Building the Next Generation of Implementation Science Careers to Advance Health Equity

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Rapid advancements in translational research have produced innovative clinical discoveries and evidence-based interventions that are ready for uptake in real-world settings, creating vast opportunities and challenges for implementation science. However, there is an inadequate research workforce to study effective strategies and delivery of implementation to advance the field. Novel career development initiatives will build scholars for the next generation of implementation science to bridge research to practice for diverse populations to advance health equity, specifically with a strategic focus on heart, lung, blood and sleep diseases and conditions. Along with traditional mentoring and curricula, research training includes state-of-the-art approaches using complex methods and multi-disciplinary collaborations between researchers, practice settings, and diverse communities. Implementation science scholars strive not only to decrease the lag time between the discovery of evidence-based interventions and successful implementation but also how to advance health equity and to reduce disparities for underserved populations that suffer disproportionally. *Ethn Dis*. 2019;29(Suppl 1):77-82; doi:10.18865/ed.29.S1.77.

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In 2003, Claude Lenfant, then director of the National Heart, Lung and Blood Institute (NHLBI) at the National Institutes of Health (NIH), asked the clinical research community whether the discovery from biomedical science was "lost in translation — and if it is, why it is, and what we can do about it?"[1] He cautioned against the lack of attention to the end of the "translational highway"[2] when basic science discoveries progress to interventions and treatments in the real world at the late-stage translation phase. As part of NIH's efforts to enhance translational research progress, the National Center for Advancing Translational Sciences (NCATS) was established in 2012 to catalyze innovation for diagnostics and therapeutics.[3] NIH has been instrumental in the growth of dissemination and implementation research, and responsive to the translation of scientific innovations such as genomic and precision medicine.[4,5] Despite these advancements in the implementation science field with state-of-the-art technologies, innovative methodologies and validated frameworks, health disparities remain. The increasing diversity of the US population necessitates health equity as a priority for implementation research and research training.

The scale-up of proven-effective interventions with sustainable implementation has the potential to close gaps in health outcomes and reduce health disparities in the United States.[6] Underrepresented groups, including those from racial, ethnic, rural, and low-income populations across the United States, have not benefitted to the same degree from implementation research advances.[6] Despite an exciting era of scientific health innovations for translation in the real-world, discoveries can move slowly, stall, or never make it successfully down the translational continuum, particularly for disadvantaged groups. Skilled implementation scientists who use complex methodologies and engage in multidisciplinary teams are needed to keep pace with the demands of scientific discovery and implementation for diverse populations.

Research funding at federal and organizational programs have increased training programs to enhance diversity in the biomedical workforce,[7] and to meet the needs of diverse commu-

nities. Within the implementation field, NIH has provided fundamental support for implementation science and research careers through grants, training institutes, and centers that include health disparities. As part of its strategic vision, NHLBI, one of the largest institutes within NIH, prioritized strengthening translation research and implementation science on heart, lung, blood and sleep disorders, advancing health equity, and building research training.[8] The newest component of NHLBI, the Center for Translation Research and Implementation Science, directs research career development awards in implementation science with a focus on health equity.[9] Grant initiatives to increase research capacity in global low-resource settings supported by NHLBI foster multidisciplinary training models to reduce disparities and promote health equity.

Implementation Science Training Needs and Opportunities to Advance Health Equity

Training to improve timely uptake, fidelity and sustainability for all groups include formal training, coursework, and mentorship in health disparities. Skills to develop community collaborations and stakeholder partnerships among underrepresented groups are necessary. Cultural adaptations of interventions during uptake, as well as the cultural relevance of de-implementation processes, are evolving areas of research. Precision medicine and genomics using implementation science strategies may reduce health disparities for populations who have traditionally lacked access to screening, treatment, and personalized medicine. Novel approaches to these research training needs and opportunities are discussed further below.

As the field of implementation science grows, scientists across varied disciplines, experiences, and career stages (ie, new, early, mid to senior investigators) are choosing to study and integrate implementation science training into their career. Diverse partnerships and stakeholders at the patient, clinical provider (ie, inpatient and outpatient), organization, systems, community, and population levels are critical components for the feasibility of implementation. Cultural adaptations using implementation research strategies can validate the process of adaptation and impact on implementation outcomes.[10] As evidence-based practices and guidelines are adopted and scaled up, these cultural adaptations can occur by design or unintentionally.

The extant literature suggests that cultural adaptations and implementations need rigorous reviews to uncover the components of adaption that have treatment effects. There is no standard for cultural adaptation of interventions, and research on intervention fidelity of cultural adaptations is weak. Cultural influences across multiple levels of the organization, community, and individual may affect implementation context, success and sustainability processes.[11] Methodologies and validated tools address factors including language, developmental and learning stages, disability, location, and gender during the implementation process similar to the Ecological Validity Model of cultural adaption for mental health treatments.[12] Training in complex methods that select and tailor implementation (eg, concept mapping, group model building, conjoint analysis, and intervention mapping)[13] can include culturally relevant concepts. Given the diversity of the population, career scientists need to understand cultural factors and adaption at the individual, organizational, community and system levels to determine if and how to use these factors to address health equity and improve implementation outcomes.

Known as the process of de-implementation, practices or interventions considered to be of low-value can be stopped, replaced, or reduced.[14] Yet, we know little about de-implementation, its cultural relevance, and relationship to health equity. The use of low-value practices in addressing health disparities warrants further investigation. Training and expertise in statistical analyses of large health care databases may uncover health disparities and low-value practices based on the characteristics of the provider or setting (eg, federally qualified health centers, community hospitals, and academic medical centers).

Another burgeoning area for research careers is building implementation strategies and framework models that promote the successful adoption of genomic medicine to reduce health disparities.[15] Historically, genomic databases lack diversity, but the NIH's All of Us Research Program aims to increase the contribution of underrepresented populations through precision medicine.[16] The implementation of precision medicine beyond academic centers into smaller community clinic settings presents a daunting challenge for future scientists. Large genomic

data integrated into learning health care systems can inform precision public health approaches where health programs are tailored or context-specific, using individual- and community-level information.[17] In 2013, NIH established the Implementing GeNomics In pracTicE (IGNITE) www.ignite-genomics.org) network to support clinical implementation of genomic medicine in the real-world.[18] As part of IGNITE, implementation of advanced risk assessment tools that incorporate genomic information, family health history, and other factors into electronic medical records facilitate clinical decision support tools across diverse health care settings.[19] CDC's Public Health Genomics Knowledge Base has extended its specialized database in collaboration with NHLBI to form the Heart, Lung, Blood, and Sleep Disorders Knowledge Base in Population Genomics (HLBS-PopOmics), providing valuable resources for new and early career researchers to integrate genomic methodologies and implementation science.[20] Implementation science approaches for precision medicine will be crticial for improving care in low-resource settings and among underrepresented poopulations where genomic medicine has traditionally been lacking.

NIH Research Career Support to Advance Equity through Implementation Science

Implementation science research that addresses health equity must include collaborations across stakeholders (ie, researchers, practitioners, patients, organizations, and communities) that address diversity and the needs of the population including women, ethnic minorities, residents in rural areas, children, the elderly, and persons with disabilities.[21] Federal agencies and organizations with implementation research programs have supported a range of training and training resources including conferences, short-term learning institutes, mentoring and research training awards incorporating health disparities and health equity strategies that emphasize stakeholder and community-based collaborations.[22,23] NIH has partnered with many funders and stakeholders to advance the implementation science field (eg Patient-Centered Outcomes Research Institute [PCORI], Agency for Healthcare Research and Quality [AHRQ], Department of Veterans Administration Quality Enhancement Research Initiative [QUERI], Substance Abuse and Mental Health Services Administration [SAMHSA], Robert Wood Johnson Foundation).[24,25] Current implementation science activities across NIH, federal agencies, and other organizations have steadily increased and include research and research training opportunities where health equity can be enhanced.

NIH has a strong history of research and research training support for implementation science with diverse stakeholders and community participation. NIH funding supports training institutes and implementation research centers that are hubs for methodological advances and resources on dissemination and implementation including health disparities issues.[26,27] The NIH-organized Training in Dissemination and Implementation Research in Health (TIDIRH) Institute is a longstanding, competitive, intensive annual training supported by various agencies and organizational partners to train new implementation scientists. The Center for Dissemination and Implementation at the Institute for Public Health at Washington University in St. Louis is an established leader in training implementation scientists to advance health equity in both domestic and international settings.[28] At the Center for Research in Implementation Science and Prevention at the University of Colorado at Denver, in addition to research training programs, researchers and stakeholders have free access to training resources, such as the Dissemination and Implementation in Health Training Guide and Workbook.[29] The Society for Implementation Research Collaboration (SIRC) created the Network of Expertise to engage new and established investigators, Evidence-based Practice Champions, and implementation practitioners through both in-person and virtual Implementation Development Workshops.[30] These networks and training centers are just a few exemplars of collaborations and career training efforts that use health equity in the training models for researchers, practitioners, and other stakeholders.

NHLBI Strategic Efforts to Increase Implementation Science Careers to Advance Health Equity

When NHLBI updated its strategic vision and objectives and created the Center for Translation Re-

search and Implementation Science (CTRIS), implementation science research and research training was a top priority for the institute.[9] Strategic goals for NHLBI aim to enable and develop a diverse biomedical workforce and to facilitate innovation and accelerate research translation across the entire research spectrum. Notably, three of the eight overarching NHLBI specific research objectives are relevant to implementation science training and advancing health equity: to investigate factors that account for differences in health among populations (Objective 3); to optimize clinical and implementation research to improve health and reduce disease (Objective 6); and to further develop, diversify, and sustain a scientific workforce capable of accomplishing the NHLBI's mission (Objective 8).[30] Fostering implementation science careers that include research training on how to best advance health equity is a major step toward addressing NHLBI's overall strategic goals and objectives.

In 2017, NHLBI hosted a workshop entitled, Training the Next Generation of Implementation Researchers for Health Equity, through partnerships with several NIH Institutes, Centers, and Offices (National Institute of Mental Health, National Institute on Drug Abuse, Eunice Kennedy Shriver National Institute of Child Health and Human Development, National Institute on Minority Health and Health Disparities, National Institute on Aging, National Institute of Diabetes and Digestive and Kidney Diseases, and the NIH Office of Disease Prevention), and the Department of Health and Human Services Office of Minority Health. Scientific experts and thought leaders in the fields of implementation science, prevention science, health inequities research, training, and research workforce development convened to stimulate approaches and strategies to increase participation in implementation research that addresses health equity.[31] In response to the recommendations from this workshop, NHLBI hosted its first Saunders-Watkins Leadership Workshop on Health Inequities and Implementation Research in May 2018 to stimulate the next generation of the health inequity researchers. [32] This short-term training opportunity provided mentorship and guidance for early-stage research investigator career success in heart, lung, blood, and sleep-related research.

NHLBI has also funded an unprecedented 10 research career grants (Ks) to develop implementation science researchers through the NHLBI Research Career Development Programs in T4 Implementation Research (K12).[33] (Table 1) These grants are the catalyst for the new NHLBI Building the Next Generation of Implementation Science (iNexIS) initiative. Through activities and grant support, iNexIS seeks to build a generation of implementation scientists to study and deliver evidence-based interventions and guidelines in real-world communities and public health

Table 1. NHLBI Research Career Development Programs in T4 Implementation Research (K12) Grant Awardees (2017) (RFA-HL-17-016)

Principal Investigator(s)	Institution	Program Title
Theodore J. Iwashyna; Anne Sales	University of Michigan	Training to Advance Care Through Implementation Science in Cardiac and Lung Illnesses (TACTICAL)
David Au; Randall Curtis; Bryan Weiner	University of Washington	University of Washington Implementation Science Training Program (UW-ISTP)
Mario Castro	Washington University in St. Louis	Washington University K12 Program in T4 IR (WU K12 T4)
Sunil Kripalani; Christianne Roumie	Vanderbilt University	Vanderbilt Scholars in T4 Translational Research (V-sTTaR Program)
Kirsten Bibbins-Domingo	University of California, San Francisco	UCSF Career Development Program in IR in HLBS
Russell Glasgow; Edward Paul Havranek; Adithya Cattamanchi	University of Colorado	Implementation to Achieve Clinical Transformation (IMPACT)
Hayden Bosworth	Duke University	Dissemination and Implementation Science in Cardiovascular Outcomes (DISCO)
Steven Bernstein	Yale University	Yale Scholars in Implementation Science (YSIS)
Stephenie Lemon; Thomas Houston	University of Massachusetts Medical School	K12 Cardiopulmonary Implementation Science Program
Ranjit Singh; John Canty	State University of NY at Buffalo	UB Clinical Scholar Program in Implementation Science to Achieve Triple Aims

settings for HLBS and contribute to the reduction of wide disparities among underserved populations.

Implementation frameworks can be leveraged in global settings to address non-communicable diseases and co-occurring illnesses such as HIV. NIH has supported global efforts for implementation science led by its collaborative, cross-cutting Fogarty International Center (FIC) with research programs and training efforts in low-income countries to take science discoveries to practice and inform global health equity efforts.[34] NHLBI specifically prioritized implementation research initiatives for international low- and middle-income and low-resource settings within its mission areas for heart, lung, blood, and sleep disorders, and among people living with HIV. Research initiatives at NHLBI have been collaborative in nature with FIC and other agencies, including the World Health Organization (WHO). These initiatives have focused on building capacity with research teams to address heart, lung, and blood disorders in low-income countries and low-resource settings,[35] as well as the scaling up of regional and national hypertension interventions.[36] Domestically funded grants on HIV and co-occurring heart and lung disease (eg, PRECluDE[37]) will inform global implementation efforts as well.

A Call for the Next Generation of Implementation Science Careers to Advance Health Equity

Implementation scientists play a critical role in scientific discoveries that move along the translational path toward implementation for all groups. Advances in methodology and identification of cultural factors using implementation frameworks will help to reduce health disparities by preparing the next generation of implementation scientists to address heart, lung, blood, and sleep disorders, and other chronic and co-occurring diseases. The era of genomic discovery presents challenges, but also potential for implementation scientists to improve genomic medicine, risk assessment, the uptake of precision medicine and clinical practice and community-based interventions among diverse settings and populations. NIH provides fundamental support for translation research and implementation science and builds research careers to advance the field for innovative implementation science. NHLBI's strategic support of research training for implementation research on heart, lung, blood, and sleep disorders to advance health equity establishes new cohorts of scholars prepared to implement novel approaches to improve health equity. This next generation of implementation scientists will be critical in ensuring the rapid translation of discovery to prevention and treatment implementation in real-world settings for all population groups.

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Conflict of Interest

No conflicts of interest to report.

Author Contributions

Research concept and design: Boyce, Barfield, Curry, Shero, Green Parker, Cox, Price; Acquisition of data: Bustillo; Data analysis and interpretation: Boyce; Manuscript draft: Boyce, Barfield, Curry, Shero, Green Parker, Cox, Price, Bustillo; Administrative: Boyce, Barfield, Curry, Shero, Green Parker, Cox, Price, Bustillo; Supervision: Boyce

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