

EXPLORING PROFESSIONAL DEVELOPMENT FOR NEW INVESTIGATORS UNDERREPRESENTED IN THE FEDERALLY FUNDED BIOMEDICAL RESEARCH WORKFORCE

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Objective: The National Research Mentoring Network (NRMN) is a strategic partnership whose goals include remedying documented disparities by race and ethnicity in the awarding of National Institutes of Health research grants. Our objectives were to offer a profile of early-career investigators who applied to NRMN's Grantsmanship Coaching Programs (GCP) and test for differences in the research productivity, professional obligations, research resources, and motivations of applicants from underrepresented groups (URGs) compared with applicants from well-represented groups (WRGs). We also evaluated how employment at a minority serving institution (MSI) influenced access to research resources and professional obligations.

Participants: 880 investigators who submitted online applications to join an NRMN GCP between August 1, 2015 and February 1, 2018.

Methods: We used two-sample tests of proportions and logistic regression to explore differences in applicants' characteristics and local research environment by group (URG vs WRG) and institution type (MSI vs Other).

Results: URG and WRG applicants did not differ in grant application submission history. However, URG applicants had published fewer articles than WRG peers (9.8 vs 15.3, $P < .001$) and fewer articles as first/last author (4.4 vs 6.9, $P < .001$). URG applicants reported less access to core facilities to conduct research (74% vs 81%, $P < .05$). Investigators at MSIs reported less access to collaborators ($P < .01$) and departmental colleagues with federal funding ($P < .001$) and spent less time on conducting research ($P < .001$). URGs were more motivated to seek professional development support to

expand their peer networks ($P < .05$) and advance their careers ($P < .001$).

Conclusions: Our findings identified several points of intervention to help applicants from URGs to improve their future chances of obtaining competitive funding. *Ethn Dis.* 2019;29(Suppl 1): 123-128; doi:10.18865/ed.29.S1.123.

Keywords: Minority Faculty Groups; Research Grants; Diversity; Professional Development; Research Resources

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INTRODUCTION

Competitive Research Funding for Health Equity

The complexities of minority health and health disparities research require a unique blend of perspectives including scientific¹ and sociocultural diversity.² Investigators from minority populations that bear the greatest disease burdens are often motivated to pursue research because of its potential impact on their communities' health.³ Additionally, they may more actively integrate their cultural, racial or ethnic backgrounds into their work.⁴ Thus, advancing health equity requires the full participation of a diverse biomedical research workforce.^{5,6} However,

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investigators from underrepresented groups (URG) in the biomedical sciences are less likely to be awarded federal research funding than their peers from well-represented groups (WRG), even after controlling for education, training, research productivity and employer characteristics,⁷ and are less likely to reapply for grant funding after initial failure.⁸ Unresolved, these differences in outcomes threaten the future of health equity research.

Few opportunities are available for intensive professional training and mentoring with respect to writing a successful grant application.⁹ This lack of grant training and mentoring is particularly problematic for investigators from URGs. For example, at research-intensive universities, URG faculty report limited access to culturally competent mentors.¹⁰ Investigators at minority serving institutions (MSI), which are often teaching-intensive and have smaller research portfolios, have fewer mentors with a history of securing competitive grant funding.¹¹⁻¹³ Yet, research resources such as tools, software, specialized equipment, institutional support services, access to targeted collaborations and research networks are critically important to URG investigators' research funding. Inequitable access to resources that enable and expedite research may have long-term impacts on securing grant funding.⁷

In addition to limited access to training and mentorship in grant writing, URGs must also contend with harsh realities about the nature of the grant peer review process. An investigator's past research productivity impacts competitiveness for additional research funding. The peer-review process assumes an investigator's past per-

formance and contributions to their field predict future contributions.¹⁴⁻¹⁶ However, unique factors may result in fewer publications for URG investigators conducting health equity research. For example, for those conducting community-based participatory research, the intensive process often takes years to develop before results can be analyzed and published.¹⁷ Compared with their counterparts from WRGs in biomedical science, URGs also resubmit grant applications more times before being funded but are less likely to resubmit.^{7,8} In sum, it is an uphill journey for URG investigators. Programs that address these opportunities and challenges are critically important to preparing the next generation of URG scientists to compete successfully for health equity research funding.

A National Grantsmanship Coaching Partnership to Address the Federal Funding Gap

URG investigators value role modeling and are more likely than peers in WRGs to participate in faculty development programs.¹⁸ The National Research Mentoring Network (NRMN) is a key component of the National Institutes of Health's Diversity Program Consortium. Aligned with the NRMN goal to enhance diversity in the biomedical funded workforce,^{19,20} we implemented four Grantsmanship Coaching Programs (GCP). As a nationwide consortium, we leveraged the collective expertise of biomedical professionals and institutions to offer evidence-based programs and evaluate their effectiveness with the ultimate objective of informing the future education and training of a di-

verse biomedical research workforce. The four models of the GCP provide intensive coaching to address the technical components of grant writing while acknowledging, and where feasible addressing, the psychosocial and research resource challenges faced by URGs in their pursuit of funding.²¹⁻²³

The applications we received for the GCPs yielded a large national dataset of information on those who sought the type of professional development support provided by our programs (eg, applicant demographics, past research experience, motivations for applying) and salient features of their work life and home institutions (eg, amount of protected research time for research, access to research resources and colleagues in one's research area). We analyzed these data to: 1) provide an overall picture of our national applicant pool; and 2) test for differences by applicant group status (URGs vs WRGs) and institution type (MSI vs Other) in variables that might influence an investigator's success in developing, submitting and acquiring research grant proposals. Our findings offer several points of intervention to help URGs improve future chances of obtaining competitive funding.

METHODS

Data Collection

Our study includes data from 880 investigators who voluntarily submitted online applications to join one of the four NRMN GCPs²¹ between August 1, 2015 and February 1, 2018. Applications requested details about applicants' position, training and research background, research productivity (articles pub-

lished in peer-reviewed journals, grant applications submitted to and funded by federal and non-federal funding agencies), research resources available at their institutions (eg, software, relevant scientific journal subscriptions, core facilities, statistical support, grants management support, scientific colleagues or collaborators), and their expectations and obligations regarding time to participate in a GCP. Four open-ended questions inquired about the applicant's motivation to participate in the GCP, current mentoring support, preparation for an independent research career, and their respective grant application. Our research was approved by a single institutional review board (IRB) and data sharing agreement coordinated by Boston College and all procedures followed were in accordance with the ethical standards of the IRB.

Independent Variables

Consistent with the National Institutes of Health's (NIH) definition of populations underrepresented in the scientific workforce,²⁴ we categorized applicants from the following racial and ethnic groups as URG: Blacks or African Americans, Hispanics or Latinos, American Indians or Alaska Natives, Native Hawaiians, and other Pacific Islanders. Asians and Whites were defined as WRG because of their adequate or over-representation in the biomedical research workforce.

We used US Department of Education definitions to identify applicants employed by an MSI.²⁵ MSIs include historically Black colleges and universities, tribal colleges and universities, and Hispanic-serving institutions.

Dependent Variables

We assessed applicants' research productivity by number of: 1) articles published in peer-reviewed journals; 2) publications as first/last author; and 3) F31, F32, K99/R00, K, R03, R21 or R01 grant applications as principal investigator (PI) and previously submitted to NIH as these mechanisms represent the typical funding path toward research independence.

We developed binary codes for applicants' responses about the availability of specific research resources at their institution: scientific journal subscriptions relevant to the applicant's research area, an institutional grants management office, colleagues or potential collaborators in the applicant's research area, core research laboratories or other facilities necessary for applicant's research, statistical support, and membership in a department in which more than 50% of faculty had federal funding.

We used four categorical variables to assess professional obligations that could facilitate or hinder the preparation and submission of grant applications: 1) time spent conducting research (categorized as 0-10%; 11-20%; 21-30%; 31-40%; 41-50%; and >50%); 2) current teaching load during the academic year (categorized as no full courses, occasional lectures, one course per academic term, two courses per academic term, three courses per academic term, or more than three courses per academic term); 3) option to buy out courses (categorized as yes or no); and 4) summer teaching obligations (categorized as yes or no).

Applicants were asked four open-ended questions regarding their motivations to participate in a GCP,

preparation for independent research, current mentoring and career goals, and their planned grant application. We developed a coding scheme to systematically categorize their responses to explore differences in the motivations of URGs and WRGs. (Coding scheme available from lead author).

Analysis

We used Stata 15²⁶ to develop cross tabulations and two-sample tests of proportions to investigate group differences (URG vs WRG) in: 1) research productivity; 2) access to research resources; 3) professional obligations supporting or hindering grant application development; and 4) motivations to seek professional development. Logistic regression analyses were conducted to examine associations among institutions, access to research resources, and professional obligations. Statistical significance was defined as $\alpha < .05$.

RESULTS

Fifty-five percent of NRMN GCP applicants were investigators from URGs (31% Black/African American, 16% Hispanic/Latinx, 3% American Indians/Alaska Natives, 2% Hawaiian/Pacific Islander, 3% Multiracial); 37% belonged to WRGs (21% White, 15% Asian). The remaining 9% preferred not to report or offered no response. Women made up 65% of the applicant pool, men 30%; 5% did not select from the binary gender categories. Applicants occupied the following positions: research-focused faculty (25%), teaching-focused faculty (5%), mixed teaching and research faculty (31%), postdoctoral trainee (31%), in-

Table 1. Comparison of research productivity and access to research resources for URG and WRG applicants

	URG (n=482 ^a)	WRG (n=322 ^a)	P
Research Productivity			
Number of peer-reviewed publications, mean	9.8	15.3	P<.001
Number of peer-reviewed publications as first/last author, mean	4.4	6.9	P<.001
Number of NIH grant applications previously submitted as a PI, mean	.4	.4	P=.27
Access to Research Resources			
Access to scientific journal subscriptions relevant to applicant's research area	90%	94%	P=.11
Grants management office	83%	88%	P=.09
Access to colleagues or potential collaborators in applicant's research area	78%	81%	P=.42
Core research laboratory or other facilities necessary for applicant's research	74%	81%	P<.05
Statistical support	69%	71%	P=.43
More than 50% of faculty in applicants' department have federal research funding	27%	34%	P<.05

a. totals add up to 804; 76 investigators did not provide data on race/ethnicity. URG, underrepresented group; WRG, well-represented group.

dustry researcher (.2%), non-research industry worker (.3%), government lab researcher (.5%), and other non-designated worker categories (7%).

Of the 880 applicants, 40% (N=353) had previously applied to one of the specified NIH funding mechanisms as PI; only 9% (N=77) received awards. There was no statistically significant difference between the proportion of URG and WRG applicants who had previously submitted proposals (43% vs 38.8%, respectively; Table 1). At the time of application, investigators averaged 12 peer-reviewed journal articles (SD=12.6) and 5.3 articles as first/last author (SD=5.9). However, consistent with the literature,²⁷ those from URGs published a mean of 5.5 fewer articles than their WRG peers (9.8 vs.15.3, P<.001) and 2.5 fewer articles as

first/last author (4.4 vs. 6.9, P<.001).

URG applicants were less likely than WRG applicants to report access to two type of research resources: core facilities to conduct research (74% vs 81%, P<.05) and being in a department where the majority of faculty had external federal research funding (27% vs 34%, P<.05). We expected that research resources might vary by institution and found that investigators at MSIs were less likely than those at other institutions to report having access to colleagues or potential collaborators in the applicant's research area (14% vs 22%, respectively; P<.01).

Almost half of applicants spent more than 50% of their time conducting research (N=433, 49%). Four hundred and twenty (48%) applicants taught zero to one course per

academic term; 280 (25%) taught 2 or more courses. Only 177 (20%) were unable to buy out of courses with outside funding; 213 (24%) reported summer teaching obligations. The majority expected to be granted release time upon acceptance into a GCP (N=772, 88%). (data not shown)

We found that URGs spent 3.4% fewer hours per week on grant application development (P<.001) and 11% less time conducting research (P<.05) than WRGs. Given that MSIs are characterized as typically more teaching-intensive with smaller research portfolios and that URGs are often on faculty at these institutions,¹⁸ we performed a regression analysis to further examine differences in professional obligations (Table 2). We found that those employed by an MSI spent 16% less time

Table 2. Differences in professional obligations by URG status and MSI

	URG	P	MSI	P
Approximate number of hours per week dedicated to writing grant application	-3.4%	P<.001	1.9%	P=.07
Dept. grants release time to work on application	26%	P=.45	138%	P<.01
Approx. time spent conducting research	-11%	P<.05	-16%	P<.01
Expected teaching load (no. of courses per academic term)	2.3%	P=.60	-8.9%	P=.13
Ability to buy out courses with outside funding	4.7%	P=.54	3.7%	P=.71
Summer teaching obligations	-11%	P=.22	41%	P<.01

URG, underrepresented group; MSI, minority-serving institution.

conducting research ($P < .01$) than those at other institutions. These investigators were also 41% more likely to teach during the summer ($P < .01$). However, they more likely expected departmental release time if they were accepted into an NRMN GCP ($P < .01$).

URGs reported that they were seeking “advice, guidance or learning activities to evolve or gain personal knowledge relevant to conducting research as an independent investigator.” These applicants commented that grant funding was essential to progress on their career path (URG 5% vs WRG 4%, $P < .01$). They also reported wanting to further develop a network of colleagues who might help improve a research approach, expand knowledge of disciplinary practices, and/or provide critique/feedback related to a research grant application (URG 2% vs WRG 1%, $P < .05$). Finally, URGs were more likely to report that they wanted to use the funding to address a biomedical or public health challenge (URG 13% vs WRG 8%, $P < .01$).

DISCUSSION

The large number of URG investigators in this national dataset offered a unique lens for exploring professional development needs as well as the challenges and realities they face in pursuit of competitive research funding. Although our analysis was carefully prepared, we are aware of its shortcomings. First, there may be important differences between investigators who applied to our programs and those who did not, so we generalize our findings to new investigators in the biomedical sciences who are willing to seek out professional

development support. Future studies would be improved by the use of additional controls in our regression analyses.

Our findings showed some resource challenges with URG investigators, but we were encouraged to find that they were as likely as WRG investigators to have submitted grant applications and are motivated by their passions to advance research that promotes health equity. Our other findings suggest areas of special emphasis that professional development programs might consider when striving to position URG investigators competitively for sponsored research. First, in the current hypercompetitive funding environment, URGs cannot afford to have a shorter publication record. Although the previously reported NIH grant gap by race/ethnicity persisted when controlling for PI productivity,⁷ programs should help URGs address this important variable, which is heavily scrutinized in the NIH peer-review criteria.¹⁶

Second, programs should consider to what research resources URGs have access and link them to networks in which they can collaborate and access facilities that advance their work. To a large degree, the grant peer review process is subjective and potentially compromised by biases that can negatively influence the outcomes of URG application submissions.²⁸ Given these realities, scientific collaboration becomes critical to improving the competitiveness of URGs. URGs also could benefit from professional development programs that prioritize skill development and intentional efforts to embed URGs in pertinent research networks.²⁹ The value of strategic partnerships can facilitate access to research resources including scientific meetings

as well as opportunities for collaboration, problem solving, and networking.³⁰ Moreover, given that URGs were more likely working in departments with few colleagues with federal funding, they do not as consistently see models for research independence. Intentional connections to successfully funded investigators who can provide mentoring and coaching as to the process of grant funding are essential.

Third, though investigators at MSIs have less time for research, our data suggest that MSIs are actively awarding release time for investigators who are accepted into meaningful professional development programs. Thus, programs should consider negotiating release time.

CONCLUSION

Our data underscore that URGs' motivations to seek out support with grant application development were aligned with their desire to impact change. Thus, programs aimed at closing any funding gaps will require more than just skill development. They will have to think critically about how URGs' heads, hearts, and hands are committed to the work of health equity.

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CONFLICT OF INTEREST

No conflicts of interest to report.

AUTHOR CONTRIBUTIONS

Research concept and design: Eide, Harwood; Acquisition of data: Eide, Harwood; Data analysis and interpretation: Hemming, Eide, Harwood, Ali, Zhu, Cutler; Manuscript draft: Hemming, Eide, Harwood, Ali, Zhu, Cutler; Statistical expertise: Hemming, Harwood, Ali, Zhu, Cutler; Administrative: Hemming, Eide, Harwood.

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