NRMNet: Building a National Resource for Mentorship, Networking and Professional Development to Enhance Diversity

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Background: To address the need for diversifying the biomedical research workforce, the National Institutes of Health (NIH) established the Diversity Program Consortium (DPC) with the goal of developing, implementing, assessing, and disseminating interventions and programs to enhance the participation and persistence of individuals from underrepresented backgrounds in biomedical research careers.

Intervention: As part of the DPC initiative, the NIH funded the National Research Mentoring Network (NRMN), which aimed to increase diversity of the biomedical research workforce through culturally responsive mentorship, networking, and professional development. In 2015, the NRMNet portal was developed to provide a broad-based network of mentors who are accessible to diverse mentees across the country. The portal also provides networking and professional development resources that support mentee transitions from one career stage to the next.

Results: NRMNet is the gateway for career stage-specific mentorship, networking, resources, and professional development programs for trainees across the biomedical, behavioral, clinical, and social sciences. In the first five years, the NRMN strategic recruitment efforts resulted in an expanded network of nearly 13,000 diverse mentors and mentees with NRMN representation in all 50 states and Puerto Rico. Consistently, over the first five years, racial and ethnic diversity was reflected in composition of mentee and mentor groups: 66% of 6,526 mentees and 33% of 3,866 mentors were from underrepresented groups.

Conclusions: The NRMNet portal is a promising effort for enhancing participation and continued engagement of undrerepresented individuals in biomedical research careers by providing culturally responsive mentorship, networking, and professional development for individuals at all career stages. *Ethn Dis*. 2021;31(3):469-480; doi:10.18865/ed.31.3.469

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Introduction

In a study of barriers to NIH funding, minority investigators reported that inadequate mentoring, lack of institutional support, social, cultural, and environmental factors all posed obstacles to success.[1] Mentoring programs for underrepresented minorities (URM, ie, African American, Hispanic/Latinx, American Indian, and Alaska Natives) must address these concerns and create a network of invested mentors committed to advancing careers of URM scientists. Research indicates that URMs receive less mentoring than their non-minority peers.[2-4] While a lack of mentoring is not unique to URM faculty, the effect disproportionately impacts this group, especially those in majority/White institutions. Ginther and colleagues have shown that African American researchers receive fewer R01 grants compared with their White peers.[2,5] A follow-up article examined possible reasons for the disparity in NIH funding and hypothesized that variability in access to mentoring may be a contributing factor.[2,6] While attrition at the faculty level is significant, the gap between the URM and better-served students exists throughout the higher education STEM pathway. Three important factors driving attrition are the lack of: mentors and role models on campus; diverse faculty and students; and professional networking opportunities.[7-9]

Though the importance of mentoring is recognized universally, there is a dearth of online portals or websites that bring mentoring resources and services under one umbrella, organized to serve each career level with the goal of increasing diversity of the university-level faculty. In an effort to address this critical need, the NRMNet portal was developed as part of the National Research Mentoring Network (NRMN).

The first phase of NRMN was funded from 2014-2019, and it is the focus of this article. NRMN is a nationwide consortium collaborating to provide students and scientists across all career stages of research in the biomedical, behavioral, clinical, and social sciences with enhanced mentorship, networking, and professional development. The goal of the NRMN is to diversify the biomedical workforce.[10] The NIH Statement of Diversity, which NRMN follows, specifies its commitment to addressing under-representation of key populations within the biomedical research workforce.[11] Underrepresented groups in these fields are: Blacks or African Americans, Hispanic/Latinx, American Indians or Alaska Natives, and Native Hawaiians and other Pacific Islanders, individuals with disabilities, individuals from disadvantaged backgrounds, and women.[11]

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The NRMNet portal, one activity of the NRMN, provides a broad-based network of mentors who are accessible to diverse mentees across the country and provides mentors and mentees with resources that support mentee transitions from one career stage to the next. The overarching objective of the portal is to create a sustainable digital infrastructure to support and facilitate culturally responsive mentorship (CRM), networking, and professional development. The portal is built on the Social Cognitive Career Theory (SCCT) that supports immersion, career progression, and persistence within the biomedical research fields. Mentoring relationships and the development of career intentions, motivations, and persistence occur within the social and psychological domains of career development, which is well described by SCCT.[12] The SCCT is at the foundation of NRMN's conceptual model because it: 1) is a well-studied theory with 20 years of strong empirical support; 2) addresses developmental tasks that occur across career stages; 3) has demonstrated the ability to bring together related concepts (eg, self-efficacy, science identity, personal identity); and 4) captures environmental factors such as mentoring, networking, and professional development and influences career development, persistence, and choice.

Intervention

The NRMNet portal (nrmnet.net), launched in July 2015, is the gateway to career stage-specific resources that support end-users from undergraduates to academic administrators. Users register as an NRMN mentor or mentee by completing a set of profile questions used to create connections. Through the portal, users can access mentorship and networking to deepen their connection to the diverse nationwide scientific community and engage in professional development and career-designed resources to hone their skills for a successful career trajectory. NRMNet also includes an events calendar with partner and NRMN activities, NRMN Career Development Webinars, social media presence, and other NRMN resources to enrich the users' STEM experiences. All resources are available at no cost.

MyMentor: Culturally Responsive Mentorship

NRMN defines mentoring as a collaborative learning relationship that proceeds through purposeful stages over time and helps mentees acquire the essential competencies needed for success in their chosen career. Through the MyMentor application, members participate in a one-on-one guided virtual mentorship (GVM) to embark on a culturally responsive, ongoing mentoring connection utilizing an evidence-based curriculum. Additionally, scientific/professional societies/organizations, institutions, and programs can create exclusive GVM environments specifically for their members.

Based on research literature on multicultural training regarding effec-

tive practices of culturally responsive teaching,[13-15] NRMN adopted the term culturally responsive mentoring (CRM). NRMN strived to facilitate and support extended CRM through an evidence-based curriculum featuring effective mentoring practices.[16] This curriculum includes: aligning expectations; identity as a scientist; work-life balance; dealing with stress; microaggressions; cultural identity; perseverance; and networking.

To embark on a MyMentor connection, mentees identify their current career stage and then select a mentor either based on the matching algorithm derived from the NRMN profile questions or based on the results of their own search. Once the mentor accepts the mentoring request, the dyad receives the curriculum with 19 discussion prompts to guide the connection. The default setting is to complete one prompt per week, but this can be altered based on needs. On average, mentors and mentees spend approximately 30 minutes per week engaging in their connections.

MyNRMN: Networking

The MyNRMN application is a networking tool designed to help mentees and mentors connect professionally and support mentoring relationships and connections nationwide. With MyNRMN, users can browse profiles of other members to build their network, ask questions (eg, general, research, professional development, etc.), and schedule formal mentorship appointments. Additionally, users can video chat with other members, join and/or create groups, and build their CV/resume. To continuously improve the user experience on our virtual platforms, we established a Product Council to provide advice on the efficacy and utility of the technical platform, branding, and strategic development of the GVM features and networking platforms.

Professional Development

The NRMN Career Development Webinar (CDW) Series explores the challenges and importance of finding a mentor within the biophysical community, the role of mentoring for URM, and the resources in NRMN. NRMN hosts a monthly webinar to guide individuals through the resources available to both NRMN members and non-members. The goal of these monthly webinars is to develop a community and to expose upcoming researchers and scholars to new opportunities and perspectives to increase diversity in the biomedical fields. We partner with organizations and professionals to provide content relevant to mentorship, diversity, and STEM. All webinars are available at no cost on NRMNet. NRMN also created and implemented professional development and grantsmanship coaching to support grant funding success of URM scholars. Associated details regarding the NRMN grantsmanship programs and outcomes can be found in the literature.[10,17,18]

Recruitment

The NRMN recruitment strategy consisted of three main components: the NRMN Ambassador Program; In-Person Recruitment; and Social Media/Virtual Recruitment. From the inception, we acknowledged that to recruit a diverse, nationwide network of mentors and mentees for a new program, our recruitment strategy needed to focus heavily on developing a network of NRMN Ambassadors. The NRMN Ambassadors program consists of NRMN mentors and mentees, NRMN staff, and NRMN partners, who agree to assist with the recruitment of mentors and mentees to the network. Utilizing NRMN Ambassadors not only engendered a nationwide awareness of NRMN, but was also a fiscally responsible strategy for recruitment. We capitalized on the fact that NRMN Ambassadors were already attending scientific/professional society meetings and/or other conferences as part of their own research/professional commitment. We equipped NRMN Ambassadors with the appropriate training and resources to represent NRMN at these meetings/conferences.

Many in-person recruitment events were conducted to learn which would give the best yield of enrollees to NRMN. The methods and tactics implemented during these events were also trial and error, helping us discover best practices. For instance, during the first year, prospects who expressed interest in NRMN provided their name and email. After the event, we sent them information about NRMN and how to register via email. Despite multiple outreach attempts to these prospects, only a few individuals opened the welcome email, clicked through, and navigated to the NRMN website to register. Consequently, we implemented a two-step registration process during in-person events such as the Annual Biomedical Research Conference for Minority Students (ABRCMS) and the meeting of the Society for Advancement of Chicanos/Hispanics and Native

Americans in Science (SACNAS). In Years 4-5, individuals registered at the event by submitting their name and email or registering using single sign-on (LinkedIn, Facebook, or Gmail) through NRMNet. By completing this first step, the user became an NRMN member. The user could complete the remaining profile questions on-site or return later to finish. The implementation of the two-step registration process alleviated the challenge of prospects not wanting to register on-site due to the length of the process.

NRMN Ambassadors also conducted virtual recruitment, through NRMNet, social media, demos/webinars, email campaigns, and the NRMN Newsletter. We tracked user traffic through each type of recruitment campaign. We created and used the Urchin Tracking links that provided analytics to help us learn which campaigns were most effective and adjusted recruitment strategies accordingly. Additionally, we incorporated Google Analytics to gain a better understanding of the user experience, including the registration process, the most useful resources, and most-often visited content on the website.

Results

MyMentor: Culturally Responsive Mentorship

By the end of Phase I, 906 dyads completed a GVM connection. Upon completion of a mentoring connection, mentees and mentors are asked to complete a survey about their experience. In total, 77 mentees and 114 mentors responded to the survey. Regarding the quality of the mentoring connections, 54.5% of mentees responded that the mentoring they received was "Excellent." When asked about the mentoring relationship, 59.7% of mentees and 43.9% of mentors responded that their relationship was "Excellent." When asked, "how good of a match do you feel you and your [mentor/mentee] was?" 55.6% of mentees and 48.2% of mentors responded with "Excellent." In a matrix of improvement, 50.7% of mentees responded that they improved in aligning expectations, 46.6% in setting goals, 47.9% in managing demands, 41.0% in managing stress, 39.7% in managing their work/life balance, 30.1% in their sense of belonging, 32.9% in their science identity, 50.7% in building/expanding their professional networks, and 45.2% in feeling prepared for the next steps in their career. Additional outcomes for NRMN's GVM program will be reported in future publications.

MyNRMN: Networking

NRMN's networking component, MyNRMN, helped mentees and mentors connect across the United States and some US territories. This is especially important for areas with mentoring deficits, as discussed earlier. Between the launch of MyNRMN, May 11, 2016, and the end of NRMN Phase I, June 30, 2019, the platform saw 4,197 member network connections, 678 "Find a Mentor" connections, 4,060 comments posted, 108 calendar events created, 345 files shared, 790 CV/resumes uploaded or created, and 156 My Groups created with 1,842 participants in these groups. For additional outcomes about MyNRMN refer to Ahmed et al.[19]

Professional Development

The Career Development Webinars (CDWs) are a collaborative effort to deliver professional development resources to members and nonmembers. One of our most attended webinars was in collaboration with Dr. Jaime Rubin of Columbia Medical School. Dr. Rubin presented, "Transitioning to Research Independence: Funding & Grantsmanship for Newly Independent Investigators." We had more than 740 registrations and more than 400 participants who attended the webinar. Other CDWs included the monthly "How to Leverage the NRMN Network Webinar Series," a partnership with iBiology, NRMN Health Research Talks, and resources for those applying to and/or working through graduate school and early career objectives.

Recruitment

A steady increase of participants was seen with nearly 13,000 registered users from 2014-2019 (Table 1). The NRMN strategic recruitment efforts, with an emphasis on the NRMN Ambassador program, resulted in a steady increase throughout the years and representation of NRMN in all 50 states and Puerto Rico (Figure 1). This was achieved through attendance at various recruitment events during the early years. We quickly learned that attending the SACNAS and the ABRCMS yearly conferences yielded the highest returns for NRMN.

Registration at ABRCMS and SACNAS conferences significantly

Table 1. NRMN recruitment growth

Year	Mentees	Mentors	Undeclared	Total
Year 1 (2014-2015)	37	16	0	53
Year 2 (2015-2016)	1688	983	52	2723
Year 3 (2016-2017)	3687	2005	733	6425
Year 4 (2017-2018)	4846	2617	1726	9189
Year 5 (2018-2019)	6528	3894	2539	12961

increased mentors/mentees. During Years 2-3 we registered 389 individuals from these two conferences. After the two-step registration process was implemented in Years 4 and 5, we increased registration by 374.3% to a total of 1,456 individuals within those two years.

Table 2 shows the race/ethnicity of NRMN mentees and mentors and demonstrates that our recruitment strategy resulted in a community of diverse members. Of those tracked through May 2019, 59% of the currently registered mentees were from underrepresented groups, and 27% self-identified as Hispanic/Latinx. Thirty-four percent of mentors self-identified as belonging to an underrepresented group, and 14% self-identified as Hispanic/Latinx. Regarding sex, 67% of mentees self-identified as female, and 56% of mentors self-identified as female (Table 2). Regarding education levels, the largest groups of mentees are undergraduates (32%), professional/non-student (24%), and postdoctoral (18%) (Table 3). Mentors are largely composed of professional/non-student (76%) and postdoctoral (11%). Table 3 also shows the career breakdown of

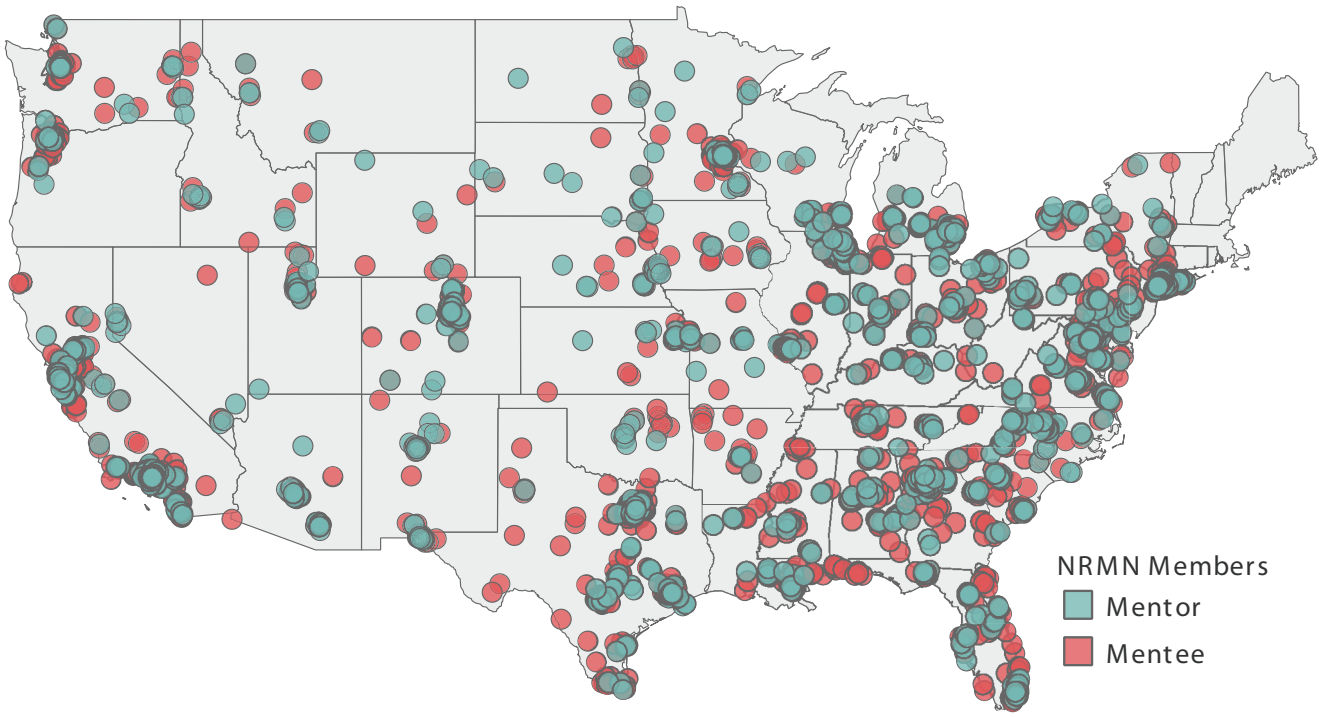

Figure 1. NRMN registrants geographically represented by zip code. Mentees and mentors are located in all 50 states and some territories, however this map only depicts the contiguous United States

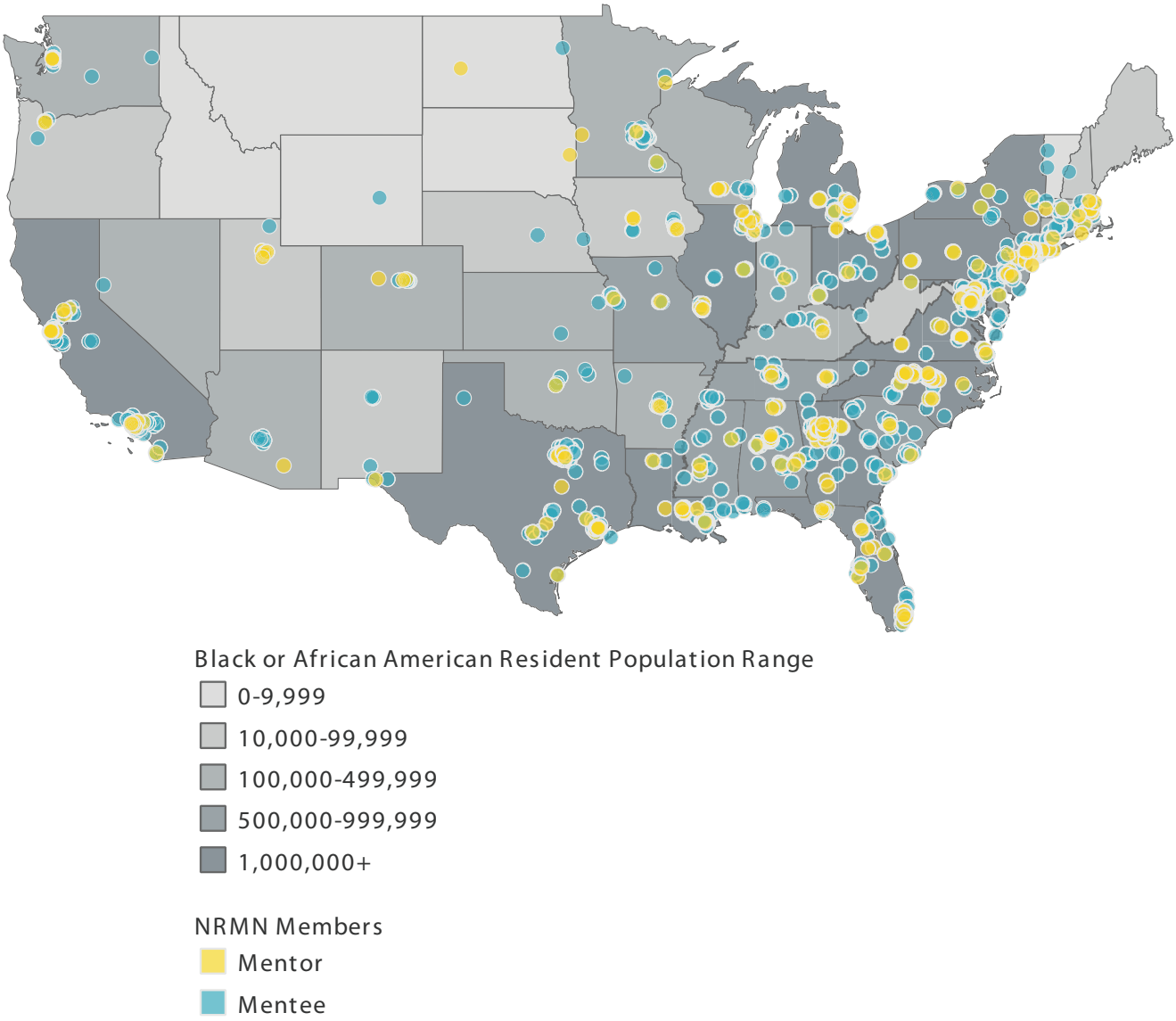

Figure 2. The dots represent geographic distribution by zip code of mentees and mentors according to their self-identified race/ethnicity. This map represents the US population racial/ethnic distribution of Blacks or African Americans according to the 2010 US Census Data. Information for the US Territories were not included in the US Census Data. This map only depicts the contiguous United States

NRMN mentors and mentees. Assistant professors and postdoctoral fellows constitute the highest group of mentees, totaling 982 and 866 respectively, and mentors 642 and 258 respectively, among all career stages.

Figures 2, 3, 4 illustrate the geographical distribution of NRMN members within the contiguous United States, per the 2010 US Census Data. As previously shown, the NRMN population contains 6,526 mentees and 3,886 mentors. These figures demonstrate NRMN's success in recruiting mentors and mentees in states where the specific race/ethnicity is more prominent, and provides NRMN the opportunity to evaluate recruitment initiatives. Figure 2 illustrates the Black or African Ameri-

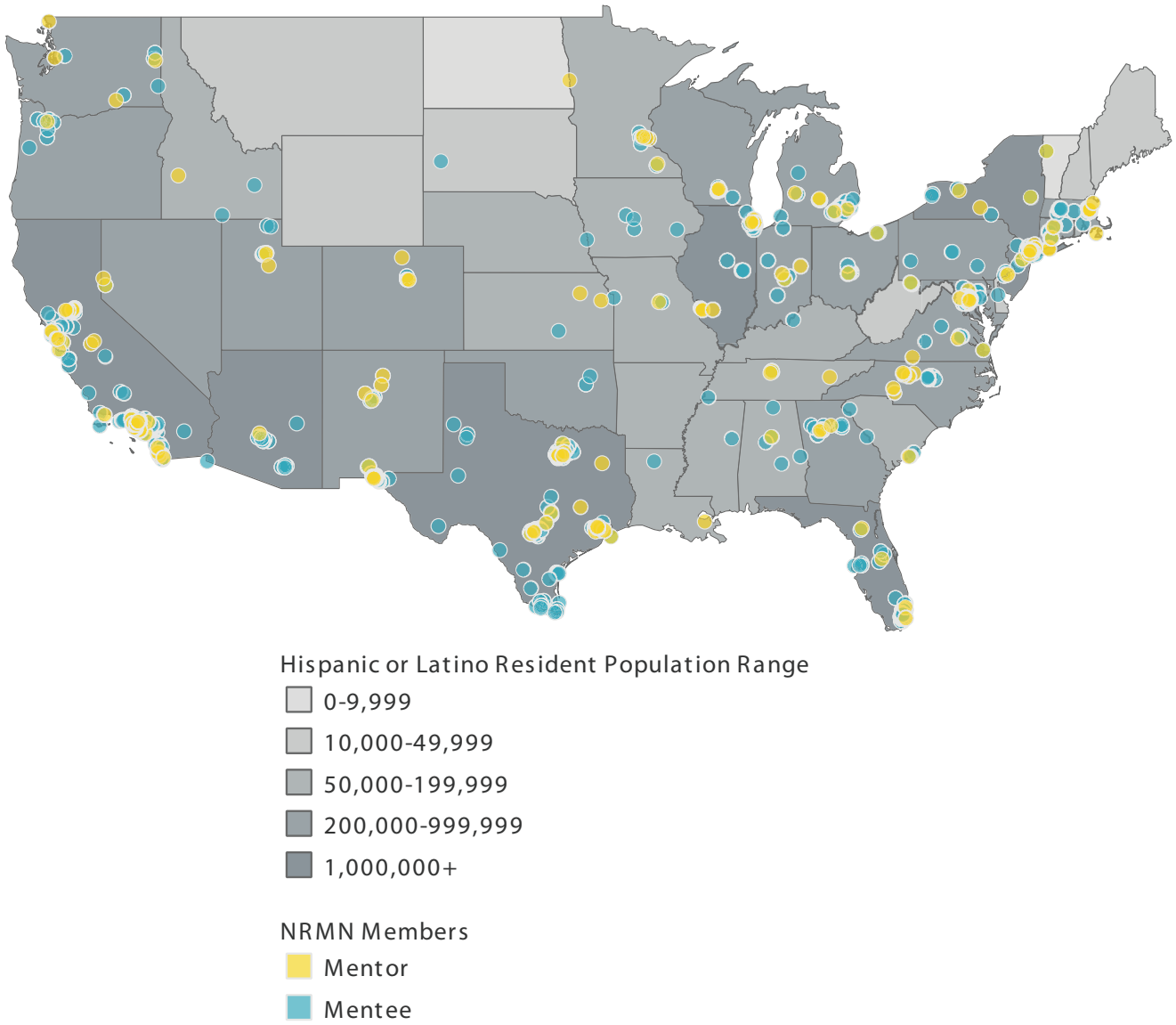

Figure 3. The dots represent geographic distribution by zip code of mentees and mentors according to their self-identified race/ethnicity. This map represents the US population racial/ethnic distribution of Hispanics or Latinos according to the 2010 US Census Data. Information for the US Territories were not included in the US Census Data. This map only depicts the contiguous United States

can population throughout the United States and the percentage of Black or African American mentees (30%) and mentors (12.5%) of the NRMN's total population of 6,256, and 3,886, respectively. Likewise, Figure 3 shows the distribution of the Hispanic/Latinx population, with mentees, 18.4%, mentors, 8.9% of the total mentee/mentor population. Figure 4 shows that, of the total mentee/mentor population, 2.3% mentees and 1.6 mentors were American Indian.

Discussion

The Importance of Mentoring

Mentoring is an important factor contributing to career advancement and success.[20,21] Individual-centered mentoring serves the personal aspira-

Table 2: NRMN mentee and mentor demographics (gender, race, and ethnicity)

Demographic	Mentees		Mentors	
	n	%	n	%
Gender				
Female	4395	67.3%	2196	56.5%
Male	1829	28.0%	1415	36.4%
Transgender	13	0.2%	8	0.2%
Intersex	4	0.1%	2	0.1%
Other	17	0.3%	9	0.2%
Prefer not to report	73	1.1%	209	5.4%
No selection	2	0.0%	5	0.1%
Blank	194	3.0%	46	1.2%
Race				
Asian	862	13.2%	488	12.6%
Black	1958	30.0%	487	12.5%
Hawaiian-Pacific Islander	57	0.9%	24	0.6%
Mixed race	306	4.7%	109	2.8%
Native American	149	2.3%	63	1.6%
White	1978	30.3%	2211	56.9%
Other	498	7.6%	139	3.6%
Prefer not to report	460	7.0%	299	7.7%
Blank	258	4.0%	66	1.7%
Ethnicity				
Cuban	52	0.8%	26	0.7%
Mexican-Chicano	574	8.8%	169	4.3%
Puerto Rican	577	8.8%	150	3.9%
Mixed ethnicity	61	0.9%	21	0.5%
Non-Latino	4277	65.5%	2993	76.9%
Other	472	7.2%	180	4.6%
Prefer not to report	274	4.2%	285	7.3%
Blank	241	3.7%	66	1.7%

All data in this table are self-reported from the NRMN registrants; data collected during registration.

tion, which is best met by developing a network of mentors that supports long-term career and professional goals.[20,22,23] NRMNet is a unique, novel online mentoring site that brings together mentors and mentees nationwide for culturally responsive mentoring through MyMentor, networking, and professional development. We recruited a diverse population of mentors and mentees who can connect virtually from across the nation or within the same city. The strength of the NRMN platform is that it can be leveraged by individuals and organizations to supplement their mentoring, networking, and professional development resources and offerings without being bounded by physical location.

In addition to providing a platform for mentees to obtain access to multiple mentors, we provided a space for participants to hold dual roles, as mentors and mentees. As noted in Table 3, most mentees were at the assistant professor and post docs career stage, which indicates the need for mentorship at these career stages. Interestingly, the data in Table 3 also shows a considerable number of assistant professors and post docs who serve as mentors, demonstrating the need for having a mentor at this career stage and a willingness to give back as a mentor. Mentoring is lacking for early career professionals in biomedical research, yet this is a critical transition point in their career paths.[24-26] As seen in the survey data obtained from MyMentor, GVM is an effective means for those lacking mentoring to obtain it, especially if mentors are not available in their area. Of interest and according to data from the National Center for Science and Engineering Statistics, there were 2,915 URM postdocs in science, engineering, and health in 2017.[27] In the same year, NRMN had 1,124 postdocs as members, representing 38.5% of URM postdocs in the nation as members of NRMN, and indicating the importance of NRMN in providing mentorship and networking for this critical career transition stage.

Recruitment

As shown in Figures 2-4, we were successful in recruiting mentors and mentees in states where the specific race/ethnicity is more prominent. Figure 4 shows the presence of NRMN American Indian mentees in the Northeast region but also shows few American Indian mentors within this region. This example emphasizes the need for a virtual national mentoring program in which mentees from regions that lack mentors can connect with mentors in other parts of the country. Further, in locations with fewer mentors and mentees, there is an opportunity to evaluate our recruitment initiatives and focus on the areas with less representation. In Texas, for example, of the regions displaying NRMN mentors who identified as Hispanic/Latinx, the east, and central regions are modestly represented

while the north, south, and west regions lack NRMN mentor representation (Figure 3). Regarding mentees, Figure 3 illustrates a high density of NRMN mentees who identified as Hispanic/Latinx in most areas of Texas except for the northern region. These datasets help us develop strategic recruitment plans to focus our mentor reach in the north, south, and western regions of Texas and our mentee reach in the southern region of Texas. Additionally, there are specific states with a high density of a certain race/ethnicity but with little NRMN representation from that specific race/ethnicity. For instance, as illustrated in Figure 4, Oklahoma has a high density of American Indians, but there are only a few NRMN mentors in this state. These data identify an opportunity for outreach to colleges, institutions, and organizations to increase our NRMN mentor presence in Oklahoma.

Despite our success in establishing a network of close to 13,000 mentors and mentees, there is still a lot of work to do. Consistently throughout the 5 years, approximately two-thirds of our mentors were from well-represented groups, yet our mentee population is two-thirds from URM groups. The lack of URM mentors, especially of those at the more senior career stages, is consistent with the paucity of URM at the tenure track level.[28] We observed that mentors who receive training are more willing to participate in a voluntary mentoring program as a number of our mentors came as participants from mentor training provided through NRMN by the Mentor Training Core. For more information about the mentor training refer to Sorkness et al.[10] We will continue to assess our NRMN recruitment strategies to increase our network of URM mentors, however, at a national level, we need to decrease the attrition of scientists from underrepresented groups within the biomedical research workforce and increase their recruitment and retention in this workforce.

Table 3. NRMN mentee and mentor demographics (career and education levels)

Demographic	Mentees		Mentors	
	n	%	n	%
Career level[a]				
Non-science field	370		180	
Science field	790		438	
Research staff	335		114	
Post doc	866		258	
Instructor	181		184	
Asst prof	982		642	
Assoc prof	158		640	
Prof	51		901	
Retired	3		26	
Other	601		461	
None	1525		139	
Blank	1166		219	
Education level				
Undergraduate	2116	32.4%	102	2.6%
Post doc	1183	18.1%	438	11.3%
DVM	6	.1%	3	.1%
DDS	10	.2%	5	.1%
PharmD	21	.3%	1	.0%
MD/PhD	46	.7%	11	.3%
MD	49	.8%	4	.1%
PhD	856	13.1%	188	4.8%
Masters	352	5.4%	59	1.5%
Post baccalaureate	138	2.1%	13	.3%
Professional/non-student	1561	23.9%	2961	76.1%
Other/retired	0	.0%	17	.4%
None	190	2.9%	89	2.3%

[a]This question asked users to "select all that apply."
Note: all data in this table are self-reported from the NRMN registrants; data collected during registration.

Future Considerations and Limitations

Individuals with disabilities are underrepresented in the biomedical fields.[11] Creating an optimal user experience for individuals with disabilities is of utmost importance; however, it requires substantial resources. Of those NRMNet registrants who provided disability information, approximately 3% of mentors and 8% of mentees stated having one or more types of disability. As resources become available, we will make the NRMNet platform more accessible for all users.

Furthermore, there is a dearth of literature focused on online mentoring that seeks to diversify the biomedical, behavioral, and STEM workforce in the United States. Online mentoring is an emerging topic

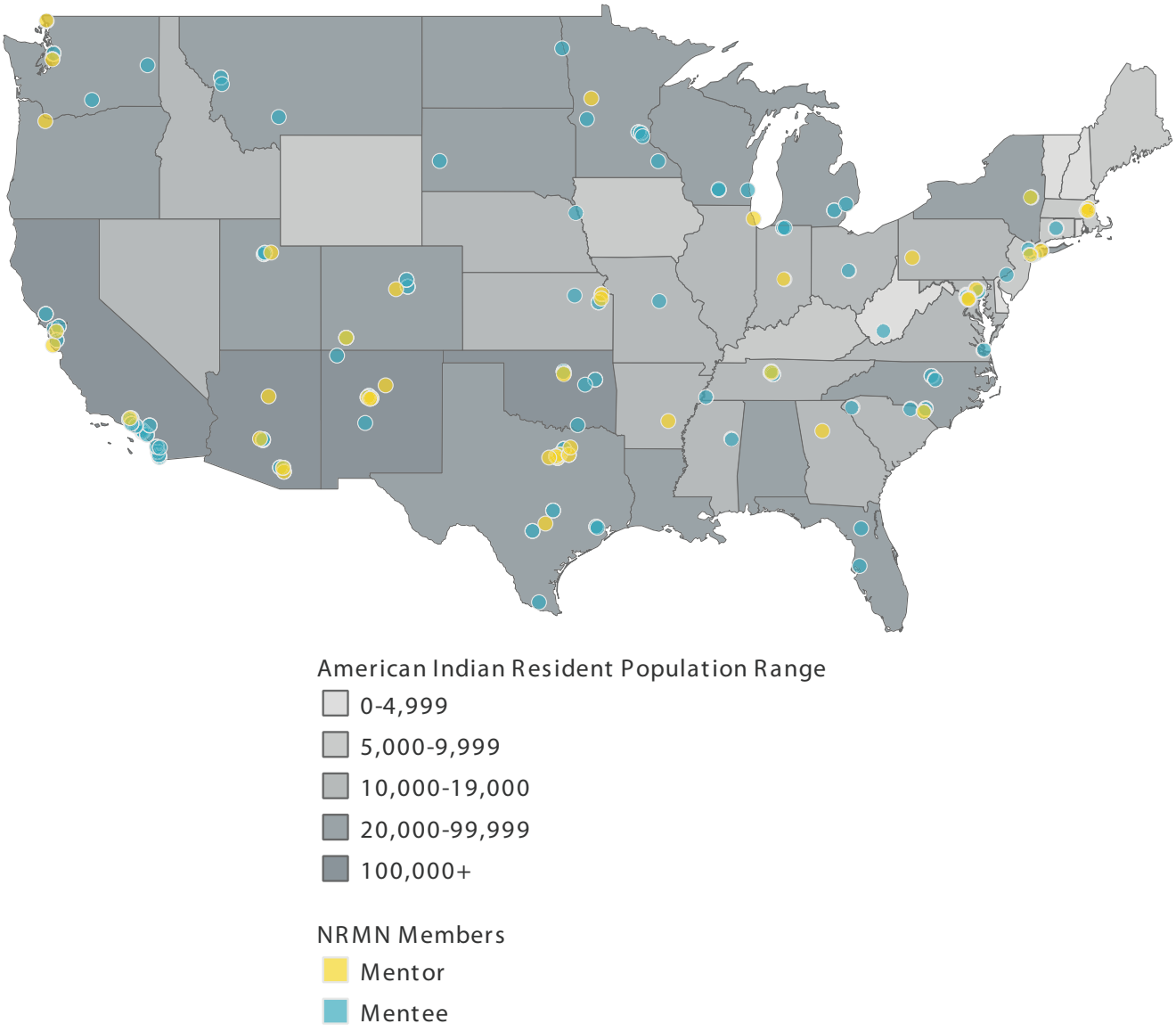

Figure 4. The dots represent geographic distribution by zip code of mentees and mentors according to their self-identified race/ethnicity. This map represents the US population racial/ethnic distribution of American Indians according to the 2010 US Census Data. Information for the US Territories were not included in the US Census Data. This map only depicts the contiguous United States

that continues to grow.[29] The lessons learned in building a national platform for mentoring and networking contributes to the scholarship surrounding CRM and networking.

Throughout our recruitment events and individual conversations, we learned the value of top-down support for mentoring initiatives. Organizations and departments attempting to establish, implement, and maintain mentoring programs are faced with significant barriers when they do not receive support from their leadership. NRMN provides a platform that institutions of higher education, organizations, and programs can leverage to support mentor training, mentoring, and networking activities. Nonetheless, those in leadership posi-

tions must understand the impact of mentoring and how creating a diverse and inclusive STEM workforce benefits the scientific enterprise.

Conclusion

We created a sustainable online architecture to support and facilitate CRM to accelerate the research career development of scholars. NRMN achieved a network of nearly 13,000 diverse members with representation in all 50 states and Puerto Rico. NRMN has led the effort of enhancing the participation and persistence of diverse individuals in biomedical research careers by providing CRM, networking, and professionalism for individuals at all career stages. However, we will need to continue to collect longitudinal data in order to show additional outcomes on how NRMN accelerated the research career development of URM scholars.

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Previous Presentations

Data in this manuscript have been provided to the National Institutes of Health as part of the Diversity Program Consortium for programmatic purposes. Data in this article are new and unpublished.

Accessing Materials

NRMNet platform and resources can be found at www.nrmnet.net. To become an NRMN mentor and/or mentee, the participant must complete a set of profile questions. To be eligible to participate in the program, a participant must be at aged ≥18 years. If the participant is a mentee, the participant must be US citizen, US non-citizen national, or permanent resident.

Conflict of Interest

No conflicts of interest to report.

Author Contributions

Research concept and design: Javier, Ahmed, Vishwanatha; Acquisition of data: Javier, Ahmed, Vishwanatha; Data analysis and interpretation: Javier, Stinson, Zavala, Ahmed, Vishwanatha; Manuscript draft: Javier, Stinson, Zavala, Vishwanatha; Acquisition of funding: Javier, Ahmed, Vishwanatha; Administrative: Javier, Stinson, Zavala, Ahmed, Vishwanatha; Supervision: Javier, Ahmed, Vishwanatha

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