

MENTORED TRAINING TO INCREASE DIVERSITY AMONG FACULTY IN THE BIOMEDICAL SCIENCES: THE NHLBI SUMMER INSTITUTE PROGRAMS TO INCREASE DIVERSITY (SIPID) AND THE PROGRAMS TO INCREASE DIVERSITY AMONG INDIVIDUALS ENGAGED IN HEALTH-RELATED RESEARCH (PRIDE)

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Objective: To report baseline characteristics of junior-level faculty participants in the Summer Institute Programs to Increase Diversity (SIPID) and the Programs to Increase Diversity among individuals engaged in Health-Related Research (PRIDE), which aim to facilitate participants' career development as independent investigators in heart, lung, blood, and sleep research.

Design and Setting: Junior faculty from groups underrepresented in the biomedical research workforce attended two, 2-3 week, annual summer research-education programs at one of six sites. Programs provided didactic and/or laboratory courses, workshops to develop research, writing and career-development skills, as well as a mentoring component, with regular contact maintained via phone, email and webinar conferences. Between summer institutes, trainees participated in a short mid-year meeting and an annual scientific meeting. Participants were surveyed during and after SIPID/PRIDE to evaluate program components.

Participants: Junior faculty from underrepresented populations across the United States and Puerto Rico participated in one of three SIPID (2007-2010) or six PRIDE programs (2011-2014).

Results: Of 204 SIPID/PRIDE participants, 68% were female; 67% African American and 27% Hispanic/Latino; at enrollment, 75% were assistant professors and 15%

instructors, with most (96%) on non-tenure track. Fifty-eight percent had research doctorates (PhD, ScD) and 42% had medical (MD, DO) degrees. Mentees' feedback about the program indicated skills development (eg, manuscript and grant writing), access to networking, and mentoring were the most beneficial elements of SIPID and PRIDE programs. Grant awards shifted from primarily mentored research mechanisms to primarily independent investigator awards after training.

Conclusions: Mentees reported their career development benefited from SIPID and PRIDE participation. *Ethn Dis.* 2017;27(3):249-256; doi:10.18865/ed.27.3.249

Keywords: Diversity; Junior Faculty; Career Development; Mentored Training

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INTRODUCTION

Population differences in health outcomes are well-documented in the United States^{1,2} and a more diverse biomedical workforce may be needed to address these disparities.³ However, Black researchers are 10% less likely than White researchers to have grants funded by the National Institutes of Health (NIH),⁴ which may limit research by investigators most motivated to address these problems. Further, although postgraduate programs improve the likelihood of obtaining awards overall, they do not narrow the gap between White and minority investigators.^{3,4} In fact, minority investigators are less likely to receive R01 awards and to submit NIH grants, and they have fewer publications, citations, and grant experience compared with White investigators with similar training.⁴ Thus, new approaches are needed to increase the diversity of the biomedical-research workforce.

Efforts responding to the need to build and sustain a more diverse biomedical-research workforce^{5,6} include two programs funded by the NIH National Heart, Lung, and Blood Institute (NHLBI).^{5,7,8} Established in 2006, the Summer Institute Program to Increase Diversity (SIPIID)⁷ and reissued in 2010 as the Programs to Increase Diversity among Individuals Engaged in Health-related Research (PRIDE)⁸ fill a training gap for junior-level faculty and scientists from populations underrepresented in the biomedical and behavioral sciences, which include racial/ethnic minorities, disabled, and disadvantaged groups.

The short-term goals of these pro-

grams are to train mentees how to better write scientific articles and prepare competitive grant applications to ultimately publish manuscripts and receive grant funding. In this article, we report baseline characteristics of the SIPIID/PRIDE and mentee feedback about the program components from anonymous surveys.

METHODS

The SIPIID/PRIDE summer institute (SI) programs^{5,7,8} provided mentoring, didactic and hands-on experiences to enhance research skills for junior-level faculty underrepresented in the biomedical and behavioral sciences. The long-term goal was for

The SIPIID and PRIDE programs fill a training gap for junior-level faculty and scientists from populations underrepresented in the biomedical and behavioral sciences.

mentees to gain research independence, including submitting grant applications and obtaining external funding for biomedical research within two years of program completion.

This report describes mentees from six distinct SI programs across two funding periods (SIPIID 2007-

2010, $N=52$ and PRIDE 2011-2014, $N=152$). The training programs (three in SIPIID and six in PRIDE) were each specialized in mentored training in different areas of science and substantive training content, although all focused on heart, lung, blood, and sleep (HLBS) disorders.

Three SIPIID programs funded in 2007 also were supported by PRIDE in 2010. These programs included: 1) Cardiovascular Health Disparities Research at SUNY Downstate Medical Center in Brooklyn, NY, providing training in cardiovascular health disparities (<http://www.biostat.wustl.edu/pridecc/about/cardiovascular-health-related-research/>); 2) Functional Genomics of Blood Disorders at the University of Texas at Dallas (SIPIID) and Augusta University (PRIDE), providing bench research training to study red blood cell disorders (<http://www.biostat.wustl.edu/pridecc/about/functional-and-translational-genomics-of-blood-disorders/>), and 3) Genetic Epidemiology of Cardiovascular Disease at Washington University in St. Louis, offering training in genetic epidemiology and bioinformatics (<http://www.biostat.wustl.edu/pridecc/about/cardiovascular-genetics-and-epidemiology/>).

Three new programs were added to the PRIDE roster in 2010, including: 1) Behavioral and Sleep Medicine at New York University Langone Medical Center, providing training in health disparities sleep disorders research (<http://www.biostat.wustl.edu/pridecc/about/behavioral-and-sleep-medicine/>); 2) Comparative Effectiveness Research at Columbia University, providing training in comparative effectiveness research

(<http://www.biostat.wustl.edu/pridecc/about/comparative-effective-ness-research/>); and 3) Mentoring Researchers in Latino Health Disparities at San Diego State University, offering training in health-disparities research specific to Latino subgroups (<http://www.biostat.wustl.edu/pridecc/about/mentoring-researchers-in-latino-health-disparities/>)

Although each program differed in scientific focus, common training elements were shared across all programs. Common components included: didactic and/or laboratory training specific to the research emphasis of the program, research design and analysis methods, responsible conduct of research training, grant writing workshops, research project and grant proposal development, regular support and networking activities and career planning. In addition, all programs assigned one or more PRIDE-research mentors, as well as a home-institution mentor to offer career-advancement advice. Each participant was introduced to a large network of researchers and encouraged to interact with scholars and program officers from the NHLBI program offices. Additional details about training elements can be obtained from the corresponding author.

All PRIDE programs also benefited from centralized recruiting and admissions procedures and program evaluations performed by a separately funded PRIDE Coordination Core (CC) at Washington University in St. Louis. The PRIDE CC helped with recruitment, reviewing applications, selecting applicants, developing and administering questionnaires, collecting

data for publications and grants, and managing data for long-term evaluations of SIPID and PRIDE programs.

There were face-to-face meetings at each program site during the first (SI-1) and second (SI-2) summers, each lasting approximately 2-3 weeks for intensive training in basic research methods and writing skills development (including grant writing). A brief 1-2 day mid-year face-to-face meeting was held for progress reviews and included a mock study session to review on-going grant writing projects. In addition, starting with PRIDE, an annual scientific meeting was held in the Bethesda, MD area where trainees from all programs met to present their scientific research and to expand their professional networks across programs. During the year, participants reviewed their grant-writing progress through webinar sessions.

Each training program had 3 cohorts of mentees, defined by the academic year of mentees' participation in the program. SIPID Cohort 1 participated during 2007-2008, Cohort 2 in 2008-2009, and Cohort 3 in 2009-2010; PRIDE Cohort 1 participated in 2011-2012, Cohort 2 in 2012-2013, and Cohort 3 in 2013-2014. Each participant is followed for 10 years to assess career progression. We previously described the SIPID program design, structure, content, recruiting and data collection procedures.⁵ Additional details about the program can be obtained from the corresponding author.

Data were collected via online surveys at enrollment, during training, and annually after program completion. Demographic information included (among others) age, sex,

race/ethnicity, education, age, employment and faculty rank. We also collected information about career-development outcomes, including promotions, tenure, publications, grant submissions and awards. We used data from curriculum vitae and SCOPUS (publications) and NIH RePORTER (grant awards) (additional details about the database can be obtained from the corresponding author). In 2014, we also surveyed all SIPID/PRIDE mentees who completed the program to evaluate the benefits they gained from their participation. We collected data longitudinally during SI-1, mid-year, the annual scientific meeting, and SI2.

For the grants database, three categories of grant awards were defined: "Independent-investigator" awards (eg, R01 and other Research Project Grants), "Mentored" research awards, and "Other" awards. The latter is a heterogeneous category including education or loan-repayment program awards. To be counted the grant award met this criteria: 1) the mentee must be the principal investigator (or multiple principal investigator) of record; 2) the application must be formally peer reviewed by an external agency (ie, not intramural); and 3) the award must be verified on the granting institution's website (eg, NIH RePORTER, Robert Wood Johnson Foundation, American Heart Association). Grant awards data reported here were collected in fall 2015. We also collected basic demographic information (eg, age, sex, race/ethnicity, education, age, employment/faculty rank) from the application survey and updated this information annually.

Primary indicators of success in-

cluded faculty promotion and retention, and number of publications and grants submitted and received, among other variables such as honors/awards and presentations (additional details about the database can be obtained from the corresponding author). Other survey data included feedback regarding mentoring assignments, academic/research experiences, overall and specific program components, and the annual meeting. Most of the survey data were in the form of satisfaction ratings or open-ended text responses about what the scholars liked best and least. We also administered previously developed questionnaires for research self-efficacy using the

Clinical Research Appraisal Inventory (CRAI)⁹ and mentor-role appraisals using the Ragins and McFarlin Mentor Role Instrument (RMMRI).¹⁰⁻¹²

In this article, we describe the baseline characteristics of SIPID/PRIDE mentees and feedback on the programs that were reported on anonymous questionnaires administered after program completion. We also report the pattern of grants received before and after SIPID/PRIDE participation.

RESULTS

Tables 1 and 2 show descriptive statistics of mentees' baseline char-

acteristics by cohort and aggregated across all mentees and SI programs. PRIDE participants were predominantly female, African American, assistant professors, and had doctorate-level degrees. For SIPID recruitment, each program recruited its own participants.⁵ However, the PRIDE CC helped monitor and assisted PRIDE programs with recruitment. Of 460 PRIDE applications received, 163 were eligible and accepted for admission, but six declined citing schedule conflicts (3.8%) and five dropped later (3%), leaving 152 who completed the program. Of the five individuals who started the training but dropped out after the first summer session,

TABLE 1. Baseline sample characteristics for SIPID cohorts

Cohort numbers	Cohort 1	Cohort 2	Cohort 3	Total
Training years	2007-08	2008-09	2009-10	2007-10
Sample sizes	n=13 (%)	n=18 (%)	n=21 (%)	N=52 (%)
Race				
American Indian or Alaska Native				
Native Hawaiian or Pacific Islander				
Black or African American	11 (84)	17 (94)	19 (90)	47 (90)
More than 1 Race chosen				
Declined or did not answer	1 (8)	1 (6)	2 (10)	4 (8)
Asian	1 (8)			1 (2)
White				
Hispanic or Latino ethnicity				
Yes	1 (8)	1 (6)	2 (10)	4 (8)
No	12 (92)	17 (94)	19 (90)	48 (92)
Sex				
Male	5 (38)	6 (33)	9 (43)	20 (38)
Female	8 (62)	12 (67)	12 (57)	32 (62)
Disability				
Yes				
No	13 (100)	18 (100)	21 (100)	52 (100)
Faculty rank at SI-1				
Other	2 (15)	1 (6)	1 (5)	4 (8)
Instructor or research scientist	4 (31)	1 (6)	3 (14)	8 (15)
Assistant professor	5 (39)	14 (77)	16 (76)	35 (67)
Associate professor	2 (15)	2 (11)	1 (5)	5 (10)
Degree				
Doctorate (eg, PhD, ScD)	7 (54)	10 (56)	11 (52)	28 (54)
Combined MD/PhD			1 (5)	1 (2)
Medical (eg, MD, DO)	6 (46)	8 (44)	9 (43)	23 (44)

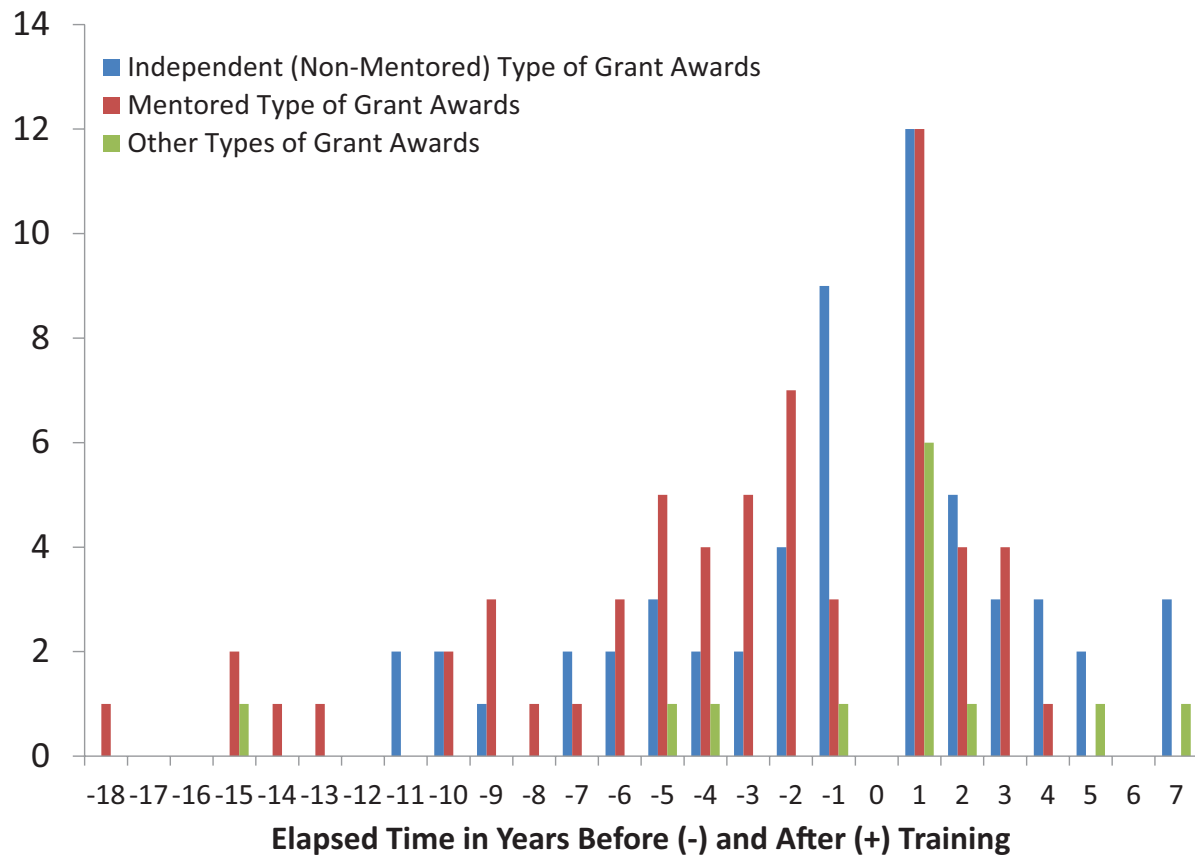


Figure 1. Number of funded grant awards (as PI or MPI) by grant mechanism (independent-investigator, mentored, other) and elapsed time in years before (-) and after (+) PRIDE training. Additional details about the definitions of grant award mechanisms can be obtained from the corresponding author.

two had died, one was awarded a grant that conflicted with PRIDE participation, one withdrew because the department chair rescinded permission to participate, and one individual withdrew. Of the ineligible applicants, most (68%) were not from underrepresented groups in biomedical research and the remainder did not have a faculty position, did not have an HLBS research focus, or were not a U.S. citizen/permanent resident.

The general pattern of grants received (by type) is illustrated in Figure 1, according to the number of years before and after program completion. A greater number of mentored-

research awards were received prior to training, and a greater number of independent-investigator awards were received after training. Overall, 130 awards were verified in NIH REPORTER (mean .64 grants/person) after a weighted-average elapsed time of three years, with 58 of the 130 grants obtained after SIPID/PRIDE training (mean .28 grants/person).

Sixty-eight percent of the PRIDE sample (104/152) responded to the anonymous survey about the benefits they gained from participating in PRIDE. Responses to each question were categorized and then tallied by category, and the percentage

of total responses for each category was recorded. Participants could provide multiple responses to each question, and the total percentage across all responses should equal 100%.

Question 3 asked: "In what ways have you benefited from participating in the PRIDE program?" Forty-five percent indicated benefits from skills training (eg, manuscript and grant writing skills, communications involving negotiations, and general management, organization, and coordination of research and science projects). Networking had 19% of the responses, eg, forming collaborations with SIPID/PRIDE peers and men-

TABLE 2. Baseline sample characteristics for PRIDE cohorts and grand total (SIPID + PRIDE)

Cohort numbers	Cohort 1	Cohort 2	Cohort 3	Total	Grand Total
Training years	2011-12	2012-13	2012-13	2011-14	2007-14
Sample sizes	n=44 (%)	n=47 (%)	n=61 (%)	N=152 (%)	N=204 (%)
Race					
American Indian or Alaska Native	4 (9)	2 (4)	3 (5)	9 (6)	9 (4)
Native Hawaiian or Pacific Islander			1 (2)	1 (1)	1 (<1)
Black or African American	31 (70)	27 (57)	32 (52)	90 (59)	137 (67)
More than 1 Race chosen	2 (5)	3 (7)	6 (10)	11 (7)	11 (5)
Declined or Did Not Answer	2 (5)	3 (7)	5 (8)	10 (7)	14 (7)
Asian	1 (2)	2 (4)		3 (2)	4 (2)
White	4 (9)	10 (21)	14 (23)	28 (18)	28 (14)
Hispanic or Latino ethnicity					
Yes	9 (20)	21 (45)	22 (36)	52 (34)	56 (27)
No	35 (80)	26 (55)	39 (64)	100 (66)	148 (73)
Sex					
Male	15 (34)	14 (30)	17 (28)	46 (30)	66 (32)
Female	29 (66)	33 (70)	44 (73)	106 (70)	138 (68)
Disability					
Yes	1 (2)		1 (2)	2 (1)	2 (1)
No	43 (98)	47 (100)	60 (98)	150 (99)	202 (99)
Faculty rank at SI-1					
Other	1 (2)			1 (1)	5 (2)
Instructor or research scientist	9 (20)	10 (21)	9 (15)	28 (18)	36 (18)
Assistant professor	32 (73)	35 (75)	50 (82)	117 (77)	152 (75)
Associate professor	2 (5)	2 (4)	2 (3)	6 (4)	11 (5)
Degree					
Doctorate (eg, PhD, ScD)	24 (54)	29 (62)	38 (62)	91 (60)	119 (58)
Combined MD/PhD	3 (7)	1 (2)	2 (3)	6 (4)	7 (4)
Medical (eg, MD, DO)	17 (39)	17 (36)	21 (35)	55 (36)	78 (38)

tors had positive effects analytic and writing skills, allowed them to tap into resources of various multidisciplinary groups, and enhance their credibility within the research community. Mentees' accomplishments (eg, publications and funding, memberships in scientific organizations, election to offices, becoming a journal or grant reviewer, and career advancements) accounted for 14% of responses.

Mentoring (both research mentors and career development mentors) accounted for 16% of the responses. Further elaboration indicated that individual mentoring by program-assigned mentors was crucial in developing their research proposals and

in their career advancement. Peer mentoring also was highly valued, especially meeting regularly by phone or webinar with their cohort for research brainstorming sessions. Mentees particularly valued their mentors' assistance in developing research ideas and projects, facilitating collaborations and networking, providing advice about career progress, and establishing mutually agreed upon goals and commitments for both mentee and mentor. A few negative mentoring experiences reported early after mentor assignment were addressed by close monitoring and intervention by site program directors.

The remaining 6% of responses to

this question referenced a variety of factors such as increasing self-confidence, increasing diversity in the biomedical sciences and didactic coursework.

DISCUSSION

The SIPID/PRIDE programs were developed to provide the mentoring and training critical for mentees from underrepresented groups in biomedical research to become successful scientists involved in HLBS research. Research-skills training and mentoring during SIPID/PRIDE were positively evaluated by mentees, who attributed their accomplishments and

career advancement to various program components. A unique feature of SIPID/PRIDE is the multidimensional nature of the programs, each with a different HLBS-research focus, but with similarities in focus across all programs to provide mentoring for research education and skills training to promote career advancement and retention in the HLBS biomedical-research workforce. Another feature of SIPID/PRIDE is its provision of access for mentees to interact with NHLBI program staff in their respective disciplines as well as network with their SIPID/PRIDE peers and other mentors across programs to establish new research collaborations.

An important indicator of success of the SIPID/PRIDE program is number of grants received. However, obtaining research grants is becoming harder given the flat funding level of federal research dollars since 2004, particularly for R01 grants.¹³ Very few grants are funded at the first submission, and resubmission is now the norm. Moreover, fewer physicians are applying for post-doctoral fellowships and early-career mentored-K awards.¹³ With this metric of success, a key consideration is to help junior faculty obtain the required research skills and publications to be favorably reviewed. We found that award receipt was nearly equally split between R series and K series grants. We also compared our grant awards with those from a similar study of underrepresented junior faculty who were provided 8- to 10-week training internships in laboratories of host scientists.⁶ The overall average awards received per person at 5 years post-training was .59, compared with

.16 grants per person for a comparison group that did not engage in any training.⁶ The SIPID/PRIDE mentees, with a mean of .28 grants/person after training, surpassed the comparison group average. Considering the shorter post-training period for PRIDE (2 years) than the previous study (5 years), our results are likely to be comparable with the training group in that study after an appropriate post-training period has elapsed.

With respect to the anonymous evaluations of the program, mentees reported several benefits; the five most frequently reported benefits were: skills development, networking opportunities, personal accomplishments, mentoring, and career development. The feedback received also indicated that individual mentee-mentor relationships may benefit from close monitoring in the beginning to ensure that mutually agreed upon goals and commitments are honored and that a new mentor is assigned quickly if the original match is not working. Overall, survey feedback demonstrated that the mentoring and skills training were beneficial for mentees' career development.

One of the lessons learned is that, whereas a single criterion that defines "success" may be relevant (eg, received R01 funding), the timeline for achieving success may be quite variable depending upon the mentee's level of training and years of experience. Time is needed to develop a publication record in the mentee's field of interest, and writing skills may need to be improved. Requisite skills to conduct a certain type of research may need to be acquired. Mentees may benefit from spending time as a co-investiga-

tor, site PI, or sub-contract PI to gain experience in data collection, management and analysis. Mentees also may need to develop a network of research mentors and collaborators. Mastering these skills and gaining experience may require additional time before a mentee is ready to submit a research grant application. A mentee's individual training needs and experiences should be assessed prior to program participation and revisited periodically during the training and mentoring process. Thus, whereas some mentees may be well-prepared to submit a grant application within a 2-year period, others may need more time to achieve that objective. Thus, a mentored grant mechanism may be more appropriate for some. In addition, teaching and/or clinical demands placed on some mentees at their home institution may allow for less-protected time for research.

Limitations

This article describes elements of the SIPID and PRIDE programs and mentees' evaluations of the program as well as grant awards. Limitations include: 1) we lacked an appropriately matched comparison group that did not receive training; and 2) our findings may not be generalizable to other groups. Also, we are limited by a relatively short time after program completion for the more recent cohorts to be able to report on longer-term follow-up of the mentees' success in terms of grant awards. Although all SIPID cohorts met the 2-year post-training milestone, only the first PRIDE cohort had completed the program for two or more years at the time grants data were collected.

As others have suggested,⁶ some measures of success may not be realized for as long as five years post-training.

CONCLUSION

In conclusion, the SIPID/PRIDE programs, which focus on research and career development, skills training and mentoring, have been successful in advancing the research career of participating mentees, with success measured by the mentees' evaluation of the program. SIPID/PRIDE provides an opportunity to further the development of junior scientists from populations underrepresented in the biomedical and behavioral sciences, fostering diversity in the biomedical-research workforce, which is a seminal part of NIH's strategic goals.¹⁴ The recently funded third phase (2014-2018) of the SIPID/PRIDE programs underscores the value that NHLBI places on these programs, and data from this phase will contribute to future evaluations of the overall program, including long-term outcomes, such as promotions, grant awards and publications.

ACKNOWLEDGMENTS

The authors thank all of the PRIDE trainees, mentors, and faculty that made this training program possible. We thank program staff at each site. Dr. Pace also acknowledges members of her research laboratory who served as teaching assistants during hands-on bench training sessions and the generous provision of housing for PRIDE trainees by the upper administration at The University of Texas at Dallas and Georgia Regents University.

Funding was provided by grants from the National Institutes of Health (NIH) National Heart, Lung, and Blood Institute (NHLBI): R25HL-10-5401 (PIs: MD Begg, KW Davidson, AL Taylor);

R25HL-08-5042 and R25HL-10-5446 (PI: M Boutjdir); R25HL-10-5430 (PI: JP Elder); R25HL-10-5444 (PIs: G Jean-Louis, OG Ogedegbe); R25HL-08-5070 and R25HL-10-6365 (PI: BS Pace); R25HL-08-5040 and R25HL-10-5400 (PI: DC Rao); and R25-HL-10-5408 (PI: TK Rice).

CONFLICT OF INTEREST

No conflicts of interest to report.

AUTHOR CONTRIBUTIONS

Research concept and design: Rice, Jeffe, Boyington, Jobe, Dávila-Román, Gonzalez, Makala, Sarkar, Ogedegbe, Taylor, Czajkowski, Rao, Pace, Jean-Louis, Boutjdir; Acquisition of data: Rice, Jeffe, Boyington, Jobe, Gonzalez, Makala, Sarkar, Rao, Pace; Data analysis and interpretation: Rice, Boyington, Dávila-Román, Gonzalez, de las Fuentes, Makala, Pace, Jean-Louis, Boutjdir; Manuscript draft: Rice, Jeffe, Boyington, Jobe, Dávila-Román, Gonzalez, de las Fuentes, Makala, Ogedegbe, Taylor, Czajkowski, Pace, Jean-Louis, Boutjdir; Statistical expertise: Rice, Jeffe, Ogedegbe; Acquisition of funding: Rice, Boyington, Dávila-Román, Gonzalez, Makala, Taylor, Rao, Pace, Boutjdir; Administrative: Rice, Jeffe, Boyington, Dávila-Román, Gonzalez, Makala, Sarkar, Czajkowski; Supervision: Rice, Boyington, Jobe, Dávila-Román, Gonzalez, de las Fuentes, Ogedegbe

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