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ORIGINAL PAPER

Embedding HIV Mentoring Programs in HIV Research Networks

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Abstract Responding to the demands of the HIV/AIDS epidemic necessitates a diverse scientific and clinical workforce trained in applying interdisciplinary research approaches to address the epidemic domestically and internationally. Ensuring diversity in our workforce requires concerted efforts. Yet, the majority of graduate and post-graduate programs are ill-equipped to provide this type of training. Research networks, the HPTN, HVTN, CFAR and ATN, are uniquely positioned to implement interdisciplinary mentoring programs and all four have done so. We describe these programs, the nuts and bolts of program implementation and efforts to recruit and retain diversity scholars. We outline some inherent challenges such as competing demands for network resources or tension in aligning scholars' research agenda with that of the networks. We argue that the benefits to be gained from continuing these programs far outweigh their costs and that these programs are an essential component of a comprehensive strategy for developing the future HIV research workforce.

Keywords HIV research network · Diversity scholars · Interdisciplinary mentoring

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Introduction

Advances in the prevention and treatment of HIV infection occurring in the past decade, such as the widespread implementation of treatment as prevention and use of alternative prevention methods including pre and post exposure prophylaxis, have heightened the urgency of utilizing interdisciplinary approaches to mount effective responses to the HIV epidemic both domestically and internationally [1–7]. Unfortunately, the majority of recent graduates from medical, Ph.D. and other doctoral programs have not received adequate training in interdisciplinary perspectives and methodologies to approach such a complex health issues as HIV/AIDS [2, 8, 9]. As described in greater detail by Magnus and colleagues, training these new genre researchers requires helping them to conceptualize HIV prevention and treatment broadly by considering the biomedical, socio-cultural, contextual, political and environmental components as well as coaching them to integrate concepts, theories and methodologies from diverse disciplines. There is also a need to help them establish collaborative relationships with scientists representing a wide spectrum of disciplines and to understand, respect, value and include members of the affected communities in HIV/AIDS research efforts. Additionally, we must provide opportunities where junior scholars can gain real world experience by conducting interdisciplinary HIV/AIDS research in applied settings with guidance from mentors from different disciplines who reinforce and recognize their efforts. By so doing we will help scholars solidify their scientific identity as interdisciplinary HIV/AIDS researchers (see Pfund et al. in this issue) and create a community of scientists that can rapidly advance HIV prevention and treatment efforts. Few graduate or post-graduate programs or even university-based mentoring

programs have the faculty and resources to provide this broad-based training and experience so critical to advancing HIV prevention and treatment efforts. Utilizing integrated and established HIV research networks to provide these training opportunities is not only a viable alternative, but one of the most efficient ways to meet the demands for the rigorous interdisciplinary training needed to address the HIV/AIDS epidemic domestically and internationally.

Assisting emerging scholars early as they develop their HIV research careers contributes substantially to their longer-term academic success and even persistence in the academic environment. The theoretical and conceptual underpinnings for this are well established and presented at length in Pfund, Byars-Winston, Branchaw, Hurtado and Eagan's article. Their article summarized the attributes that play a role in supporting a person-in-environment perspective that accounts for psychological, environmental and interpersonal forces that can propel or constrain scholarly development and success particularly for underrepresented minorities (URM). The environmental and interpersonal factors impacting scholarly proficiency are also highlighted in a recent NATURE News feature by Erika Check Hayden [10]. Hayden points to factors of personal bias that have been noted as influential in NIH funding decisions, and by extension must be addressed in the mentoring relationship in order to prepare URM scholars for the harsh realities they will face as they pursue federal support for their HIV/AIDS research studies. Such personal biases are noted in Pfund et al.'s article and are supported by social cognitive career theory that points to ways in which persistence in academic careers can be influenced by beliefs and experiences facing early career scholars. It is imperative to address contextual and interpersonal experiences in order to create healthy and sustainable academic career paths. The scholars programs described in this article are presented as a mechanism with demonstrated success in aiding early career scholars, especially URM scholars, to develop HIV/AIDS research careers.

HIV Research Networks

HIV research networks have been an important component of the United States' response to the HIV epidemic. The mission of these networks is to make scientific and clinical advances in a distinct research area (i.e. prevention, microbicides and vaccines) or with special groups (i.e. adolescents). Research networks such as the Adolescent Trials Network for HIV/AIDS Interventions (ATN), HIV Prevention Trials Network (HPTN), and the HIV Vaccine Network (HVTN), as well as other collaborative initiatives, such as the Centers for AIDS Research's (CFARs) and the Social and Behavioral Science Research Network (SBSRN), possess the essential ingredients to implement interdisciplinary mentoring programs. These large interdisciplinary clinical, research and training networks, funded as cooperative agreements primarily by the Division of AIDS in the National Institute of Allergy and Infectious Diseases (NIAID), National Institute of Child Health and Human Development and other collaborating NIH institutes, by design, bring together experienced, talented and diversely trained scientists to work collaboratively on common goals to advance HIV/AIDS treatment and prevention efforts [11]. Their affiliated infrastructure of clinical sites provides fertile ground from which to recruit participants and conduct multi-site studies. Furthermore, networks have established systems and procedures (i.e. protocol development and monitoring, regularly convened conference calls and face-to-face-meetings, access to laboratory and biostatistical support services, etc.) that facilitate the research process. Although most networks' original funding announcements did not include a workforce development component, the networks created their own versions of HIV/AIDS research mentoring programs supported with network resources [12, 13]. Thus, by providing mentored research experiences network-based programs complement other NIH supported training efforts such as T-32s and career development programs such as those supported through the R-25 mechanism. These networks are helping to develop the next generation of scientists prepared to launch comprehensive initiatives that will advance HIV prevention and treatment efforts in specific research arenas.

Program Descriptions

The HPTN scholar's program, established in 2010, has supported 21 scholars including five in its 2015 cohort. The goal of the HPTN scholars program is to increase the number of U.S. underrepresented diversity scholars who are successful HIV prevention researchers by providing them with experiences, knowledge and skills as well as fostering the connections they need to advance their independent research careers [14]. The program provides scholars with access to data from network studies and an 18 months mentoring relationship with an established network researcher. As part of these mentoring relationships, scholars analyze data from specific protocols and prepare manuscripts to submit to peer review journals and to professional/scientific conferences. They engage in professional development and mentoring in areas directly relevant to their stage of career development including biostatistics, research methods, and grantsmanship. Scholars and mentors are provided financial support. Outcomes include 11 published manuscripts, two R-21s, and two oral and five poster presentations.

The HVTN's mentoring program, called RAMP, was initiated in 2011 with the goal of attracting African American and Latino medical students to the field of HIV vaccine research. The program has both a short-term (2–4 month) and a long-term (9–12 month) track. RAMP scholars are embedded within the HVTN and work closely with their mentors to develop and conduct a research project aligned with the HVTN research agenda at a domestic or an international site. They are awarded up to $20,000 for the shorter program and up to $60,000 for the longer program. To date, five cohorts (N = 38) have gone through the program [15]. A recently published evaluation of the first two cohorts shows promising results [12]. Ninety-three percent (13/14) of scholars completed the program. They found a significant increase from baseline to program completion in scholar's knowledge about HIV vaccine career opportunities and in their belief that these opportunities were available to them. They also reported a significant increase (from 25 to 62 %) in scholars' intentions to pursue a career in HIV vaccine research. Furthermore, 100 % of scholars were satisfied or very satisfied with the program overall.

In addition to RAMP, the HVTN in collaboration with the Center for HIV/AIDS Vaccine Immunology (CHAVI), a consortium of HIV investigators, developed the Early Stage Investigator Mentored Research Scholar Program in HIV Vaccines for investigators interested in translating findings from nonhuman primates research (NHP) to HIV vaccine development. The program uses a mentoring team approach in which each scholar is assigned a mentor with NHP expertise and another with expertise in clinical vaccinology. In consultation with their mentors, scholars propose translational research projects of 1–2 years duration; budgets for projects were capped at $250,000 per year for 2 years or $450,000 per year for resource intensive studies. Between 2008 and 2012, 14 scholars participated in the program; 93 % of scholars and 71 % of mentors completed the program and the majority were very satisfied or satisfied with their participation. Seventy-one percent (10/14) planned to continue in HIV vaccine research. Scholars were primary authors on 29 manuscripts and coauthors on 74. Mentors were not reimbursed for their time [16].

The ATN Mentoring Program, the most recently initiated network-based mentoring program, recruited its first and only cohort in autumn of 2012 (n = 6). Supported entirely with network resources (no supplemental funds were provided), the goal of this 36 month program is to provide both structured training and youth focused interdisciplinary research experience aligned with the ATN's research agenda. Scholars are embedded within the network and matched with a biomedical and a behavioral science mentor affiliated with the ATN. They attend the biannual network meetings, participate in on-going protocols and are encouraged to publish at least one paper using extant ATN data. Although the program provides up to $5000 per year to each scholar for research related expenses, neither the scholars nor the mentors are compensated for their time. Five out of the six scholars and 100 % of mentors completed the program and the majority were very satisfied or satisfied with their participation. All of the scholars completed a first author manuscript with ATN data. Two scholars submitted K applications; one application was awarded and the other was scored but not funded. One scholar received a Robert Wood Johnson grant, another received a Special Project of National Significance Award and another received an R-21. All scholars were engaged in ATN protocols and 60 % have presented at the ATN biannual meetings. Currently there are no plans to continue the program given the ATN's reorganization.

The SBSRN was formed to foster multisite collaborations between the behavioral and social scientists working within the CFARs and to foster better integration among behavioral, social, basic and clinical scientists. Initially conceived as a partnership between the CFARs at the University of Pennsylvania and Emory in 2006, it has grown to include all of the currently funded CFARS [17]. The SBSRN developed a mentoring program for early career social and behavioral scientists wishing to integrate social and behavioral research with other scientific disciplines [18]. As of 2013, 79 scholars had participated in the program. Each year two junior investigators are selected from each participating CFAR. These scholars work with senior CFAR personnel to present at scientific programs, apply for CFAR developmental funds and participate in other scientific activities.

Advantages of HIV-Research Network-Based Mentoring Programs

As outlined in Table 1, network-based mentoring programs offer many advantages over mentoring programs situated in a department, center or single academic unit for a number of reasons. HIV research networks bring together leading scientists from multiple disciplines to work collaboratively on research protocols that integrate theories and methods from different disciplines to more comprehensively address HIV/AIDS issues. Over the years, these scientists have developed mutual respect for the contributions of each other's disciplines and have learned to effectively communicate with one another, bridging the differences in discipline specific styles, cultures and languages that often hinder interdisciplinary HIV/AIDS research efforts [4, 19]. Most importantly, these scientists are an accessible and available pool of mentors and potential future collaborators that will advance scholars' HIV/AIDS research careers.

Table 1 Comparison of network-based and free standing mentoring programs

	Network-based mentoring programs	Free standing mentoring programs
Mentor & program	Mentor pool consists of a cadre of interdisciplinary scientists from diverse institutions many of whom are leaders in their fields	Mentor pool usually consists of scientists who are affiliated with the university, center or department in which the program is housed
	Research training is limited to each network's specific research mission	Scholars have more latitude in selecting their research area as long as there is an available mentor in the mentor pool
	Majority of mentoring activities are conducted using electronic media (i.e. e-mail, skype) or telephone with periodic face-to-face interactions	Majority of mentoring activities are conducted face-to-face
Support & infrastructure	Ready access to a diverse pool of research participants through the affiliated clinical sites	Access to research participants is typically limited to the local community
	Facilitate conduct of multi-site studies for improved generalizability	Harder to conduct multi-site studies
	Access to centralized data-repositories from completed protocols to advance scholar's productivity	Available data for publications are often limited to mentor's research projects
	Established infrastructure and administrative resources to support scholars as they progress through the network's mentoring program	Infrastructure and administrative resources limited to those provided by one institution
Career advancement	Facilitates development of national and international collaborators for future research endeavors	Collaboration with scientists at other institutions is limited to mentor's scientific network
	Promotes scholars' national and international visibility and reputation through regular interactions with renown scientists	Development of scientific reputation is more gradual

Through their affiliated clinical sites, many of which are situated in heavily HIV impacted areas, networks provide ready access to a diverse pool of potential study participants and to experienced study coordinators and supporting staff that facilitate successful study implementation. Because community participation and acceptance is critical to the success of HIV research programs, another benefit of networks is their established ties with affected communities. Resources available to network scholars include but are not limited to access to national and local community advisory boards and community coalitions as well as a cadre of "ambassadors" that promote community involvement and information sharing. Through these established community ties and relationships, scholars can more rapidly increase their community acceptance and credibility. They can also advance their cultural awareness and understanding of complex issues facing individuals and communities disproportionately impacted by HIV/AIDS.

Most HIV research networks have centralized data-repositories from completed protocols that can be garnered to benefit both the scholar and the network. For instance, with the guidance of their mentors, scholars can conduct secondary analyses using these extant databases and improve their publication records while simultaneously contributing to the network's productivity and body of relevant HIV research. Scholars can also present their findings at network meetings and scientific conferences, increasing their exposure and visibility and promoting their work on the national or international stage. Furthermore, networks provide ample opportunities for scholars to participate and even lead research protocols, providing real world experience in the development and implementation of interdisciplinary HIV/AIDS research. Networks also enable scholars to develop collaborative relationships with both federal and university-based scientists that will help advance their independent research careers while conducting state-of-the art interdisciplinary, high impact HIV-related research.

Last, HIV research networks have established infrastructure and administrative resources to support scholars as they progress through the network's mentoring program. Networks have well-established procedures, policies and operational systems that are expertly and efficiently managed by the coordinating body. They also have on-going communication and monitoring systems that are used to advance the research agenda, discuss emerging topics and issues, monitor progress on active protocols, conduct analyses and write manuscripts.

Challenges of HIV Research Network-Based Mentoring Programs

Embedding a mentoring program within complex HIV research networks is not without challenges. Since they are federally funded, networks have a pre-determined mission

and HIV related research agenda that may or may not directly align with a scholar's area of interest. Thus, scholars frequently have to adjust or adapt their research areas to fit within the network's mission and research agenda.

HIV research networks are large, multi-layered organizations and the review and approval process proceeds through these different layers. Navigating and negotiating the network structures and processes can be challenging, cumbersome and time-consuming. For instance, in the ATN, protocol generation and approval is initiated at the level of the scientific leadership groups. Once approved, it advances to the full leadership body, then to the Executive Committee, and ultimately undergoes NIH program review. Furthermore, approval is not guaranteed and could be denied at any stage of the review process.

Network resources are also predefined and there is ongoing competition for these resources. Not every innovative or important protocol can be supported; protocols must be prioritized to ensure that they advance the network's research agenda and have the broadest potential impact. Competing interests between scholarly rigor, community norms and expectations and fiscal austerity, can create difficult choices in HIV research foci for both scholars and established researchers.

Unfortunately, unconscious bias and self-interest may also infiltrate the process and result in tensions. Providing scholars with this 'real-world' experience in their early career can be jolting. However, it is important to provide them with a well-rounded and realistic perspective on the clinical, research and ethical realities of HIV/AIDS scientific engagement. For example, certain populations, such as minority men who have sex with men (MSM), may not receive the scientific attention they deserve given their disproportionate representation among persons living with HIV/AIDS especially among recently reported cases. Research protocols may be "sanitized" or certain voices silenced in order to gain network approval or to make the protocol palatable to certain individuals. Scholars can thus experience these harsh realities while receiving support from experienced mentors and others in the network (e.g. the Black Caucus of the HPTN). This type of professional development not only increases their capacity to work through these obstacles but also prepares them for future experiences.

Despite the challenges, HIV research network-based mentoring programs offer rich experiences and diverse opportunities rarely available in single-site or other types of mentoring programs. Networks complement and enhance the training and experiences provided through departmental or other university-based mentoring programs and are an important component of a comprehensive strategy for developing the future HIV research workforce.

Nuts and Bolts of HIV Research Network-Based Mentoring Program

The Candidates

Increasing the diversity of the scientific workforce at all levels of the research pipeline requires deliberate, sustained efforts. The existing HIV research network-based mentoring programs are employing varied methods and defining different eligibility criteria to address this issue. For instance, the ATN and the HPTN target individuals with terminal and doctoral level degrees while the HVTN targets medical students. Both the HPTN and the HVTN exclusively recruit diverse scholars from underrepresented minority groups. While the ATN emphasizes diversity in its selection process, it is not a requirement. One of the ATN's program goals is to ensure an available, well-trained pool of youth-focused HIV researchers; ATN scholars must be committed to conducting research with youth. The HPTN's program goal is to ensure the availability of prevention researchers who have completed their terminal training degree. The HVTN aims to increase diversity among vaccine researchers by engaging them early while the scholars are still in medical school.

However, selecting the most appropriate candidates can be challenging. Not only must the candidate meet the minimum program requirements, but their HIV/AIDS research interest must also be aligned with the network's research agenda. Furthermore, appropriate network-related mentors (as determined by geography, research area, and other salient characteristics) must be available. Although not explicitly stated, selection committees often strive to select applicants with a high likelihood of completing the program because of future funding pressures that mandate that programs "succeed". Despite concerted attempts to standardize the process and apply rigorous criteria when judging each applicant, the selection process may be unduly influenced by these factors as well as unconscious biases (i.e., preference for certain professional disciplines, hesitance to take on controversial issues). As a result, some diversity applicants are judged as less competitive than their counterparts.

The Mentors

Like other mentoring programs, appropriately matching mentors and scholars is a critical task for HIV research network-based mentoring programs. Although this matching process is facilitated, in a large measure, by the available pool of diversely trained scientists affiliated with the networks, merely having a doctoral degree or being an experienced network researcher is not sufficient qualification to serve as a mentor. The matching process is the

initial step in establishing a bi-directional, reciprocal relationship that fosters the development of both scholars and mentors as suggested by McGee et al. in this special issue.

To achieve this goal, network-based mentoring programs tend to use an iterative matching process with active involvement of both mentors and scholars. The process usually begins with the program directors developing a suggested list of at least three possible mentor-scholar teams based on factors such as area of interest, geographic proximity, race and/or gender, personality traits, etc. and setting a defined period of time for the teams to engage via various formats (i.e. telephone, e-mail, Skype, Facetime or other electronic meeting formats, face-to-face, etc.). Mentors and scholars are then asked to rank each other in order of preference. Using these rankings, the program directors develop the suggested pairings, making every attempt to match each one with their first choice. Both parties have to concur with the assignments before the pairing becomes "official". If one party disagrees with the suggested matching, the program directors strive to provide alternate choices within the available pool of mentors and scholars.

Given the limited number of ethnic minority HIV researchers in general, and more specifically those actively engaged in networks, it is often difficult to pair a diversity scholar with at least one mentor who shares their ethnic or cultural background. For instance, in Brewer's study cited in this issue pg xx, 80 % of scholars were African-American while the majority of the mentors were White. This creates additional challenges for URM scholars as they strive to select and to be selected by appropriate mentors. URM scholars may find interacting with renowned scientists, more intimidating or difficult than White scholars. Some scholars may be hesitant to ask salient questions or speak less than expected for fear of coming across negatively. Their hesitance during these interactions may be misconstrued by the mentors; scholars may misinterpret their mentor's questions or reactions as negative reflections of themselves. These and other factors may influence the ranking process resulting in less than optimum matches.

As discussed by Brewer et al, all scholars, but particularly URM scholars, need guidance and support in selecting mentors and defining the expectations of the mentoring relationship. Developing a reciprocal, dynamic mentor-scholar relationship is critical to optimizing benefits for scholars and mentors. Yet training on relationship building for both scholars and mentors is not an essential component of most mentoring programs and it should be. Increasing attention is being given to mentor training with the expectation that they will provide guidance on relationship building to their assigned scholars. An excellent example is a 2 day mentoring workshop to enhance mentor effectiveness offered by the University of California at San Francisco [20].

Conclusion

The complexities of HIV/AIDS research and clinical applications demand that scientists address complex social, biomedical and ethical issues in the development and delivery of prevention and treatment services. As part of their career development, the next generation of HIV researchers and clinicians must not only be trained to conceptualize broadly and apply interdisciplinary techniques, but also be provided real-world research opportunities in applied settings. HIV research network-based mentoring programs are uniquely positioned to provide these types of career development experiences. While these training programs are not without challenges, the ultimate benefit they provide to generate impactful and significant scientific advances in HIV/AIDS far outweighs the challenges posed or the future costs associated with not investing in these programs.

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