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Enhancing the Careers of Under-Represented Junior Faculty in Biomedical Research: The Summer Institute Program to Increase Diversity (SIPID)

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SIPID manuscript supplemental digital content.doc

Includes the following supplemental tables

- Cover sheet
- Supplemental Table 1: Design of the program
- Supplemental Table 2: Recruitment sources
- Supplemental Table 3: Admissions procedure
- Supplemental Table 4: Design of data collection and forms

Abstract

The Summer Institute Program to Increase Diversity (SIPID) in Health-Related Research is a career advancement opportunity sponsored by the National Heart, Lung, and Blood Institute. Three mentored programs address difficulties experienced by junior investigators in establishing independent research careers and academic advancement. Aims are to increase the number of faculty from under-represented minority groups who successfully compete for external research funding.

Data were collected using a centralized data-entry system from three Summer Institutes. Outcomes include mentees' satisfaction rating about the program, grant and publications productivity and specific comments.

Fifty-eight junior faculty mentees (38% male) noticeably improved their rates of preparing/submitting grant applications and publications, with a 18–23% increase in confidence levels in planning and conducting research. According to survey comments, the training received in grantsmanship skills and one-on-one mentoring were the most valuable program components.

The **SIPID** mentoring program was highly valued by the junior faculty mentees. The program will continue in 2011–2014 as **PRIDE** (**P**ROgram to **I**ncrease **D**iversity among individuals **E**ngaged in health-related research). Long-term follow-up of current mentees will be indexed at five years post training (2013). In summary, these mentoring programs hope to continue increasing the diversity of the next generation of scientists in biomedical research.

It is widely recognized that under-represented minorities (URM) suffer a disproportionate public health burden in terms of greater morbidity and mortality associated especially with heart, lung, blood, and sleep disorders.^{1,2} For example, life expectancy is ~5 years shorter in Black and Native American than in Caucasian and Hispanic populations.^{3–5} Although extensive research investigating the reasons that lead to these disparities is needed, minority recruitment in large scale epidemiological studies is a real challenge. One factor associated with recruitment success is having racially concordant scientific teams.^{7–8} To address this substantive issue of building and sustaining a community of diverse faculty and scientists committed to conducting research in the biomedical field, the National Heart, Lung, and Blood Institute (NHLBI) established the “Summer Institute Programs to Increase Diversity” (SIPID) in health-related research. The particular aim of this SIPID initiative was to increase retention of a diverse group of faculty and scientists in health-related research careers.⁹

Methods

Design, Setting and Participants

The NHLBI launched the SIPID program in 2006 to establish Summer Institutes that enable faculty and scientists from URM and/or with disabilities to further develop their research skills and knowledge and enhance their career development. These scientists and research-oriented faculty, usually at the early stages of their careers, are encouraged to develop research skills and gain experience in advanced methods and experimental approaches in basic and applied sciences relevant to heart, lung, blood, and sleep (HLBS) disorders. The overarching goal is that they become successful competitors for external funding for

scientific research in the biomedical and behavioral sciences, by obtaining a grant within two years of completing the program. All faculty and scientists admitted to the program are referred to as “mentees”.

Three Summer Institutes were originally funded, each specializing in a different area of substantive expertise relating to HLBS disorders (genetic epidemiology, functional genomics of blood disorders, and health disparities) but sharing common elements in program design and structure. *Summer Institute in Genetic Epidemiology and Cardiovascular Disease*: This Summer Institute at Washington University in St. Louis provides basic training and mentoring in genetic epidemiology and cardiovascular disease, including bioinformatics methods. *Summer Institute in Functional Genomics of Blood Disorders*: The Summer Institute hosted by the Department of Molecular and Cell Biology at The University of Texas at Dallas (UT Dallas) was designed to teach mentees bench research skills and the application of modern functional genomics approaches to blood disorders. *Summer Institute in Cardiovascular Health Disparities Research*: The goal of the Institute at the SUNY Downstate Medical Center at Brooklyn, NY is to instruct scientists in multidisciplinary approaches to research in cardiovascular health disparities. The primary outcomes of interest for the SIPID program include: (1) independent research funding through grants from the National Institutes of Health (NIH) and other funding sources; and (2) research productivity measured by number of publications; and (3) promotions and other milestones reflecting career advancement.

Although each Summer Institute differs in subject matter, they share common elements in program design and structure (see details in Supplemental Digital Content Table 1). The *First Summer Institute* includes 2–3 of weeks intensive training in basic methods, grant writing, and mentoring. A *Mid-year Meeting* typically includes 1–2 days during which mentees and mentors meet to review progress, resolve problems, and participate in advanced research training and/or mock-study section reviews. The *Second Summer Institute* includes 2–3 weeks of intensive training in advanced topics, including developing five-year career plans. These plans play a critical role because face-to-face meetings are not organized as part of the program once the second Summer Institute is completed. However, tracking the career development of trainees does continue past the 2 summers of direct contact.

Recruitment to the programs is accomplished using various methods, including advertising and recommendations from current and previous mentees. Some recruiting sources are provided in Supplemental Digital Content Table 2. The admission procedure is a multi-tiered process, consisting of a common screening pre-application, a common full application, and a selection process, as outlined in Supplemental Digital Content Table 3.

Three Cohorts of mentees have matriculated into the SIPID programs. Cohort is defined by year of participation (2007–2008, 2008–2009, and 2009–2010). Within each Cohort are 3 separate Summer Institute Programs. Thus, in total there are 9 independent groups of trainees (3 cohorts by 3 programs).

Program Evaluation and Tracking

Evaluation is an essential component of the mentoring program, both for assessing and modifying the content and quality of the training, and for assessing and tracking the progress of the participants.^{10,11} The SIPID evaluation design is three-tiered: (1) evaluation of the program by the mentees; (2) evaluation of the mentoring process by mentees and mentors; and (3) evaluation of the effectiveness of the program by tracking the mentees' progress over time. A series of evaluation instruments were developed for these purposes, a schedule of assessment was implemented (see Supplemental Digital Content Table 4), and the entire process was programmed using a web interface with variable levels of password-protected access by all participants including the mentees, mentors, and program administrators and staff.

Methodology, instruments, and program outcomes

As shown in Supplemental Digital Content Table 4,^{12–15} initial information collected includes demographics and background, feedback regarding mentor assignments, academic/research experiences, and grants and publications. After the summer and mid-year visits, additional data includes updates on previously collected information, as well as feedback on the mentoring team, overall and specific program components, and evaluations of the mentee by the mentors. Subsets of these forms are collected at regular intervals, and the grants and publications databases are updated regularly for generating reports to NHLBI. Data are entered using a web-based system, with data saved and analyzed using SAS¹⁶ (sample counts, means, and standard deviations).

Informed consent or exemption was obtained from each mentee, as approved by each institution's institutional review board.

The primary outcomes of the evaluations include assessing program content, monitoring career progress and assessing confidence levels in designing and conducting research and grant writing. The design and content of each program as well as the mentoring process is closely monitored so that timely modifications or enhancements could be initiated as necessary. Numerical data (i.e. satisfaction with progress, attitudes about mentor assignment, program evaluation – see Supplemental Digital Content Table 4 Forms A-J) are collected using 6-point Likert items.¹⁷ Additionally, open-ended responses are collected (e.g., enumerate strengths and weaknesses, improvements to achieve objectives, suggest additional topics). Evaluations are anonymous, although an identity key is retained so that serious problems (e.g., a mis-match in mentor / mentee assignments) may be identified by the Program Directors and promptly corrected. The overarching outcome is the impact of the program on the mentees' career success in terms of publications and grants activities.

Results

Table 1 shows the demographics for mentees at the time of entry into the SIPID training program. Of the 58 mentees (16 in Cohort 1, 19 in Cohort 2 and 23 in Cohort 3), 38% are male, 92% are African American, and 45% have an MD (as compared to PhD or equivalent) degree. The mentees are junior faculty with over two-thirds having an average of nearly 9

years since completion of their terminal (MD or PhD) degree. While MDs have had their degree longer (average of 4 years, ranging from 2 through 9 years across cohorts), this period roughly corresponds to their residency training, suggesting the 2 groups may have had approximately equal opportunities to engage in research since graduation. Overall, the mentees averaged 8 total scientific publications each (< 1 publication per year per mentee), two-thirds reported having submitted a grant application in the past, and a little over half were awarded a grant. Most grant applications were for developing pilot data or career development.

Mentee Progress

Figure 1 shows mentee progress in terms of experience level, attitudes, intentions and knowledge across the duration of the program. Pre is before training, Post 1 is after the First Summer Institute, Post 2 after the Mid-Year, Post 3 after the Second Summer Institute, and Post 4 is yearly follow-up after the formal training is ended. Mentees showed clear trends for increasing confidence in being able to design research, conduct research and write a research grant application (Figure 1A). Although sample sizes are still too small for hypothesis testing using statistical tests, the standard error bars suggest these trends are meaningful. For example, the average confidence ratings increased 18–23% from pre-SIPID to the Post 4 assessment. In Figure 1B the trends are less obvious. Although mentees at all levels (Pre, Post1 through Post 4) plan to submit a grant application to fund their research, they show a 3% increase in certainty between Mid-year and after the second summer (Post 2 to Post 3). The ratings by mentees of the mentors and mentoring teams in Figure 2A were similarly high on questions such as mentor was accessible, demonstrated content expertise, provided constructive comments, and provided direction/ guidance. Only the last 2 questions (suggested appropriate resources, and challenged mentee to extend abilities and new directions in research) showed a clear increase after SIPID training (at Post 4). Overall assessment of the individual SIPID program content by mentees was uniformly high after all 3 visits (Figure 2B). The mentees universally indicated that the programs captured their interests, were useful and beneficial, met their expectations, and allowed them to network with peers.

Outcomes

Figure 3 shows the primary outcome measures in the SIPID training programs (grants and publications). These counts represent the accomplishments of mentees since the onset of SIPID training. Figure 3A shows number of grant applications under development, submitted or resubmitted, and funded. Percents are expressed across categories within a given Cohort. In Cohort 1 the numbers of grant applications are moderately spread among all three categories of being under development (42%), submitted or resubmitted (26%), or funded (32%). A similar pattern is noted for Cohort 2 with grants under development (38%), submitted (38%) and funded (24%). However, in Cohort 3 many more grant applications are under development (71%), as compared to submitted or resubmitted (14%) and funded (14%). This is not unexpected because Cohort 3 has had less time to develop grant applications.

Figure 3B shows the publication rates for each of the 3 Cohorts. As expected, Cohort 1 has the most publications. Another trend is that these publication rates have increased as compared to those at entry into the SIPID program. At entry into the program (Table 1) or baseline level, mentees averaged about 8 total publications each (i.e., about 0.9 publications per mentee per year). In Cohort 1, 16 mentees reported activity on 78 publications (52 published) during the 2.5 years after their first summer. This is an average of 1.3 publications per mentee per year. Similarly, the 19 mentees in Cohort 2 reported activity on 41 publications (29 published), for an average of 1.0 published manuscripts per mentee per year during the last 1.5 years. Finally, in Cohort 3, for the ½ after their first summer, the 23 mentees have published an average of 1.3 manuscripts per mentee per year. However, it is likely that at least some of these manuscripts were already in preparation prior to their SIPID experience.

Program Evaluations

Many of the evaluation forms allowed for written comments. In addition to comments that inspired adjustments to the current program contents (too long, too short, etc), the next most prevalent sets of comments centered on the mentoring component (mentors who will provide helpful feedback on your work and mentors who help you participate in larger networks), and the grant writing component (hearing tips and information from NIH program officers as well as from successful researchers, and mock study sections). Accolades by the mentees were most often paid to these two components, and specific examples are provided below.

Conclusions

The evaluation data presented here demonstrate that a great deal of progress can be made in a short period of time in a mentored career development program for URM and disabled biomedical and behavioral scientists. For example, since the SIPID program began in 2007, the 58 mentees have submitted nearly 40 grant applications, 17 of which have been funded. These grants include several research program grant awards (R01, R03, and R21), mentored career development awards (K01, K08, K12, and K23), and internal (institutional) and foundation grants (e.g., Robert Wood Johnson Foundation). Nearly 40 additional grant applications are currently in the planning stages by these junior faculty members. Similarly, publication rates have been exemplary in the last 3.5 years. The 58 mentees have together published nearly 100 manuscripts in peer-reviewed journals, with more than 25 currently under review. These are extraordinary accomplishments for junior faculty, who have on the average less than 9 years since receiving their terminal degrees.

While many factors contribute to these successes, some of them are directly attributable to, or were facilitated by, the SIPID program, although it is still too early for definitive claims (due to small sample sizes). For example, as the program progressed over time, very clear trends have emerged in the mentees' reporting increasing confidence in their ability to design and conduct research, as well as increased confidence in their ability to write grant applications. They also reported increased intentions to submit grant applications to fund their research. These trends in increased confidence are important because research has

shown it to be an important correlate of intention,^{18–20} and intention to engage in a specific behavior is highly predictive of actually engaging in that behavior.^{18,21} Moreover, multifaceted interventions like SIPID that focus on increasing one's confidence in designing and conducting research would be expected to have greater success in improving these behaviors than single-focus interventions, particularly interventions that focus only on knowledge acquisition.²² Interventions that do not influence intentions would be less likely to influence behavior change.²³

Some of the components of the program that were deemed particularly helpful in attaining these accomplishments were outlined in the comments that the mentees made on the survey questions, particularly about mentoring/networking opportunities and grant-writing, as follows.

It was apparent that a great deal of variability exists in access to mentoring/networking opportunities at the mentees' home institutions. Consequently, some of the mentees received one-on-one mentoring for the first time in their professional careers and found this to be a profoundly rewarding experience. One mentee remarked on the fact that it was particularly appreciated to have a mentor who would actually read, critique and provide honest and supportive feedback. Others found a great deal of support in the camaraderie of interacting with and encouragement among junior faculty from other institutions. One mentee reported that he no longer felt as though he were "alone and tunneling through solid rock". Many of the mentees expressed the hope that SIPID could continue to facilitate these interactions with the network of peers they met in SIPID for a longer term.

The second major set of comments by nearly all of the mentees was how valuable the grant-writing and grant planning tutorials were. An NHLBI program officer partnered with each of the SIPID programs, and attended part of the Summer Institutes and presented information, tips and guidelines to the mentees on NIH grant mechanisms, peer review, and grantsmanship. Other formal activities were presentations from local and/or national senior investigators and experts who have been particularly successful in obtaining grant funding during their careers and who have served on NIH study sections. Finally, a "mock study section", where each mentee gave a short presentation of their research and grant application plans, and two or more reviewers (i.e., mentors and other experts in the field as well as a fellow mentee peer reviewer) provided constructive feedback. These reviewers were frank and honest, and even if critical invariably led to improvements in their grant applications as judged by their mentors.

A third category of mentees' comments concerned more general career development issues. Mentees particularly appreciated sessions that focused on issues specific to being a minority in a majority environment. Others appreciated the surveys and lectures at which senior investigators provided examples of taking a basic idea all the way from the bench to patient care, or following a basic science idea to the translatable end. One mentee indicated that, after attending the SIPID program, he finally had a clear idea of the path required to become a principal investigator. Others were greatly enthusiastic about lectures that explained how to build a research team or hearing senior investigators talk about upcoming (but yet

unpublished) new findings or technologies or informally interacting with speakers about careers.

A final category of mentees' comments that were quite useful inspired changes to the program curriculum. For example, the NHLBI lectures were modified to include more detailed information about mentored career development awards. Also, a new lecture series targeted de-identified copies of successful and exemplary career development or research program award grants. More hands-on power calculations were requested. Others suggested that lectures on health disparities should concentrate more on novel ways of addressing problems, rather than enumerating the problems. Strategies for managing time and balancing among the demands from home / clinical / research / health sectors were requested.

A weakness of this study has been the difficulty in matriculating mentees from the full range of URM and disabled scientists. The vast majority of the mentees have been African American, with a smaller number of Latinos/Latinas. To date, no American Indian, Alaska Native, Pacific Islander, or disabled mentees matriculated, despite advertisements to appropriate professional societies and newsletters of interest to these groups. Future directions will be to increase recruitment from this segment of the research community.

In summary, the SIPID has been a successful "pilot" program for mentoring junior faculty from URM groups. The graduates believe that they have received multiple benefits, and we believe that they likewise have made multiple contributions to the SIPID program itself. Although it is certainly too early to make definitive statements about whether this program has been a complete success, we can point to one very important indicator of success. The NHLBI has issued a new funding opportunity announcement that continues and expands this program. The last SIPID Cohort matriculated through their second and final summer in 2010. The new initiative (PRIDE) matriculated its first Cohort in the summer of 2011, and will continue to track the career progress of original SIPID and new PRIDE mentees over time.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.

Mean ratings (with standard error bars) for questions relating to Mentee's experience levels (A is top panel) and attitudes, intentions and knowledge (B is bottom panel). The 5 bars for each question represent responses during the pre-evaluation (prior to the first summer), and at each post evaluation: post 1 (after 1st summer), post 2 (after Mid-year), post 3 (after 2nd summer) and post 4 (yearly follow-up). Questions are placed on the categorical X-axis, with mean ratings plotted on the Y-axis. In 1A, Likert categorical scores represent 1 (none), 2 (a little bit), 3 (a fair amount), 4 (a moderate amount), 5 (more than average) and 6 (very

much). For the bottom panel (1B), Likert categorical scores are 1 (strongly disagree), 2 (disagree), 3 (slightly disagree), 4 (slightly agree), 5 (agree) and 6 (strongly agree).

Figure 2.

Mean ratings for mentee ratings of mentor and mentoring team (A is top panel) and for mentees' assessment of the overall program (B is bottom panel). See Figure 1 for definitions of axes. Likert categorical scores correspond to those in Figure 1B.

Figure 3.

Grant and Publication Activities by Cohort. The percent of grants (A is top panel) and publications (B is bottom panel) by Cohort. For example, grant writing activities in Cohort 1 include 42% under development (N = 8 grants), 26% submitted or resubmitted (N = 5 grants) and 32% were funded (N = 6 grants). Similarly, for publication activities in Cohort 1, 15% (N = 12) manuscript are in preparation, 18% (N = 14) have been submitted and 67% (N = 52) are accepted for publication or have been published.

Table 1

Initial Sample Characteristics *

Characteristics	Unit	Cohort 1		Cohort 2		Cohort 3		Total	
Total Mentees	Count	16		19		23		58	
Sex (A1)	% Male	37.5		31.6		43.5		37.9	
Ethnicity (A2)									
African American	Count	14		17		22		53	
Hispanic	Count	1		1		1		3	
Other	Count	1		0		0		1	
Degree (A3)									
PhD or PhD + other	Count	8		10		12		30	
MD or MD + other	Count	7		8		11		26	
Other	Count	1		1		0		2	
Total Mentees by Degree		MD	Non MD	MD	Non MD	MD	Non MD	MD	Non MD
Years since terminal degree (A4)	Mean Years [†]	7	9	8	11	11	12	26	32
Current Position (A5)		5.33	7.44	15.75	7.18	12.09	6.00	11.23	6.81
Instructor	Count	3	4	6	10	7	9	16	23
Assistant Professor	Count	1	2	0	0	2	0	3	2
Other	Count	3	3	2	1	2	3	7	7
Scientific Publications (A11)	Mean Count [†]	4.17	7.56	7.43	7.64	10.27	10.27	7.92	8.55
Ever submitted a grant? (A12)	% Yes	71	78	63	91	55	50	62	72
Ever awarded a grant? (A14)	% Yes	29	78	63	64	55	50	50	63

* A1-A14 are questions 1 through 14 from Form A (see Supplemental Digital Content Table 4).

[†] Mean number of years or mean number of publications per Mentee