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Undergraduate Cancer Training Program for Underrepresented Students: Findings from a Minority Institution/Cancer Center Partnership

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Abstract Students from racially/ethnically diverse backgrounds are underrepresented in graduate programs in biomedical disciplines. One goal of the Minority Institution/Cancer Center partnership between New Mexico State University (NMSU) and the Fred Hutchinson Cancer Research Center (FHCRC) is to expand the number of underrepresented students who are trained in cancer research. As part of the collaboration, a summer internship program has been organized at the FHCRC. The program runs for 9 weeks and involves mentored research, research seminars, coffee breaks, social activities, and a final poster session. This study examined the graduate school attendance rates of past interns, explored interns' perceptions of the training program, and identified ways to improve the program. Thirty undergraduate students enrolled at NMSU participated in the internship program from 2002 to 2007 and telephone interviews were conducted on 22 (73%) of them. One-third of the students were currently in graduate school (32%); the remaining were either working (36%), still in undergraduate school (27%), or unemployed and not in school (5%). Students rated highly the following aspects of the program: mentored research, informal time spent with mentors, and research seminars. Students also reported the following activities would further enhance the program: instruction on writing a personal statement for graduate school and tips in choosing an advisor. Students also desired instruction on taking the GRE/MCAT, receiving advice on selecting a graduate or professional school, and receiving advice on where to apply. These findings can inform the design of internship programs aimed at increasing rates of graduate school attendance among underrepresented students.

Keywords Training · Education · Internship · Cancer research training · Mentorship · Underrepresented minority students

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Introduction

In the United States, students from racially/ethnically diverse backgrounds are underrepresented in graduate programs in biomedical sciences [1]. Data from the National Science Foundation Survey of Earned Doctorates show that in 2005, 5,347 PhDs were awarded in two major fields encompassing biomedical sciences: biological sciences and health [2]. Of those degrees, African Americans earned 256, Hispanics 248, and American Indian/Alaskan

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Natives 16, representing 4.7%, 4.6%, and 0.3%, respectively, of all PhDs awarded in the biomedical fields [2]. These three groups, however, represent approximately 30% of the US population [3].

Through support from the National Cancer Institute's Minority Institution/Cancer Center Partnership program, the Fred Hutchinson Cancer Research Center (FHCRC) and New Mexico State University (NMSU) have collaborated for over 6 years. The collaboration aims to build and enhance cancer research, training, and outreach programs at NMSU and to expand cancer health disparities research at FHCRC. One of the training activities has been a summer internship program held at the FHCRC for NMSU undergraduates. The program is multi-component and includes mentored research, research seminars, coffee breaks, social activities, and a final poster session.

The purpose of this study is to report on the career track of past internship participants to ascertain the impact of this program on increasing the number of underrepresented minority (URM) undergraduates at NMSU who pursue graduate education. We report information on the subsequent education of interns who participated in the program. The findings of this report add to the scant literature on training programs for URM students

Methods

Program Structure

The 9-week Cancer Research Internship Program for URM Students was designed to provide research experience and mentorship for URM undergraduates at NMSU who are of at least sophomore standing. Students in the program are paired with a faculty mentor in any Division of the Center: Basic Sciences, Public Health Sciences, Clinical, and Human Biology, and carry out a mentored research project. Students participate in a variety of educational activities throughout the summer, including weekly research seminars, and interactive 'coffee break' sessions. The research seminars expose students to a broad array of topics pertaining to ongoing research conducted at the FHCRC. Speakers represent all divisions of the FHCRC. The interactive 'coffee break' sessions, held intermittently throughout the summer, enable students and faculty to discuss issues related to research, such as the ethical considerations of research, how to prepare for graduate/medical school, and other topics. Social activities are organized to foster informal interaction both among students and between students and mentors. As a capstone experience, all students present a summary of their research findings at a final poster session, which is attended by faculty mentors, graduate students, post-doctoral fellows, and other interested FHCRC faculty and staff. Interns are strongly encouraged to submit an abstract for presentation at the annual meeting of the Society for the Advancement of Chicano and Native Americans in Science (SACNAS); the internship program provides conference registration, membership fees, and travel support for students whose abstracts are accepted. Non-Hispanic and non-Native students may present at other student-oriented conferences such as the Annual Biomedical Research Conference for Minority Students.

Study Procedures

We sought to conduct quantitative and qualitative interviews of past participants of the program. Quantitatively, we wished to assess the proportion of students who were attending graduate schools in the biomedical sciences, and qualitatively, we wished to obtain opinions from students about ways to improve the internship program. Study protocol and data collection instruments were reviewed and approved by the Institutional Review offices of the FHCRC and NMSU.

A program assistant from New Mexico State University was hired to obtain current contact information for all past participants, recruit and conduct an interview among the former interns, and transcribe each digitally recorded interview. In order to recruit participants, updated contact information was collected via NMSU's Central Database (a public use database accessed through the internet), students' research advisors, professors, or the NMSU alumni office.

Past interns were contacted by email or phone and invited to participate in a guided interview. Questions assessed students' current occupational status, their motivations to attend graduate school, their attempts to attend graduate school, and the role of the internship program in their decisions. The interview inquired about attitudes and opinions regarding specific components of the summer intern program, as well as their past educational history and family background.

Results

Students' Current Standing

A total of 22 students who participated in the Cancer Research Internship for URM Students completed elicitation interviews (73%). The interns were mostly females (73%), of Hispanic ethnicity (55%) and were never married (91%). The mean age was 24.6 years. The majority had parents who had high rates of education (77% of fathers had at least some college; 86% of mothers had some

college or more years of education). Nearly three-quarters (73%) had received financial aid for their education. Most of the interns were now currently working (36%), some were still in undergraduate school (27%), and 32% were currently in graduate school (Table 1). Eliminating those who were still in undergraduate school ($n=6$), of the remaining 16, 43.8% were in a graduate degree program, 50% were currently working, and 6.3% were unemployed and not in school.

A substantial percentage (26%) did not respond to our attempts to administer the interview, and this may represent an important source of bias. Nevertheless, non-responders did not differ from responders on gender (75% vs. 73% were female). A slightly greater share of non-responders than responders were Hispanic (63% vs. 55%), Native American (25% vs. 5%), or African American (13% vs. 5%), though the number of students was too small to test for significance.

Table 1 Current status of student interns and their assessment of program activities

Characteristic	*N*	Percent[a]
Current position		
Working	8	36.4
Enrolled in undergraduate program	6	27.2
Enrolled in graduate/professional school	7	31.8
Unemployed and not in school	1	4.5
Intention to go to graduate school		
Applied to graduate school	11	50.0
Applied to professional school	2	9.0
Intends to apply to graduate/professional school	4	18.0
No plans for further education	5	22.7
Assessment of current activities		
Final poster presentation at FHCRC	18	85.7
Attending SACNAS	15	78.9
Mentored Research	22	100.0
Attending seminars	20	90.9
Attending coffee breaks	12	63.2
Informal time spent with mentor	20	90.9
Intern experience	9	100.0
Assessment of proposed future activities		
Instruction on writing a personal statement	21	95.5
Instruction on taking the GRE/MCAT	20	90.9
Advice in selecting graduate/professional school	20	90.9
Advice on where to apply to school	20	90.9
Instruction on choosing an advisor	22	100.0
Advice on balancing school with other interests	17	77.3
Instruction on writing a resume/CV	19	86.4

FHCRC Fred Hutchinson Cancer Research Center, *SACNAS* Society for the Advancement of Chicanos and Native Americans in Science, *GRE/MCAT* Graduate Record Examination/Medical College Admission Test

[a] Based on percent responding to a given question

When we examined the percentage of students who were working, enrolled in a graduate program, or unemployed stratified by whether or not a students' parents had a 4-year college degree ($n=16$) or not ($n=6$), we found that a greater share of those who had at least one parent with a 4-year college degree were currently working (44% vs. 17%; data not shown). One quarter of students whose parents had a 4-year degree was currently enrolled in a graduate or professional school program; this proportion was one-half among students whose parents did not have a 4-year degree. We did not perform any statistical analysis of these data because of the small sample sizes.

Assessment of the Program

The vast majority of students planned to go on to graduate school even before they attended the internship. Many stated that it was the logical next step. Students were additionally motivated by the internship and were especially impressed by the interaction with researchers. Further, the students liked the structure of the internship in that it included seminars by researchers in all aspects of cancer and cancer research. Regular informal coffee breaks gave them tips on how to apply to graduate schools, including preparing a curriculum vitae. The experiential nature also impressed students and contributed to their desire to go to graduate school. Similarly, they were able to see graduate students at work and thereby had suitable role models.

The internship experience also gave students more self-confidence in their ability to succeed once they entered graduate or professional school. Table 1 lists the various aspects of the internship program and the students' assessment of how important these activities were. Those who responded that the activities were "very important" or "somewhat important" are combined. The remainder thought the activities were "not at all important." Students expressed a desire to have more instruction in preparing for graduate/professional school. Table 1 also summarizes the items they found important for future activities. Students stated that their previous knowledge of graduate school was "pretty vague" and that the process of applying was "time consuming" and that they did not really have a good idea of how much time things took and how it was necessary to start the application process long before graduation. They stated that they would like instruction in all the things one typically must do to enter graduate or professional school. One thing that was mentioned a number of times was the desire to have help in writing a personal statement. Seventeen students stated it was very important to teach this during the internship program. Eleven students wanted help in taking graduate school entrance examinations and

nine expressed interest in learning how to select an advisor. Many students expressed concern about the entire process of applying to graduate school.

Discussion

There are few published evaluations of training programs that aim to attract undergraduate students into graduate programs in biomedical sciences. Grumbach et al. [4] report that 68% of students attended medical school after participating in a structured post-baccalaureate premedical program offered at five universities in California, and Soto-Greene et al. [5] report that 36% of students who participated in the Students for Medicine Program entered health professions school. Notably, these previous evaluations report on programs focused on attracting URM students into medical school, not graduate school. Michalek et al. [6] reported that over 85% of high school students and over 92% of college students who participated in a summer research experience were pursuing advanced degrees; however, only about 35% of their sample was underrepresented.

Numerous factors for the design of successful training programs for URM students have been identified in other studies, and some have been corroborated in this study. Mentoring is thought to be a critical part of the career development of all scientists [7], and our data showed that it was rated as a key component of our training program. Informal time with one's mentor was rated highly as it allowed students to see the balance between personal and professional aspects of the lives of their research mentors. Students also valued their interactions with other student interns. A previous qualitative evaluation of 19 students who participated in the NIH T34*STAR program suggested that students highly rated the following program aspects: acquiring research skills, the opportunity to travel to conferences and present their research, mentoring, and financial support and networking [7]. Our findings further suggest that research seminars were effective at broadening students' perception of the scope of cancer research.

The findings from this study have informed improvements in the design of our continued training program. As a result of these findings, several modifications have been made. First, we have added instruction on writing a personal statement, delivered though a two-session writing workshop led by a writing instructor at the University of Washington. Further instruction is delivered in bi-weekly sessions where students submit a draft of their personal statement, research abstract, and resume for peer review and review by graduate students enrolled in the UW's Molecular and Cellular Biology program. Because of a desire to enhance the formality of the poster session, we have enlisted a group of graduate students and post-doctoral fellows to evaluate the poster presentations. The 'judges' will ask questions of the students and will provide written comments and feedback. This will better prepare students for poster presentations at the SACNAS conference. As a final modification, we have added a panel of ethnically diverse graduate and post-doctoral fellows who can speak about why they chose to pursue graduate education, the barriers they faced and overcame in applying to graduate school, and how they chose an advisor.

This study has a number of limitations that should be discussed. The small size of the sample limits the generalizability of the findings. Students who already had aspirations of attending graduate school are likely to successfully apply to internship programs and this may produce selection bias. Since it is not possible to randomly assign students to participate in an internship program, this bias is a part of all training program evaluations. Our program recruitment strategies may have increased the likelihood of selecting students who are already motivated to attend graduate school. Further, response bias could result if a student's attendance in graduate school and/or attitudes and opinions of the internship program was associated with the likelihood of being located by study staff, or agreeing to participate in the study.

These findings may inform the design other training programs that aim to increase the number of URM racial/ethnic students in biomedical science careers. Further evaluations of training programs are needed to discern which program components have the greatest influence on graduate school attendance.

References

1. Hoffer T et al (2007) Doctorate recipients from United States universities: summary report 2006. National Opinion Research Center, Chicago
2. National Science Foundation (2006) Science and engineering doctorate awards: 2005 detailed statistical tables NSF 07-305
3. US Census Bureau (2008) US Hispanic population surpasses 45 million, now 15 percent of total. Available from: http://www.census.gov/Press-Release/www/release/archives/population/011910.html
4. Grumbach K, Chen E (2006) Effectiveness of University of California postbaccalaureate premedical programs in increasing medical school matriculation for minority and disadvantaged students. Jama 296(9):1079–1085
5. Soto-Greene M et al (1999) Minority enrichment programs at the New Jersey Medical School: 26 years in review. Acad Med 74 (4):386–389
6. Michalek AM, Johnson CR (2004) Cancer research training for high school and college students at a comprehensive cancer center. J Cancer Educ 19(4):209–211
7. National Research Council, Assessment of NIH Minority Research and Training Programs, C.f.t.A.o.N.M.R.T. Programs, Editor. 2005, National Academies Press: Washington, DC