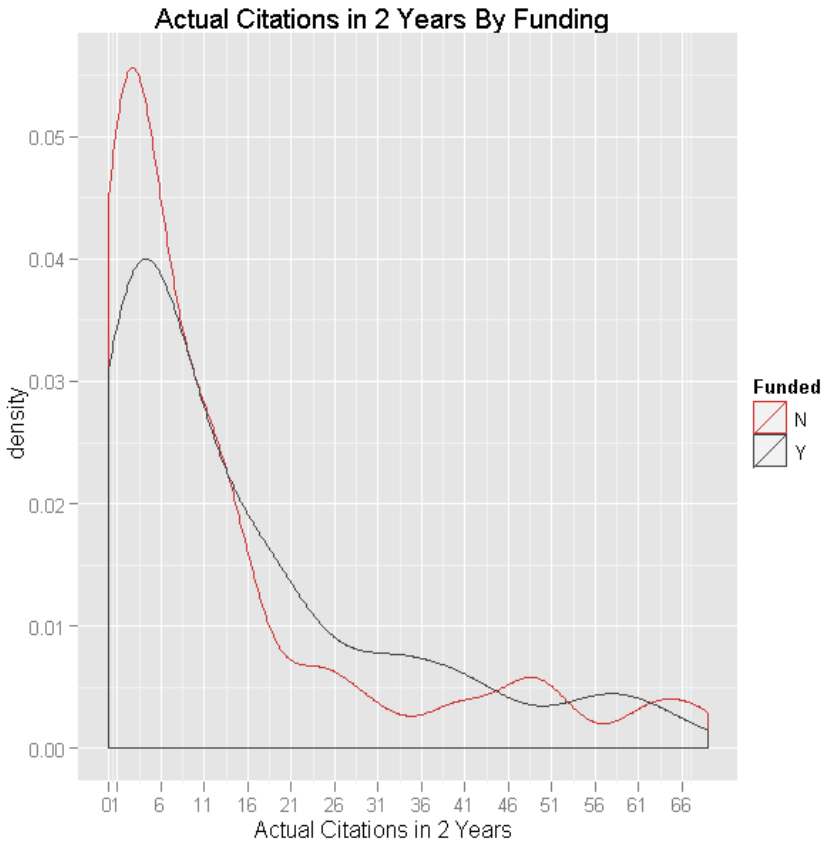

Figure 17. Actual citation counts of publications matched to BRP-SGP applicants, by funding status. Data Source: IMPAC II, Web of Science, MEDLINE.

3.6.2 Publications Linked to BRP-SGP Projects

To determine the number of publications specifically resulting from BRP-SGP funding, we searched for publications that acknowledged BRP-SGP funding by listing the award number. Although the total

number of publications for this analysis is typically much lower than that for PI name matches, it does allow for a more discrete analysis of the types of publications resulting from the program. For comparison, we collected publications from two additional NCI R03 programs in Cancer Prevention and Cancer Epidemiology. While both of these programs have provided more awards than the BRP-SGP, they conduct research in related areas under the R03 mechanism. **Table 27** shows the number of projects and project-linked publications for each of these three groups.

Group	Number of Projects	Projects with Publications (% of Projects)	Total Distinct Publications
BRP-SGP Funded Projects	252	114 (45.2%)	247
Comparison Project Group - Cancer Prevention	342	220 (64.3%)	628
Comparison Project Group - Epidemiology	421	234 (55.6%)	732
TOTAL	1,015	568 (56.0%)	1,607*

Table 27. Grant-linked publications for BRP-SGP and comparable NCI programs.
*Note: Eight publications were linked to projects in both the Cancer Prevention and Epidemiology comparison groups, therefore, the total of distinct Project-linked publications is 1,599. Data Source: IMPAC II, Web of Science, MEDLINE.

Table 28 shows the average number of publications for BRP-SGP studies versus the comparable NCI programs. Not surprisingly, the average number of publications per BRP-SGP project per year is lower versus both comparison groups (1.05 to 1.27, respectively), but all three groups have a median perproject, per year publication rate of 1.0. When we look at per project publication productivity graphically (**Figure 18**), we see similar publication productivity distribution curves for each program, with the mode of one publication per project.

Group	Average Publications Per Project Per Year	Median
BRP-SGP	1.05	1
Cancer Prevention	1.27	1
Epidemiology	1.27	1

Table 28. Average number of publications per project, per year for BRP-SGP and comparison groups. Publications per year, per project includes the total publications citing a project divided by the total observed publishing years for that project. Data Source: Web of Science, MEDLINE.

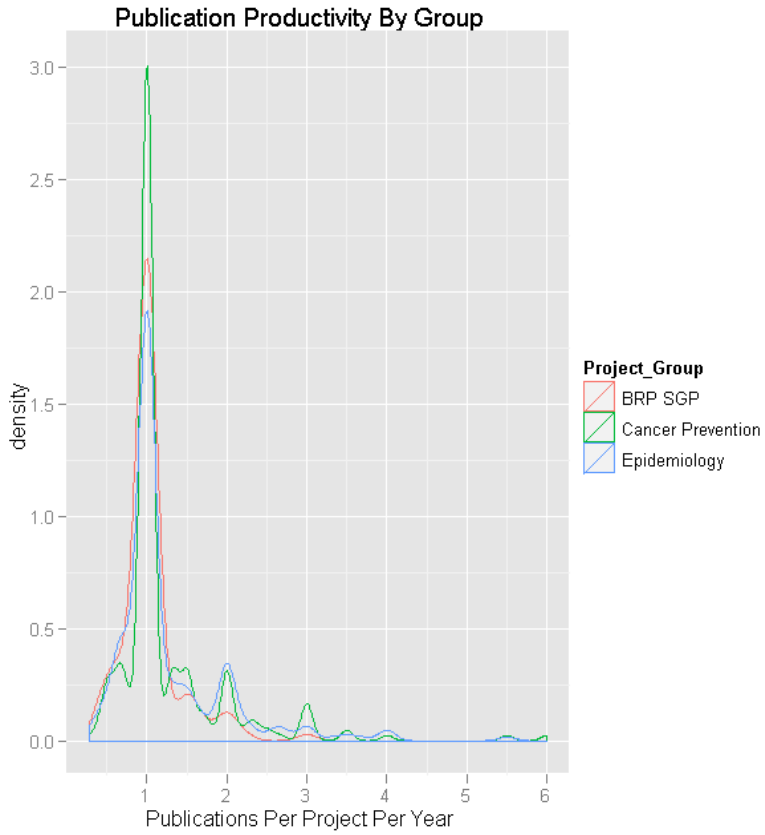

Figure 18. Publication productivity of BRP-SGP and comparable NCI programs. Data Source: Web of Science, MEDLINE.

To more precisely evaluate publication productivity of a project, we plotted the number of publications per project, per year in 2-year intervals for BRP-SGP and comparison groups (**Figure 19**). When compared to the Cancer Prevention and Epidemiology programs, the publication productivity of BRP-SGP projects was lower in the first 2 years after award, and was indistinguishable after the third year.

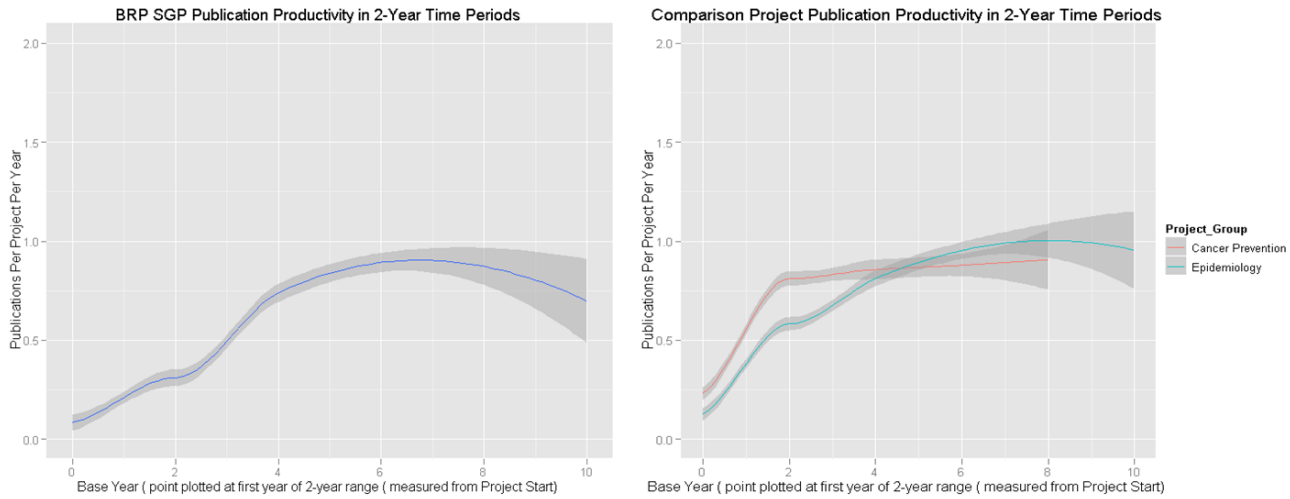

Figure 19. Publication productivity of BRP-SGP and comparable NCI programs, by 2-year intervals. Data Source: Web of Science, MEDLINE.

We also examined the citation rate of BRP-SGP study-linked publications versus those of the Cancer Prevention and Epidemiology comparison groups. A possible complicating factor was that each of the comparable NCI programs had nearly two to three times as many grants as the BRP-SGP programs, and thus data were normalized using the ratio of publications to projects (**Table 29).** Therefore, the increased number of papers of the comparison groups rather than the increased number of projects is responsible for the differences between the BRP-SGP and comparison groups.

Group	Total Publications	Ratio of Publications to Projects	Average Citations in 2 Years	Average Non-Self Citations in 2 Years	Average Citation to Benchmark Ratio	Average Non-Self Citation to Benchmark Ratio
BRP-SGP	247	0.98	6	5	0.68	0.76
Cancer Prevention	628	1.84	20	16	0.94	1.07
Epidemiology	732	1.74	23	18	1.00	1.12

Table 29. Citation rates of study-linked publications for BRP-SGP and comparison groups. Data Source: Web of Science.

To better assess the impact of the publications resulting from the BRP-SGP studies compared to the programs in Epidemiology and Cancer Prevention, we also examined the average mean citations, separated into quartiles. This calculates the average number of citations for each group, and the mean for the number of Web of Science journal subject categories represented for each publication. This metric is intended as an alternative to journal impact factor, focusing more on the effect of individual papers than the combined effect of all papers published within a specific journal. **Table 30** shows the number of projects within each group with publications with mean citation rank quartiles, as well as the

number of distinct publications represented. As previously indicated, a smaller proportion of BRP-SGP projects have publications with mean citation ranks due to an overall lower total number of publications versus the comparison groups.

Group	Number of Projects	Projects with Publications with Mean Citation Rank Quartiles (% of Projects)	Total Distinct Publications for the projects with Pubs w/mean quartiles
BRP-SGP Funded Projects	252	101 (40.1%)	189
Comparison Project Group - Cancer Prevention	342	213 (62.3%)	565
Comparison Project Group - Epidemiology	421	230 (54.6%)	693
TOTAL	1,015	544 (53.6%)	1,447

Table 30. Summary of projects and publications used to calculate average mean citation index for BRP-SGP publications and comparison groups.

Figure 20 shows the density graph representation of the average mean quartile for BRP-SGP in comparison to the Cancer Prevention and Epidemiology groups. While the Epidemiology group has nearly double the citation density of both the BRP-SGP and Cancer Prevention groups in the first (highest) quartile, the curves become better balanced beginning at calculated average mean citation quartile index of 1.25, indicating that the BRP-SGP had similar publication outputs.

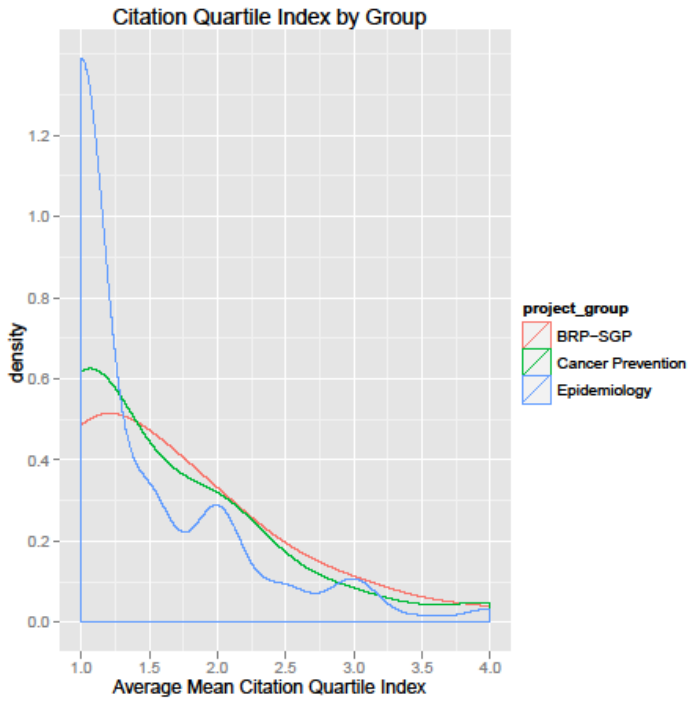

Figure 20. Average mean citation quartile index for BRP-SGP and comparison groups.

Group	Average Mean Citation Rank Index	Median
BRP-SGP	1.64	1.5
Cancer Prevention	1.58	1
Epidemiology	1.41	1

Table 31. Average mean citation rate indices of BRP-SGP and comparison groups.

When compared to the average mean citation rank index for the two comparison groups (**Table 31**), the BRP-SGP had a slightly higher index, however, still within 0.2 points of the Epidemiology group. The median citation rank index for BRP-SGP was also higher (1.5 compared to 1), which could reflect the total number of papers for each group.

Finally, **Figure 21** shows the distribution of publications for each group across the average mean citation quartile index. As expected, the overall range (excluding outliers) for the Epidemiology group was much smaller versus the Cancer Prevention and BRP-SGP groups.

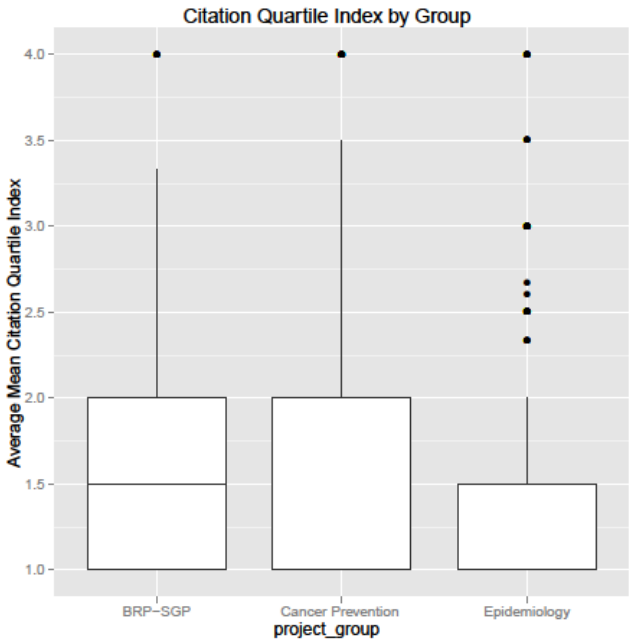

Figure 21. Citation quartile index rank for BRP-SGP and comparison groups.
In this representation, the box represents the inter-quartile range (IQR) with the middle horizontal line of the box representing the median, the lower horizontal line of the box representing the first quartile, and the upper horizontal line of the box representing the third quartile. The lower line (whisker) represents the first quartile – 1.5x the inter-quartile range, and the upper line (whisker) represents the third quartile + 1.5x the inter-quartile range. Dots above the whiskers represent data points that are considered outliers. The median line for both the Cancer Prevention and Epidemiology groups are located near 1.0.

3.7 Subsequent Faculty Rank of BRP-SGP Applicants

To understand how participation in the BRP-SGP might affect subsequent employment in the academic sector, last known appointment rank data were collected from IMPAC II and AAMC Faculty Roster for both the full and comparison cohorts. For both cohorts, the most common last known rank was Assistant Professor, followed by Associate Professor. Overall, the differences between awardees and non-awardees, if any, were small. Appointment data were not available for nearly one-fourth of the full and comparison cohorts (**Table 32**).

Cohort	Cohort N	Cohort N with Appointment Data	BRP-Funding Status	Professor	Associate Professor	Assistant Professor	Instructor	Other	No Appointment Data Found*
Full Cohort	542	324 (60%)	Yes	22 (7%)	54 (17%)	75 (23%)	7 (2%)	8 (2%)	81 (15%)
			No	28 (9%)	56 (17%)	59 (18%)	7 (2%)	8 (2%)	137 (25%)
Comparison Cohort	184	117 (64%)	Yes	9 (8%)	20 (17%)	28 (24%)	2 (2%)	4 (3%)	29 (16%)
			No	7 (6%)	21 (18%)	20 (17%)	3 (3%)	3 (3%)	38 (21%)

Table 32. Subsequent faculty rank of applicants, by funding status. Data Source: IMPAC II, AAMC Faculty Roster.

3.8 Service on NIH Grant Review Panels

Service as a grant reviewer for future BRP-SGP applications was used as a measure of continued involvement with in the area of behavioral research in the context of cancer control and prevention. **Table 33** shows the subsequent involvement of BRP-SGP applicants on NIH review panels. Approximately 14% of BRP-SGP awardees returned to serve as reviewers, while only 3% of non-awardees returned as reviewers. **Table 34** shows the distribution of reviewers by year of BRP-SGP award or last application and the number of new applications reviewed.

Total Distinct BRP-SGP Applicants who returned as reviewers	Percent of Total BRP-SGP Applicants	Total Distinct BRP-SGP Awardees who returned as reviewers	Percent of Total BRP-SGP Awardees
45	8.3%	35	14.2%

Table 33. Participation of BRP-SGP applicants on subsequent grant review panels. Data Source: IMPAC II.

Year of First BRP-SGP Award OR Year of Last BRP-SGP Application	Number of Reviewers (total, not unique)	Total Number of Subsequent BRP-SGP Applications Reviewed*
1999		1
2000	10	399
2001	8	136
2002	4	140
2003	14	474
2004	20	429
2005	7	136
2006	18	370
2007	14	158
2008	9	162
2009	1	32

Table 34. Distribution of BRP-SGP reviewers by year of award or last application and number of subsequent BRP-SGP applications reviewed.
*Note: Data through FY 2012 application year. Data Source: IMPAC II.

3.9 Outcomes of Individuals Without Subsequent Appointment Information

The majority of the outcomes analyses performed in this study are dependent on the applicants having IMPAC II records subsequent to their BRP-SGP application or award. To better understand the careers of individuals without subsequent NIH activity, we generated a random sample of 60 individuals (29 awardees and 31 non-awardees) and collected career information available online, such as CVs and professional web pages, using the Google search engine or the professional networking site LinkedIn. Of the 60 individuals in the manual search set, subsequent appointment information was collected for 52 individuals and information could not be verified for 8 individuals.

The majority (34) of those in the manual search sample held faculty positions, while 13 held positions classified as "non-faculty" (**Table 35**). Nearly half of these were individuals in private medical practice. Others continued to pursue science-related careers, either in scientific administration or staff scientist roles. Five of the individuals in the manual search group were confirmed as retired from their faculty positions.

Non-Faculty Appointment Title	Awardee	Non-Awardee
Private Medical Practice	3	3
Medical Director (hospital group)	0	1
Vice President of Scientific Affairs (biomedical company)	0	1
Research Associate / Staff Scientist / Investigator	1	2
NIH Employee	0	2

Table 35. Non-faculty appointments of individuals without subsequent IMPAC II records.

Table 36 classifies the individuals in the manual search set by academic department (if a faculty member) and title. In contrast to the findings presented previously for the full and comparison cohorts in **Table 32**, the majority of awardees and non-awardees in the manual search set with faculty positions were full or associate professors, none of the awardees were assistant professors, and only one non-awardee held this title. This could indicate that this group had a higher representation of BRP-SGP applicants that chose to apply to the program as a means to apply existing expertise to cancer prevention and control research. It could also mean that the information from AAMC Faculty Roster or IMPAC II are out of date.

Department Focus	Submitting Department	Awardee				Non-Awardee			
		Professor	Associate Professor	Assistant Professor	Other	Professor	Associate Professor	Assistant Professor	Other
Public Health	Behavioral Sciences	2	2	0	0	0	2	0	0
	Biometrics and Biostatistics	0	0	0	0	1	0	0	0
	Cancer Prevention and Control	0	0	0	0	0	0	0	1
	Communication Studies	0	0	0	0	0	0	0	0
	Community Health	1	1	0	0	0	0	0	1
	Epidemiology	0	2	0	0	0	0	0	0
	Health Education	0	0	0	0	0	0	0	0
	Health Systems/Service Administration	0	0	0	0	0	0	0	1
	Kinesiology/Exercise Science	0	0	0	0	0	0	0	0
	Population Sciences	0	0	0	0	0	0	0	0
	Psychology	2	2	0	1	1	1	0	2
	Public Health	1	1	0	0	0	2	0	0
	Social Sciences	0	0	0	0	0	0	0	0
	Social Service	0	0	0	0	0	0	0	0
	Sociology	0	0	0	0	0	0	0	0
	TOTAL PUBLIC HEALTH	**6**	**8**	**0**	**1**	**2**	**5**	**0**	**5**
Medical	Biology/Biomedical Sciences	0	0	0	0	0	0	0	0
	Family Medicine	0	1	0	0	1	1	0	0
	Health Sciences	0	0	0	0	1	0	0	0
	Hematology	0	0	0	0	0	0	0	0
	Internal Medicine	0	0	0	1	0	0	0	1
	Medicine, Other	0	0	0	0	1	1	0	0
	Nursing Science	1	0	0	0	0	0	0	0
	Nutritional Sciences	0	0	0	0	1	0	0	0
	Obstetrics & Gynecology	0	0	0	0	0	0	0	0
	Oncology	0	0	0	0	0	0	1	0
	Pediatric Medicine	0	0	0	0	0	0	0	0
	Pediatric Oncology	0	0	0	0	0	0	0	0
	Psychiatry	0	1	0	1	0	0	0	0
	Radiology	0	0	0	0	1	0	0	0
	Surgery	0	0	0	0	0	0	0	0
	TOTAL MEDICAL	**1**	**2**	**0**	**2**	**5**	**2**	**1**	**1**
Other	Business Administration & Management	0	0	0	0	0	0	0	3
	Other Fields, not classified elsewhere	1	0	0	1	0	0	0	0
	No Department found	0	0	0	3	0	0	0	5
	Retired	0	0	0	4	0	0	0	1
	TOTAL OTHER	**1**	**0**	**0**	**8**	**0**	**0**	**0**	**9**
	TOTALS	8	10	0	11	7	7	1	15

Table 36. Subsequent appointments of individuals in the manual search set, by department.

3.10 Summary of Applicant and Awardee Outcomes

Participation in the BRP-SGP program was correlated with a higher likelihood of applying for and receiving subsequent NCI and NIH grants.

Subsequent NIH Activity

- BRP-SGP awardees were more likely than non-awardees to apply for and receive subsequent research funding from NCI and NIH more broadly.
- BRP-SGP awardees were more likely than non-awardees to receive subsequent NIH R01 funding.
- Analysis of BRP-SGP applicant time to RPG/R01 indicates that awardees are earlier in their research careers, with timelines indicating a steady transition from R03 to RPG/R01.

Subsequent Funding from non-NIH Sources

- A small number of BRP-SGP applicants were matched to research awards from the DoD-CDMRP, NSF, American Cancer Society, Susan G. Komen Breast Cancer Foundation, and the Lance Armstrong Foundation. For all except LAF, the majority of grant recipients were BRP-SGP non-awardees.

Subsequent Publications

- BRP-SGP awardees were more likely than non-awardees to be published post-study. Of those who published, however, awardees and non-awardees published at comparable rates (~1-2 publications per year).
- The majority of awardees published within the first 3 years following receipt of the BRP-SGP award.
- The average citation rate of awardee publications was higher than the benchmark citation rate.
- Nearly half (114) of the funded BRP-SGP studies were associated with 247 publications, with a publication per study rate of approximately one publication per year.
- When compared to studies funded through NCI R03 programs in epidemiology and cancer prevention, the publication rate of BRP-SGP studies lags, however, this may be attributable to factors such as the availability of appropriate journals or other modes of communicating findings within the field.

Subsequent Career Appointments

- The majority of BRP-SGP awardees for whom subsequent appointment data were available held the title of Assistant Professor (~25%) or Associate Professor (18%). Rankings among non-awardees were similar, although there was a larger proportion for whom data was not available.
- Qualitative analysis of career appointments for a random sample of individuals with no subsequent IMPAC II records found that the majority of these individuals remained in science-related careers. The majority held faculty positions, but others contributed to the scientific enterprise as physicians in private practice or in other roles related to research.

Subsequent Participation on BRP-SGP Review Panels

- Less than 10% of the BRP-SGP applicant pool served on BRP-SGP review panels. Of those who served, the majority were awardees.

4.0 Summary and Policy Implications

This evaluation built on the recommendations of a previous program evaluation by incorporating quantitative measures to assess career outcomes and using a matched comparison group to determine the impact of the BRP-SGP award on these outcomes.

Overall, the BRP-SGP program is attracting the intended applicants and has had a measurable impact on the subsequent research careers of awardees, playing a role in the progression of behavioral research related to cancer prevention and control as an emerging field. Specifically, awardees are more likely than non-awardees to pursue and receive subsequent funding from the NIH and NCI and publish their research. The program is very successful in recruiting researchers from a diverse range of disciplines to the field of cancer prevention and control.

Specific findings point to opportunities for adjustment of program policy and outreach:

- Recording and tracking the PhD field of study or medical specialty of applicants and the submitting department of BRP-SGP applicants would help identify academic departments that are not submitting applications to the BRP-SGP program and with whom program staff should target for program outreach.

- Text matching of the title and abstract of funded BRP-SGP applications to subsequent NIH grant applications and awards and publications could be used as a method to determine whether the research sponsored by the R03 is being applied to the subsequent research program of awardees.

- Inclusion of both a BRP-SGP grant and subsequent NIH RPG in the acknowledgements section of research publications could also be used as a method of determining whether the R03 grant was used to stimulate a research program in the area of cancer prevention and control.

- NCI and BRP-SGP program managers should explore ways to encourage collaboration between funded researchers and other programs that sponsor research in cancer prevention and control.

- In addition to the comparison cohort analysis included in this evaluation, which looked at similarly scored BRP-SGP applications that had an equal chance of being funded or unfunded, it could be informative for program managers to pursue a comparison of the career outcomes of BRP-SGP awardees to those K07 awardees. Such an analysis could tease out particular facets of each program that help foster research in the area of cancer prevention and control.

- Only a small proportion of BRP-SGP applicants returned to serve on BRP-SGP review panels. Programmatic policy could be adjusted to encourage subsequent participation of awardees on review panels and other federal advisory committees, giving more visibility to the field of cancer prevention and control.

Overall, the BRP-SGP R03 mechanism continues to provide an opportunity for researchers with diverse training to enter the field of cancer prevention and control.

5.0 Appendices

5.1 Study Variables and Data Sources

Variable	Data Source (s)
Gender	IMPAC II DRF AAMC Faculty Roster
Race/Ethnicity	IMPAC II DRF AAMC Faculty Roster
Age (derived from Date of Birth)	IMPAC II DRF AAMC Faculty Roster
Degree(s)	IMPAC II DRF AAMC Faculty Roster
Years Since Degree	IMPAC II DRF AAMC Faculty Roster
Prior NIH Support	IMPAC II
Subsequent NIH Support	IMPAC II
Non-NIH Federal Research Support	International Cancer Research Portfolio DOE NSF FastLane
Non-Federal Research Support	International Cancer Research Portfolio Lance Armstrong Foundation
Faculty Appointment	IMPAC II AAMC Faculty Roster
Non-Research Careers	LinkedIn, google.com
Publications	MEDLINE Thomson Reuters Web of Science

5.2 Classification and Determination of Qualifying Degree

Degree information (type of degree and year earned) was obtained from IMPACII, AAMC Faculty Roster, and DRF. The possible degree types were classified into the following categories:

PhD	DMEDSC, DMSC, DNS, DNSC, DPH, DPHI, DPHIL, DPHL, DRPH, DRSC, DSC, DSW, EDD, PDFELLOW, PHD, POSTDOC, POSTDOCTRA, SCD, SD
MD	BAO, BCH, BDS, BDSC, BE, CHB, DO, MBBC, MBBCH, MBBCHB, MBBS, MBCHB, MD, MDCM, MRCOG, MSURGERY
MD/PhD	At least one PhD degree and at least one MD degree
Dual	At least one PhD OR at least one MD (but not both) and at least one Other degree (except for FAAN, RN, and OTH)
Other	APRN, BH, BVMS, BVSC, CRNP, DACVIM, DC, DCLINP, DCLINPSY, DDOT, DDS, DH, DMD, DNSCCNM, DOTH, DPHARM, DPM, DSN, DVM, FAAN, JD, JD1, LLD, MMED, ND, OD, OTH, PHAR, PHARMD, PHM, PHMD, PHRMD, PSYD, RN, RNP, VDOT, VMD
Note	AA, AACR, AAS, AB, AH, AM, AOCN, APRNBC, ARNP, AS, ASC, ATC, BA, BAMD, BAS, BBA, BC, BD, BM, BMATH, BMED, BN, BOTH, BPHA, BPHARM, BPHARMACY, BS, BSC, BSCH, BSCHONS, BSD, BSE, BSEE, BSN, BSPHAR, BSW, CCCA, CCCSLP, CE, CERT, CERTIF, CFNP, CLINRES, CM, CNM, CP, CPHIL, CRC, CS, DCH, DD, DDD, DGO, DIPACVS, DM, DMS, DRS, DTMH, EDM, EPI, FAAAAI, FAAP, FACC, FACEP, FACOG, FACP, FACS, FAHA, FCCM, FNP, FRACP, FRACPMHS, FRCA, FRCDC, FRCP, FRCPI, FRCS, GNP, HS, LCSW, LDNRD, LMT, LP, MA, MACP, MAPA, MAPP, MAS, MB, MBA, MBE, MCR, MDIV, MDOT, MDS, ME, MED, MEE, MGS, MH, MHA, MHS, MHSC, MHSE, MJ, MM, MMATH, MMS, MMSC, MOTH, MPA, MPE, MPH, MPHI, MPHIL, MPP, MPPM, MRCP, MRCPI, MS, MSBA, MSC, MSCE, MSCESCB, MSCI, MSCR, MSE, MSED, MSEE, MSHS, MSMBA, MSN, MSP, MSPH, MSSA, MSURG, MSW, MTR, MVSC, NULL, PAC, PD, PH, PHDMAB, PHDRESP, PNP, PT, RD, RNC, RPH, RVT, SB, SCB, SCM, SLP, SM, THM, WHCNP

Some synonymous degrees were standardized to a single display label for use in detailed reports: (DMD →DDS and VMD→ DVM). All degrees were stored by application for each individual, with the degree selected for a given application being the closest in time before or equal to the application fiscal year. When reporting the years since terminal degree, the degree in the earliest year on record was used for each individual. For reports showing Applicants by Degree, the degree at the time of the first BRP-SGP application was used.

5.3 DRF Fields of Study – Full BRP-SGP Study Cohort Matched to DRF

Agricultural Economics
Anthropology
Architecture/Environmental Design
Biochemistry
Bioengineering and Biomedical Engineering
Biology/Biomedical Sciences, Gen
Biometrics and Biostatistics
Business Administration and Management
Cell/Cellular Biology and Histology
Clinical Psychology
Cognitive Psychology and Psycholinguistics
Communication Research
Communication Theory
Communication, General
Communication, Other
Counseling
Curriculum and Instruction
Developmental and Child Psychology
Education, General
Educational Assessment/Testing/Measure
Educational Psychology
Educational Statistics/Research Methods
Educational/Instructional Media Design
Environmental Health
Epidemiology
Experimental Psychology
Family Psychology
Family/Consumer Science/Human Science
Health Education
Health Sciences, General
Health Sciences, Other
Health Systems/Services Administration
Higher Education/Evaluation and Research
Human Development and Family Studies
Kinesiology/Exercise Science
Marketing Management and Research
Mass Communication/Media Studies
Microbiology
Nursing Science
Nutritional Sciences
Operations Research
Other Fields, Not Elsewhere Classified
Personality Psychology
Physical Education and Coaching
Physical Education, Health and Recreation
Physics, Other
Physiological/Psychobiology
Physiology, Human and Animal
Plant Sciences, Other
Political Science and Government
Psychology, General
Psychology, Other
Psychometrics and Quantitative Psychology
Public Health
Public Health and Epidemiology
School Psychology
Science Education
Social Psychology
Social Sciences, General
Social Sciences, Other
Social Work
Sociology
Speech and Rhetorical Studies
Speech-Language Pathology and Audiology
Statistics
Teacher Education and Professional Development

5.4 Determination of Age at Application and Years Since Degree

5.4.1 Age at Application

For each application and for each individual, an age is computed if birth date information is available from any of the following sources: IMPACII, AAMC Faculty Roster, or DRF. Age is computed as the difference between the fiscal year of the application and the fiscal year of the individual's birth date. For all analyses in this report, we selected the age associated with the first BRP-SGP award or last unsuccessful BRP-SGP application for each individual. Ages younger than 20 or older than 90 are treated as data errors and are marked as missing data cases. For model analysis, we used the overall average age to impute a value for all missing age cases.

5.4.2 Years Since Degree

For each individual for which degree information was available, along with a date or year of the conferral of the degree, we calculated the years since degree by subtracting the earliest year of any degree found from the fiscal year of the first BRP-SGP award or last unsuccessful BRP-SGP application.

5.5 Prior Support Categories

Prior support information was obtained from IMPAC II. The table below shows the Prior Support categories described in Section 2.2.5 (Table 6), and the award mechanisms contributing to each category.

Prior Support Category	Definition	Overlaps with other categories?
Had T Support	At least one T mechanism w/wo other support	yes
Had F Support	At least one F mechanism w/wo other support	yes
Had K Support	At least one K mechanism w/wo other support	yes
Had L Support	At least one L mechanism w/wo other support	yes
Had RPG Support	Had at least one of the RPG mechanisms (DP1, DP2, P01, P42, PN1, R01, R03, R15, R21, R29, R33, R34, R35, R36, R37, R55, R56, RL1, RL2, RL5, RL9, U01, U19, UC1, UC7) w/wo other support	yes
Had Multiple T, F, or L Support	Had (T and F) or (T and L) or (F and L) or (T and F and L) w/wo other support	yes
Had Multiple Support, including RPG	Had (R and T) or (R and L) or (R and F) or (R and T and F) or (R and L and F) or (R and T and L) or (R and T and F and L) w/wo other support	yes
Had Only Other Support	Had Prior Support, but did not have any T, F, L or RPG Mechanism	no
No Prior Support	No NIH awards prior to 1st K Award or last unsuccessful K application	no

5.6 International Cancer Research Portfolio (ICRP) Partner Organizations

U.S. Organizations
American Cancer Society
California Breast Cancer Research Program
Prostate Cancer Foundation
Congressionally Directed Medical Research Programs, Department of Defense
National Cancer Institute
Oncology Nursing Society Foundation
Susan G. Komen Breast Cancer Foundation

E.U. Organizations
Dutch Cancer Society

U.K. Organizations
Association for International Cancer Research
Biotechnology & Biological Sciences Research Council
Breakthrough Breast Cancer
Breast Cancer Campaign
Cancer Research UK
Children with Leukaemia
Department of Health
Leukaemia Research Fund
Ludwig Institute for Cancer Research
Macmillan Cancer Relief
Marie Curie Cancer Care
Medical Research Council
Northern Ireland R&D Office
Roy Castle Lung Cancer Foundation
Scottish Government Health Directorates – Chief Scientist Office
Tenovus
Wellcome Trust
Welsh Assembly Government
Yorkshire Cancer Research

Canadian Organizations
Alberta Cancer Board
Alberta Heritage Foundation for Medical Research
Canadian Breast Cancer Foundation
Canadian Breast Cancer Research Alliance
Canadian Cancer Society
Canadian Institutes of Health Research
Canadian Prostate Cancer Research Initiative
Canadian Tobacco Control Research Initiative
CancerCare Manitoba
Cancer Care Nova Scotia
Cancer Care Ontario
Fondation du cancer du sein du Québec / Quebec Breast Cancer Foundation
Fonds de la recherché en santé du Québec
Genome Canada
Michael Smith Foundation for Health Research
National Research Council of Canada
Ontario Institute for Cancer Research
Prostate Cancer Research Foundation of Canada
Saskatchewan Cancer Agency
The Cancer Research Society
The Terry Fox Foundation

5.7 Distribution of BRP-SGP applications and awards in the U.S.

Figure A5.7.1. Distribution of BRP-SGP applications and awards by state, compared to cumulative NCI-wide applications and awards by state. Data for Hawaii and Alaska not shown. Data Source: IMPAC II.

5.8 Name Matching

5.8.1 Publication Matching

Several independent but overlapping matching rules were used to identify MEDLINE publication records in which a study applicant appeared as an author. To be considered for matching, the publication date had to be at least 1 year after the application date of the last in-study BRP-SGP application for that applicant. The upper bound for the publication date was April 1, 2011. These rules are summarized below:

1. Match publications for which there was an exact match of the MEDLINE author email address and the IMPAC II PI email address, and a moderate-strength fuzzy name match between the MEDLINE author name and the IMPAC II PI name. "Fuzzy" matching accommodates for misspellings and other variations.
2. Match publications for which there was an exact match of the MEDLINE author email address and the IMPAC II PI email address, and a name match between any of the other MEDLINE author names and the IMPAC II PI name.
3. Match publications for which there was an exact match of the Web of Science author email address (for MEDLINE publications that have been matched to Web of Science) and the IMPAC II PI email address, and a moderate-strength fuzzy name match between the MEDLINE author and the IMPAC II PI name.
4. Using the set of matches found using the first three rules, find additional publications for which the MEDLINE author names have high name-frequency-corrected overlap and a fuzzy name match between the MEDLINE author name and the IMPAC II PI name.

The matching process was conservative, favoring accuracy over inclusion. This approach results in high-confidence in the papers assigned to individuals, but means that some publications for individuals are missed. Any limitations of this method applied equally to all applicant groups.

5.8.2 Name Matching to Outcomes Datasets

Names in the ICRP grant dataset were matched by ICRP personnel to a provided list of BRP-SGP program applicant names. ICRP reported the matches found using six different matching rules. We assessed the quality of the match data and selected the two highest precision matches (exact first and last name match/exact last name match and first name Levenshtein distance < 2).[21]

Data for most other non-IMPAC II data sources (with the major exception of MEDLINE/Web Of Science, as discussed in 3.3.2) used a baseline name match, with corrections applied based on quality checks on the matching results. The baseline rule required an exact first and last name match, and if a middle name was present in both IMPAC II and the other data source, the first characters in each string had to

[21] The **Levenshtein distance** is a string metric for measuring the amount of difference between two sequences, and is defined as the minimum number of edits needed to transform one string into the other, with the allowable edit operations being insertion, deletion, or substitution of a single character.

match. For NSF grant data, the matches were first restricted to less common names and then further restricted by manual review.

5.9 Publication Productivity Analysis

To measure post-study publication productivity for each individual, the number of publications in each fiscal year after their first NCI BRP-SGP award, or their last unsuccessful NCI BRP-SGP application, was recorded.

For each individual with at least one publication (384 of 542 applicants had one or more publications, 158 had no publications following their BRP-SGP application or award), a series of successive 2-year time periods up to and including the 11th year (counting the first year as Year 1) and a final time period for the 12th year up to the present were constructed.

The publications per person, per year ratio for each individual was computed by dividing the number of publications for each person in a given time period by 2 for all but the last time period. In the last time period, the number of years from the start of the time period up to the last year with publication data was used as the denominator.

In tabular or graphic summaries, the resulting publications per person, per year in each time period were averaged over all individual cases represented by a given table cell or graph point. For example, a graph showing a value of 1.6 for BRP-SGP awardees in year 3 means that 1.6 is the average of the publications/person/year for all BRP-SGP awardees in years 3 and 4 after their first award or last unsuccessful application (for those BRP-SGP awardees who had publications for all or part of that time period, or had publications after that time period).

The Citation Benchmark is intended to be a standard against which to measure the actual citations received by a given publication. The Citation Benchmark is the median of the total number of citations at 24 months after publication of articles that share the following characteristics with those of a given publication:

5. Have the same article type (e.g., abstract, article, review, note),
6. Are published in the same journal,
7. Are published within 6 months (before or after) the date of the study article, and
8. Include the given article.

The count of actual citations received in the first 24 months is divided by the Citation Benchmark to obtain a ratio that can be used to compare citation performance among different topical categories.

The Actual/Benchmark ratios were analyzed in the same set of 2-year time ranges used for productivity by taking the total of actual citations divided by the total benchmark citations for all publications by a given person in a given time range, and then averaging these ratios over the individuals in each group (e.g., BRP-SGP awardees).