Published in final edited form as:

J Am Coll Cardiol. 2019 April 16; 73(14): 1861–1865. doi:10.1016/j.jacc.2019.01.042.

Research Education and Mentoring Program in Cardiovascular Diseases for Underrepresented Junior Faculty from NHLBI SIPID/PRIDE

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Introduction

The percentage of biomedical, behavioral and clinical underrepresented minority (URM) junior faculty is lower than their respective populations in US; whereas racial and ethnic minorities (African-Americans, Hispanic-Americans/Latinos, American-Indians, Alaska-Natives, Native-Hawaiian, Pacific-Islanders) comprise 32% of U.S. residents, they represent only 8% of medical school faculty (1,2). As URM faculty play a “distinctive and fundamental role in the teaching, research, and service missions of higher education”, the lack of academic diversity in biomedical science and medicine hinders efforts to address inequities in health outcomes (3). Cardiovascular disease (CVD) is the leading cause of death in United States and globally (4). Furthermore, racial/ethnic groups in US are disproportionately burdened by CVD, resulting in major health disparities.

Herein we report the 12-year outcomes of a National Heart, Lung and Blood Institute (NHLBI) program (Summer-Institute-Program to Increase-Diversity [SIPID], renamed “Programs to Increase-Diversity-Among-Individuals-Engaged in Health-Related-Research” [PRIDE]) focused on CVD at two academic institutions: State University of New-York

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Disclosures. None for all authors.

Downstate-Medical-Center at Brooklyn (SUNY-Downstate) and Washington University School of Medicine (WUSM) in St. Louis, Missouri (1,5–9).

Methods

Participants and Program Structure

Selected URM and/or disabled doctoral-level junior faculty from US academic and/or healthcare institutions applied and were selected to participate in SIPID/PRIDE program which consists of two consecutive summers, the intervening academic year, a mid-year meeting and a workshop at NIH (Figure 1). Summer training focused on three major areas: a) didactic CVD courses; b) mentoring, career-development, academic-promotion and networking; c) grant proposal development, review and funding strategies. Multidisciplinary didactic methods included seminars, group discussions, mentee presentations of research projects with mentor feedback, individual mentor-mentee and NHLBI program officials' meetings, and peer-review NIH-style mock-study sections.

Data collection, primary and secondary outcomes

Prospectively obtained longitudinal primary outcomes: 1) Grants submitted/awarded within 2-years post-training; 2) Peer-reviewed publications; and 3) Academic promotions. Secondary outcomes: 1) Ragins-McFarlin-Mentor-Role-Instrument (RMMRI); 2) Clinical-Research-Appraisal-Inventory (CRAI); and 3) Program-specific satisfaction scores. Data were collected directly from mentees via online-surveys at enrollment, during training and annually. Analysis of grants funded based on degree (MD vs. PhD) and home institution focus (highest research activity vs. non-highest research activity) was performed using the Carnegie Classification of higher education institutions

Results

Demographics

Of the 297 applicants, 136 junior faculty from 93 US institutions matriculated during 2006–2018 and were: African-Americans (n=107; 79%), Hispanic-Americans (n=26; 19%), Native-Americans (n=3; 2%); 90 (66%) women; 96 (70%) PhDs (or equivalent doctoral degree), 36 (26%) MDs, and 4 (3%) MD/PhD's.

Primary outcomes

Grants submitted/awarded during and after 2 years post-training—After excluding data from 19 individuals from 2017–2018 cohort who were still in training, 187 peer-reviewed grant applications were submitted by 117 mentees (during or after-training), and 123 grants were awarded (success rate: 66%). These included 81 NIH grants (Table 1): K-awards (n=23), R01s (n=11), other R-awards (n=16; R03, R21, R34, R15, R13, R56) and 42 non-NIH grants (i.e., AHA, RWJ, VA, NSF, DHHS, CDC). Collectively, the number of grants submitted (n=187, or 1.6 grants/mentee) and awarded (n=123, or 1.05 grants/mentee) is a remarkable accomplishment. Furthermore, of 136 mentees, only those comprising the first six cohorts (79/136=58%) completed training two or more years prior, and 57% of these

have already been awarded one or more grants. Together, these results suggest that the SIPID/PRIDE primary objective of grant submission within two years following completion of training has been met by the majority of mentees.

When the number of grants funded was analyzed as a function of degree (MD vs. PhD) there was no difference in the number of grants obtained by those with MD compared to those with a PhD degree ($r^2=0.02$, $p=0.45$, non-paired t-test). Analysis for home institution research activity at admission to SIPID/PRIDE program compared institutions with “highest research activity” vs. “non-highest research activity” based on Carnegie classifications (<http://carnegieclassifications.iu.edu/downloads.php>). Those mentees at “highest research activity” institutions received more grants compared to those from “non-highest research activity” institutions ($r^2=0.67$, $p=0.04$, non-paired t-test with unequal variances).

Peer-reviewed publications

During and after-training, 1,211 peer-reviewed manuscripts were published by 117 mentees, representing 3.3 times the number of publications ($n=365$) compared to prior to participation in SIPID/PRIDE.

Academic promotions

Forty-one (35%) mentees were promoted to Associate Professor or Professor; of these, 37 (27%) to Associate Professor and 4 (3%) to Professor.

Secondary outcomes

CRAI questionnaire which measures research self-efficacy, surveyed longitudinally for 10-years, showed a consistent increase in research self-efficacy (total score: 7.0 at first year and 9.0 at 10th year); total score increase was largest during the first and second years (7.0 and 8.5, respectively). The self-efficacy ratings were significantly higher for two subscales (“writing papers” and “consent process”), compared to other subscales (“study design” and “collaborating on grants”).

The RMMRI mentoring assessment (surveyed during training and for two years after-training), showed an increase in mentoring satisfaction during the first two years; the largest satisfaction score was for mentoring during the second year.

SIPID/PRIDE program satisfaction

Program, mentee and speaker satisfaction evaluated by use of a 6-point Likert rating (1=strongly disagree, 6=strongly agree) showed a high level of satisfaction (scores range: 5.5–5.8).

Discussion

This is the largest, longest and most comprehensive report of an NHLBI-sponsored URM training and mentoring program intended to increase diversity of the biomedical research workforce. The SIPID/PRIDE mentees were quite successful in achieving the primary and secondary outcomes of the program. The success rate for grant funding was 66% (average:

1.6 grants/mentee). Given the 2017 overall NIH and NHLBI grant success rates were 19% and 36%, respectively, SIPID/PRIDE mentee grant funding success is impressive. Although there were no differences in the number of grants awarded across degree type (MD vs. PhD), URM mentees based at “highest research activity” home institutions were awarded more grants compared to those based at “non-highest research activity” institutions. These findings suggest potential benefits for URM at highest-research institutions, at least early in their career potentially due to availability of institutional resources (i.e., training, mentoring and/or infrastructure) that facilitate securing grant funding. As a result of SIPID/PRIDE training, the number of scientific publications also increased significantly (3.3 times the number of publications prior to program participation). The SIPID/PRIDE program emphasizes critical review of the scientific literature, discipline and organizational skills and compelling/convincing writing. All these skills likely contributed to the large number of grant applications and publications during/after training. Unfortunately, despite the high success with grant funding and scientific publications, only 34% were promoted to Associate-Professor, suggesting that URM faculty continue to face challenges for academic promotions, an issue that has been previously reported (10). These findings suggest that academic promotion-specific awareness and mentoring is needed to bridge the gap of this important academic success metric.

Secondary outcomes included measures of satisfaction with the training program and mentoring and increased level of research self-efficacy during and after program participation. SIPID/PRIDE mentees expressed a high degree of satisfaction with the training program and mentoring. The primary and secondary outcomes are significant and encouraging, and likely attributed to the individualized training and mentoring program, which included periodic progress reports, networking and NIH-style mock-study-sections. CRAI and RMMRI scores showed high level of mentee research self-efficacy and satisfaction and high level of mentor support. Furthermore, mentee self-efficacy increased over time, suggesting increased mentee research independence. Research skills in CVD are highly emphasized topics in SIPID/PRIDE programs, and as such these findings meet program expectations. Concurrently, there was an increase in research self-efficacy over time as mentees became increasingly more confident with their critical thinking and writing skills. The NIH-style mock-study sections, which are central to the NIH grant-funding process, allowed mentees to have their own grants reviewed by their peers and by senior faculty. This activity was extremely well received by mentees, and was considered an important exercise prior to submission to grant funding agencies. Finally, and equally importantly, the number of applicants (n = 297) far exceeded the number who matriculated in the program (n = 136), suggesting that there is an unmet need for additional opportunities for mentored-research training programs such as SIPID/PRIDE.

Efforts to diversify the biomedical workforce abound, yet relatively little progress has been made to increase the number of URM faculty who are promoted and retained at the higher academic ranks. Career-based differences in research funding mentoring and academic promotion hinder URM faculty career-advancement through the academic ranks. In a national study of the career trajectories of academic medicine junior faculty first appointed to full-time instructor or Assistant Professor positions, 10-year probability of first promotion were lower and probability of attrition without promotion were higher for junior URM

faculty, compared to non-URM faculty (10). Furthermore, junior faculty who receive mentored K-awards have higher probability of promotion and lower probability of attrition, compared to those who do not receive K-awards.

The lack of career-advancement is a major reason for URM faculty attrition from research and/or academic careers. Compared to attrition among non-URM faculty, URM faculty attrition is higher at both junior and senior levels. Important contributors of URM faculty attrition include poor job satisfaction, perceived lack of opportunities and/or discrimination, overburdening with administrative responsibilities leading to lack of productivity, increased burnout and sense of isolation (3). On the other hand, formal training, mentorship, community building, networking and faculty connectivity, and increased availability of research and academic opportunities may mitigate attrition (2). Data on attrition from academia was not obtained on these cohorts. Even having similar grant support, leadership roles, compensation and career satisfaction found URM faculty have fewer publications and are less likely to be promoted and/or retained in academic careers (1). Successful retention of URM faculty requires comprehensive institutional commitment to changing the academic climate and deliberative programming to support productivity and advancement. All these challenges were addressed in our SIPID/PRIDE programs.

Conclusions

SIPID/PRIDE program is the largest, longest and successful URM research education and mentoring program in United States. In addition to focusing on CVD, instruction and mentoring from an experienced multidisciplinary faculty emphasized areas such as research methodology, grant-writing and funding opportunities, grant peer-review process, academic career development, and networking. Findings from the present study show that the SIPID/PRIDE program exceeded expectations in key metrics of success used in academic medicine (i.e., grant funding, scientific publications and academic promotions), suggesting that the program represents a good investment to further develop a diverse biomedical workforce to improve the nation's health.

Acknowledgments:

The authors express appreciation and gratitude to the SIPID/PRIDE mentees, mentors, and faculty who contributed to this training program. The authors also thank program staff for their valuable contributions, at SUNY-Downstate: Mr. Frank Fabris; Dr. Luther Clark, Dr. Girardin Jean-Louis, Dr. Judith Mitchell, and Mr. Freddy Zizi; at WUSM: Ms. Linda Schreier, Dr. Susan Racette, Dr. Mario Castro, Dr. Michael Province, Dr. Aldi Kraja and the coordination core staff: Ms. Tessa Gauzy.

Funding. NHLBI grants R25 HL105446 and R25 HL085042 to MB; R25 HL085040 and R25 HL105400 to DC and VGDR; and R01-HL10-5408 to TR. The views expressed in this article are those of the authors and do not necessarily represent the views of the National Heart, Lung, and Blood Institute, National Institutes of Health, or the Department of Health and Human Services.

ABBREVIATIONS

AHA	American Heart Association
CDC	Centers for Disease Control and Prevention

CRAI	Clinical Research Appraisal Inventory
CVD	Cardiovascular Disease
DHHS	U.S. Department of Health & Human Services
NHLBI	National Heart, Lung and Blood Institute
NIH	National Institutes of Health
NSF	National Science Foundation
PRIDE	Program to Increase Diversity Among Individuals Engaged in Health-Related Research
PD	Program Director
RMMRI	Ragins and McFarlin Mentor Role Instrument
SIPID	Summer Institute Program to Increase Diversity
URM	Underrepresented Minority

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Central Illustration: Key Elements of the NHLBI SIPID/PRIDE mentoring Program

Figure 1.

Aims, outcomes and major components of the training and mentoring program.

Table 1.

Research Grants: Submitted and Awarded Before, During and After SIPID/PRIDE Program Training.

Grant Type	Grant Status	Before Training	During Training	After Training	Total During & After Training
NIH K grants	Submitted	N/A	11	23	34
	Awarded	5	9	14	23
NIH R01 grants	Submitted	N/A	2	25	27
	Awarded	0	1	10	11
NIH other R grants	Submitted	N/A	12	24	36
	Awarded	2	5	11	16
NIH all other grants	Submitted	N/A	15	16	31
	Awarded	6	15	16	31
Total NIH grants*	Submitted	N/A	40	88	128
	Awarded	13	30	51	81
	% Mentees AWARDED at least 1 grant / total # mentees*				57/117 = 48%
Total non-NIH grants**	Submitted	N/A	24	35	59
	Awarded	11	21	21	42
	% Mentees AWARDED at least 1 grant / total # mentees*				31/117 = 26%
Total Combined grants	Submitted	N/A	64	123	187
	Awarded	24	51	72	123
	% Mentees AWARDED at least 1 grant / total # mentees*				67/117 = 57%
	Per Person Average: SUBMITTED (# grants / total # mentees)				187/117=1.6
	Per Person Average: AWARDED (# grants / total # mentees)				123/117=1.1

N/A indicates data not available, (*) a single mentee could have received more than one grant.