

Tackling NCD in LMIC



Achievements and Lessons Learned From the NHLBI–UnitedHealth Global Health Centers of Excellence Program

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ABSTRACT

Effectively tackling the growing noncommunicable disease (NCD) burden in low- and middle-income countries (LMIC) is a major challenge. To address research needs in this setting for NCDs, in 2009, National Heart, Lung, and Blood Institute (NHLBI) and UnitedHealth Group (UHG) engaged in a public-private partnership that supported a network of 11 LMIC-based research centers and created the NHLBI–UnitedHealth Global Health Centers of Excellence (COE) Program. The Program's overall goal was to contribute to reducing the cardiovascular and lung disease burdens by catalyzing in-country research institutions to develop a global network of biomedical research centers. Key elements of the Program included team science and collaborative approaches, developing research and training platforms for future investigators, and creating a data commons. This Program embraced a strategic approach for tackling NCDs in LMICs and will provide capacity for locally driven research efforts that can identify and address priority health issues in specific countries' settings.

Between 1990 and 2010 the global noncommunicable disease (NCD) burden increased from 43% to 54% of the total disease burden [1]. In 2012, globally, almost three-quarters (74%) of all the NCD burden occurred in low- and middle-income countries [2]. Population growth and population aging have contributed substantially to the expanding NCD burden trends, both of which are rapidly occurring within low- and middle-income country populations [3,4]. Effectively tackling this growing NCD burden in low- and middle-income country settings presents a major challenge, yet it is an achievable task [2,3,5].

Today, many effective NCD interventions are available. The World Economic Forum and World Health Organization recently developed a report targeted at decision makers, civil society, and the private sector, which provides assessments of the economic impact of NCDs and costs of scaling up a core of proven effective interventions within low- and middle-income countries [6]. However, responding to these challenges in low- and middle-income countries needs local research capacity building [7], so that interventions are driven by in-country knowledge-bases provided through research performed in low- and middle-income countries. Yet, research infrastructure and outputs in low- and middle-income countries are woefully inadequate, and the data from these settings are scarce [3,8]. This situation poses problems for implementation of known interventions and also for tackling low- and middle-income country disease patterns, phenotypes that might differ from high-income countries.

To address research needs for NCDs in low- and middle-income countries, in 2009, the National Heart, Lung, and Blood Institute (NHLBI) and UnitedHealth Group (UHG) engaged in a Chronic Disease Initiative (2009 to 2014), previously described [9,10], which supported a network of 11 low- and middle-income country-based research centers (6 of which were supported by both institutions) based in 10 countries (Figure 1). This public-private partnership created the NHLBI–UnitedHealth Global Health Centers of Excellence (COE) Program (referred to hereafter as the Program). The Program's overall goal was to contribute to the reduction of cardiovascular and lung disease burdens by catalyzing in-country research institutions to develop a global network of biomedical research centers that conduct collaborative research, train researchers, and advise on policy. This article describes an overview of achievements and lessons learned from the 11 COEs supported by the Program, based in Argentina, Bangladesh, China, Guatemala, India (2 centers), Kenya, Mexico, Peru, South Africa, and Tunisia. A formal evaluation of the Program is underway and is planned for completion in 2016.

FORMING THE PROGRAM: CAPTURING THE ELEMENTS OF TEAM SCIENCE

The Program was established with advice from global experts in the areas of cardiovascular and pulmonary diseases, epidemiology, biostatistics, health services and outcomes research, clinical trials, and international health

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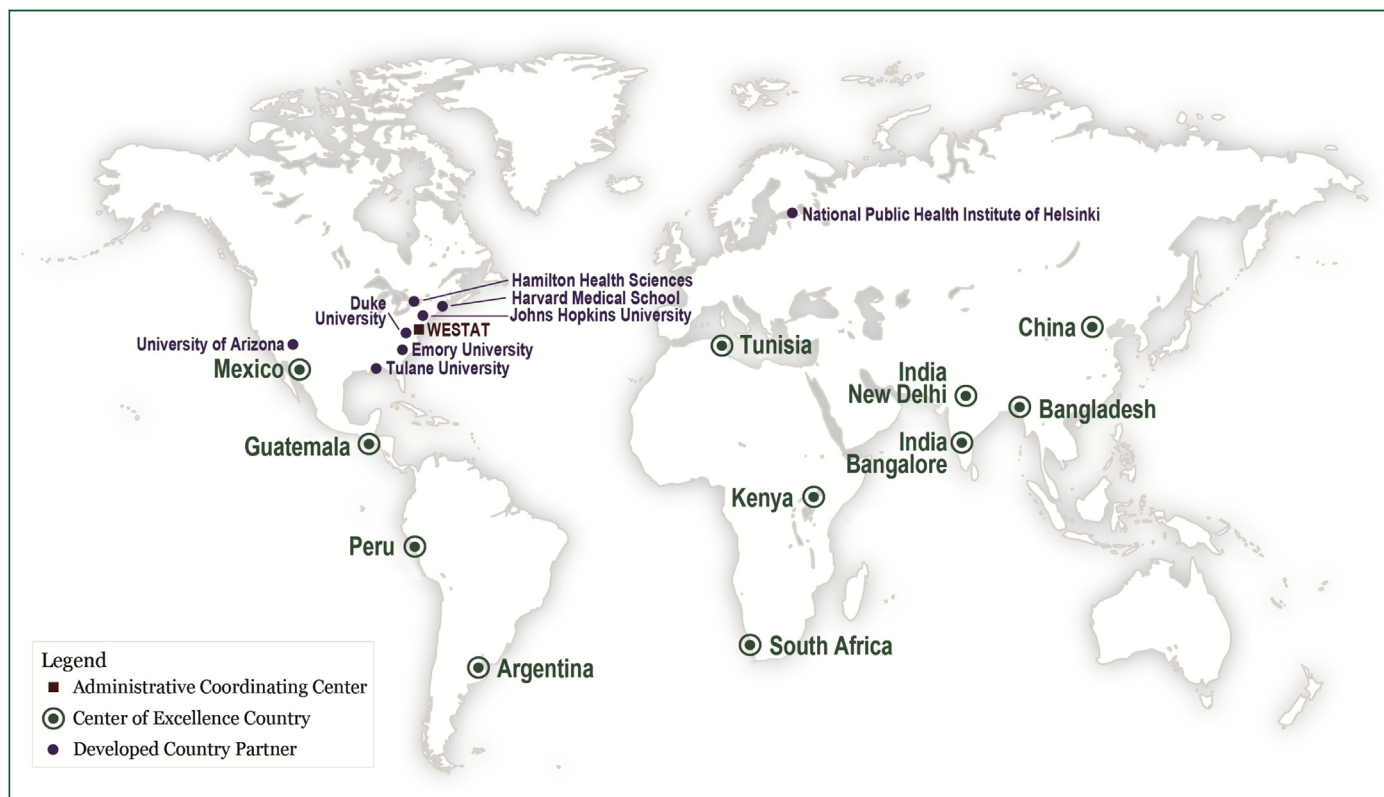


FIGURE 1. National Heart, Lung, and Blood Institute–UnitedHealth Global Health Centers of Excellence Program country location of centers, and name and location of the primary developed country partners and the administrative coordinating center.

promotion and disease prevention. COEs funded by NHLBI were located within institutions that were National Institutes of Health Fogarty International Clinical Research Fellows and Scholars sites. In addition to the COEs, a United States–based administrative coordinating center (Westat) provided administrative, logistical, and data management support, and coordination of key activities (e.g., site establishment, institutional review board coordination and tracking, and protocol registration). Finally, each COE partnered with at least 1 developed (high-income) country academic institution based in the United States, Canada, Europe, or Australia and with local partner organizations, such as health care institutions, universities and research institutions, nongovernmental agencies, and government bodies. Developed country partners provided technical and research support to facilitate growth of each center's research capacity and capability.

This initiative built on best practices of collaborative scientific work, yet was far more innovative in terms of capacity building and empowerment, both scientifically and administratively. The Program was designed so that the low- and middle-income country applicants were the prime recipient of the award. Many of the COEs had to quickly mature scientifically and bring their administrative and grant management procedures to international standards. In so doing, the COE platform lifted not only the

scientific potential of partners, but their ability to improve financial, managerial, legal, and accounting procedures. These major in-country gains proactively countered the pervasive model of “parachuting” research, all too common within international collaborations.

DEVELOPING RESEARCH PLATFORMS: COLLABORATION-BASED APPROACH

Each COE developed its research platform, collaboration network, and priority research areas for heart and lung diseases. The characteristics of each COE and its developed country partner and local partner institutions varied, resulting in each platform having unique features. The research focused on disease epidemiology, prevention, and control along with training future investigators (e.g., graduate, postdoctoral).

Program governance was led by a Steering Committee that included NHLBI, UHG, and Westat leadership and both COE and developed country partner principal investigators. It provided scientific oversight and advice on network activities; facilitated collaboration across COEs to ensure that mechanisms and strategies led to achieving program goals; advice on partnerships and global health opportunities; and a venue for sharing research accomplishments and generating common policies, guidelines,

TABLE 1. National Heart, Lung, and Blood Institute—UnitedHealth Global Health Centers of Excellence Program descriptions for 38 primary studies

Lead COE	Short Title	Study Design	Study Population (Setting)	Intervention	Outcomes Measured
Argentina*	Cardio Risk Factors Detection	Randomized multistage stratified cluster sample	MF 35–74 yrs (community)	N/A	Events, prevalence, RF control
Argentina*	Lower Respiratory Tract Illness in Children Related to IAP	Retrospective cohort	Household with child ≤5 yrs or stillborn (households with high biomass exposure)	N/A	IAP exposure, history of pregnancy, births, respiratory infections
Bangladesh	COPD and HT on Households	Cross-sectional descriptive	MF ≥18 yrs with COPD, HT (households)	N/A	Prevalence, cost of care, health-seeking behaviors
Bangladesh	Determinants of COPD	Prospective longitudinal cohort	MF ≥40 yrs (community)	N/A	Function, prevalence, coping strategies
Bangladesh	Prevalence of Arterial HT	Prospective cohort	MF ≥20 yrs (rural/urban surveillance sites)	Health messages, medical referrals	BP, prevalence, RFs,
Bangladesh	Chronic Disease in Matlab	Quantitative survey— health/ demographic surveillance system	Poor households (rural)	N/A	Socioeconomic consequences of CD; mortality distribution
Bangladesh*	Cook stoves and IAP with Women and Children	Prospective cohort	F ≥18 yrs and children ≤5 yrs (rural households)	Gas cookstoves	CVD RFs, respiratory morbidity, lung function
China	CV Risk Mgmt Arm, Salt Reduction Arm	Factorial cluster—RCT	M ≥50 yrs F ≥60 yrs (villages in 5 provinces)	Low-cost CVD prevention/ control package with incentive	Events, prevalence, adherence, cost of care
China	CRHI: Salt Reduction Arm	Factorial cluster—RCT	Villages (townships in 5 provinces)	Community salt reduction; health promotion program	Sodium-potassium ratio, BP, proportion HT
China†	Effects of SimCard-China/India	Cluster—randomized controlled intervention trial	MF ≥40 yrs with HD, stroke, DM, or SBP ≥160 mm Hg (poor villages)	Simplified CVD management program for high-risk individuals	Changes in high-risk patients treated with diuretics
Guatemala	Dietary Factors Assoc with CVD	Cross-sectional	Children 7–12 yrs and parents (schools-poor periurban areas)	N/A	Prevalence
Guatemala	CV Risk Factors in Children,	Qualitative study	School children 7–12 yrs; parents, teachers; health providers; community leaders (poor periurban areas)	N/A	Knowledge and attitudes on CVD determinants
Guatemala	CV Risk Factors in Children	Characterization of CVD RFs	School children 7–12 yrs (poor periurban areas)	N/A	Prevalence of CVD RFs
Guatemala	CV Risk Factors in Children	Pre/post single sample design pilot	Children 7–12 yrs and parents (schools in poor periurban areas)	Multilevel-CV intervention model	Feasibility, short-term effectiveness of model

(continued)

TABLE 1—continued. National Heart, Lung, and Blood Institute—UnitedHealth Global Health Centers of Excellence Program descriptions for 38 primary studies

Lead COE	Short Title	Study Design	Study Population (Setting)	Intervention	Outcomes Measured
Guatemala*	CV Risks in Persons with DM2/HT	Quasiexperimental design, model development	Patients with DM and HBP (PCC in Mexico/Costa Rica)	Validated CVD intervention model	Feasibility, acceptability, short-term efficacy
Guatemala†	mHealth Technology	Validation of intervention pilot	MF 30–60 yrs non-HT/DM (PCC in poor urban areas in 3 countries)	SMS messages	mHealth technology for SMS; one-to-one calls
Guatemala†	mHealth Technology	RCT proof-of-concept intervention	Pre-HT MF (PCC in poor urban areas in 3 countries)	Intensive lifestyle modification program	Feasibility, acceptability, implementation
India, Bangalore	PREPARE	Multicenter, household cluster—randomized trial	Households (rural regions)	Clinic visits, counseling by CHW	BMI, waist/hip circumference, BP, INTERHEART risk score, BP medication
India, Bangalore	SPREAD	Multicenter randomized open trial	Patients with ACS (hospitals)	CHW education/visits physician referrals	Adherence to pharmacotherapy, incidence of CV events, RF assessment
India, Bangalore	INSPIRE	Multicenter randomized open trial	Stroke patients (secondary and tertiary hospitals)	N/A	Clinical outcomes, clinical practice patterns for care, secondary prevention
India, New Delhi*	CARRS Surveillance Study	Multistage cluster random sampling survey	MF 20–59 yrs (urban households)	N/A	CVD prevalence, RF, incidence of morbidity and mortality
India, New Delhi*	CARRS Translational Trial	Multisite, individually randomized controlled translation trial	DM2 patients (out-patient clinics)	Multifactorial CVD risk reduction intervention	Assess intervention feasibility, patient evaluation
Kenya	IAP in Western Kenya	Cross-sectional	Females ≥ 35 yrs (hospital)	N/A	Isolated right heart failure prevalence
Kenya	Cardiac Heart Failure	Case-control	Case: MF ≥ 40 yrs with HF Control: without (hospital)	N/A	Prevalence
Kenya	HT, DM & Organ Damage	Population-based cross-sectional	MF ≥ 18 yrs (households)	N/A	Prevalence
Kenya†	IAP in Kenya/Bangladesh	Pre/post intervention RCT	Women and children ≤ 10 yrs (rural households)	Low-emission cookstoves; education program	Pulmonary function, respiratory symptoms, stove acceptance
Kenya	Hand held echocardiogram Study	Convenience sample	Echocardiography patients (rural hospital)	HHE; physical examination	HHE diagnosis of cardiac diseases
Kenya	Impact of Clean Cook stoves	Community-based randomized intervention trial	Children ≤ 5 yrs (rural households)	Low-emission cookstoves	Household air pollution, pneumonia (severity)
Mexico	Meta-Salud Chronic Disease Prevention	Pre/post-test evaluation	Adults MF average age 42 yrs (SD 10.6) (low-resource urban area)	Community-based training on NCD prevention by CHW	Clinical/behavioral-lifestyle outcomes: BMI, waist/hip circumference, weight, triglycerides, LDL cholesterol
Mexico	Meta-Salud: Chronic Disease Prevention	Process evaluation design	Stakeholders involved in the research study (participants, CHW, clinic staff)	Community-based training on NCD prevention by CHW	Intervention improvement and refinement

Peru	Geo Variation/ Progression of NCDs	Longitudinal cohort	MF ≥35 yrs (4 geographic settings in Peru)	N/A	BP, blood glucose, lung function; RF mortality, incidence; prevalence
Peru [†]	Cook stoves-Peru/ Kenya/Nepal	Multicountry, community feasibility intervention trial	Females 20–49 yrs (rural households)	Improved cookstoves with chimney	Respiratory symptoms, expiratory flow/ volume, exhaled CO, 24-h particulate matter, pulmonary function
Peru*	Lung Ultrasound and Improved Cook stoves	Diagnostic accuracy study	Children <3 yrs with WHO ALRI criteria (poor settings in Peru and Nepal)	Lung ultrasound	O ₂ saturation, pneumonia misclassification rates
South Africa	CRIBSA	Cross-sectional survey in a random population sample	Black Africans (periurban townships)	N/A	N/A
South Africa	Tools to Manage Chronic NCDs	Pragmatic cluster RCT	PCPs (PCC in underserved communities)	Novel guideline-based training program	Treatment intensification, CV and pulmonary disease care, processes/ outcomes, cost effectiveness
South Africa [†]	Eval of CHW in SA/ Bangl/Guat/ Mexico	Quasiexperimental design pilot	MF ≥25 yrs (PCC in 4 countries)	Screening by CHW, clinic referrals	CHW/professionals CVD risk scores; referral effectiveness
Tunisia	Effectiveness NCD risk factors control	Quasiexperimental design pre/post with control group	MF 18–65 yrs (community); MF 18–65 yrs (workplaces); MF 12–17 yrs (schools)	Healthy life style; peer education; media	RF (smoking, unhealthy diet, physical inactivity) control
Tunisia	Kindergarten healthy lifestyles intervention	Quasiexperimental design pre/post with control group	MF 4-5 yrs (kindergarten school children)	Healthy life style intervention; health education	RF (unhealthy diet, physical inactivity) control

ACS, acute coronary syndrome; ALRI, acute lower respiratory illness; BMI, body mass index; BP, blood pressure; CD, chronic diseases; CHW, community health workers; COE, Centers of Excellence; COPD, chronic obstructive pulmonary disease; CRHI, China Rural Health Initiative; CV, cardiovascular; CVD, cardiovascular disease; DM, diabetes; DM2, type 2 diabetes; HBP, high blood pressure; HD, heart disease; HF, heart failure; HHE, hand held echocardiography; HT, hypertension; IAP, indoor air pollution; LDL, low-density lipoprotein cholesterol; MF, males and females; N/A, not applicable; NCD, noncommunicable disease; PCC, primary care clinic; PCP, primary care provider; RCT, randomized controlled trial; RF, risk factor; SBP, systolic blood pressure; SD, standard deviation; WHO, World Health Organization.

*Led by a COE with multiple sites within their collaboration network (7 studies).

[†]A collaboration across multiple COEs (6 studies) addressing a common health priority issue.

and procedures for the network. National Institutes of Health best practices and guidelines for research, training, ethics, and data policies and procedures were adopted Program-wide. Working subcommittees of the Steering Committee were composed of investigators and staff from the COEs, developed country partners, NHLBI, UGH, and Westat. Subcommittees were created for training, epidemiology, pulmonary diseases, and community health workers.

A total of 38 original research activities were conducted between 2009 and 2014 (Table 1). Three study approaches were used: single-COE-led studies that were driven by unique local needs and opportunities conducted in 1 (25 studies) or multiple sites (7 studies) within a center and multi-COEs studies harmonized across centers addressing a common health priority issue (6 studies). The type of study designs included epidemiological (43%), behavioral (21%), interventional (17%), and other types (19% encompassing health economics, model development, and feasibility studies) (Table 1). The number of primary research studies conducted by each COE ranged from 2 (Argentina, India—New Delhi, Mexico, and Tunisia) to 7 (Guatemala). These original studies yielded a substantial number of publications (peer-reviewed scientific journals, reports, press releases, and news articles), presentations, media coverage, and involvement of COE trainees in research efforts (Table 2).

The program provided network-wide interactions (4 structured exchanges each year, 2 being face to face) and flexibility that promoted creativity, cooperation, and enhanced training. Additional supplemental funding provided resources to support strategic collaborative studies and by year 2 of the Program, the dynamics of the group transformed from being a group of funded institutions conducting their own research into a network of colleagues working together in synchrony where the whole was much greater than the sum of its parts.

RESEARCH TRAINING: HIGH PRIORITY PIPELINE FOR FUTURE INVESTIGATORS

A key component of the Program was training future researchers. The objectives of the training efforts were to: 1) develop staff capable of conducting independent and/or collaborative research; 2) train future cardiovascular and pulmonary investigators at the doctoral and postdoctoral levels; and 3) stimulate clinical, epidemiological, health services, health policy, and behavioral research. Each institution developed training plans that responded to skill gaps within their country settings. Some training opportunities were the result of single COE efforts, whereas others involved collaboration with developed country partners, other COEs, and local partners. Although training activities within individual COEs were tailored to meet local needs, there were several common elements used throughout the Program. The breadth and depth of the training component were evident across the entire Program and reflected the high level of commitment to this objective as described in this issue of the *Journal* [11].

HIGH LEVEL COLLABORATION: DEVELOPMENT OF A PROGRAM-WIDE HARMONIZED DATA COMMONS

During the active research phase of the Program, several collaborations received supplemental funding to address common priority topics across COEs including, but not limited to, community health workers [12,13], clean cookstoves [14], and NCD risk stratification and management [15,16]. Others took advantage of the well-characterized cohorts to ask fundamental basic science questions, such as a comparative analysis of the pulmonary microbiome within populations exposed and unexposed to biomass fuel.

A network-wide collaboration allowed the Program to develop a data commons of harmonized variables across several COE studies. This approach provided opportunities to maximize use of established datasets and increase the impact of the work supported by the Program. This aligned well with NHLBI's call for more innovative uses of data across all research investments [17–19].

Forty data collection instruments from 14 primary research studies were reviewed to identify common variables anticipated as valuable for multiple site analyses. Not all variables were available within each research activity, and specific criteria and methodology were created for multisite analyses. A master codebook was developed and data files were shared for planned analyses.

Data harmonization required expert knowledge of the research, database structure, data management, programming, researcher commitment, and consensus on standardized variables. Many of these challenges are common to meta-analysis and other data pooling efforts [20,21]. Some of the key lessons during this process included anticipating and planning common studies across sites upfront, using common protocols and data collection

TABLE 2. National Heart, Lung, and Blood Institute—UnitedHealth Global Health Centers of Excellence Program metrics, 2009–2014

Center of Excellence	Primary Research			Media Coverage	
	Studies	Publications	Presentations	Events	Trainees
Argentina	2	12	25	60	16
Bangladesh	5	32	65	20	24
China	3	38	77	38	104
Guatemala	7	16	29	2	148
India, Bangalore	3	6	3	1	65
India, New Delhi	2	78	2	0	112
Kenya	7	3	45	0	36
Mexico	2	8	24	6	10
Peru	3	50	19	8	42
South Africa	2	42	36	13	16
Tunisia	2	12	52	3	140
Total	38	297	377	151	713

instruments with standardized variables across sites when possible (e.g., Clinical Data Interchange Standards Consortium [20]), using data management best practices at all sites to minimize errors in data submitted for harmonization, and allowing time and resources during the lifetime of the Program for talent exchange and targeted resource support to foster high-quality outputs and collaboration between groups.

Despite all of these challenges, a harmonized data commons provided many opportunities. Additional research questions (those not answerable solely from the individual site data) now can be tackled in more depth and breadth. Some advantages to this approach include the ability to make unique global comparisons across countries and continents and assess common issues in highly varied contexts in much more depth than other global studies [1], better precision for estimates with larger samples that allow more detailed analyses, and promoting greater collaboration and efficiencies in future research efforts. To date, this global harmonized data commons has led to at least 5 studies, including some featured in this issue of the *Journal*, which offer insight into cardiovascular disease [22–24], diabetes [25], and obesity [26].

In addition to this harmonized data commons, all Program data have been submitted to the National Institutes of Health for compilation, consistent with the agency's policy [27,28]. Data sets were deidentified and redaction plans were developed for creation of public use datasets. In September 2016, datasets are planned to be made available in the public domain via NHLBI's data repository, BioLINCC.

DISCUSSION

This Program embraced a strategic approach for tackling NCDs in low- and middle-income countries. With the growing burden of NCDs in this setting and a knowledge base of effective interventions available, the need to gain locally driven research efforts that can identify and address priority health issues in specific country settings is essential.

The Program built research and administrative capacity while training the next generation of U.S. and low- and middle-income country–based researchers. For example, the Program pioneered capacity development for conducting NCD surveillance, which at the country level remains a major weakness. In addition, Program efforts created an instrument for assessing country-level capability to respond to NCDs [29,30]. COEs have also catapulted development of innovative interventions and their implementation, much needed in both low- and middle-income countries [15]. Supplementary grants promoted cross-collaboration between COEs and resulted in fast-track development and testing of state-of-the-art interventions combining technology with implementation in real-world settings. An example is technology-driven cardiovascular disease risk ascertainment by community health workers in India and China [16].

The U.S. Council on Foreign Relations' call to engage in global health is driven by the fact that the burden of death and disability is heavily NCD-related within many low- and middle-income countries, and because NCDs are undermining the effectiveness of existing U.S. global health investments [27]. This has led to their call for the U.S. government to build on existing U.S. global health platforms that can achieve sustainable reductions in premature death and disability that disproportionately affect the poor.

A unique component of this Program is that it was led by institution and investigators in low- and middle-income countries. The investigators developed and executed the research programs engaging local and global partners, ultimately creating a south-to-south driven research collaborative network unique within the world. This organizational structure fostered in-country capacity development and training components. Both capacity and training are essential in ensuring that a sound research platform and a skilled research workforce are produced. Through providing context-specific evidence, this Program will guide future research and disease prevention and control efforts. The funding structure of the program allowed for very frequent direct interactions between funding institutions (NHLBI, UHG) and the COEs. This also resulted in a benefit to the funders, because they were able to appreciate and fully understand the challenges faced by researchers in low- and middle-income countries, and therefore strengthen instructional capacity for future funding of research conducted in these settings.

Another key element this Program embraced was collaborations (multiple partners and bidirectional, diverse collaborations) across all levels. This is very consistent with recent calls for more team science, which has been shown to be impactful, foster innovation and productivity, and obtain more broad reach and uptake [31–33]. Even at the Program's genesis, the innovative public-private partnership between NHLBI and UHG led the way. The collaborative network that subsequently developed had 3 key dimensions. First, the low- and middle-income country researchers joined with developed country partners. Second, peer-to-peer collaboration and learning across the Program network between in-country researchers (those who experienced very similar challenges) was invaluable for sharing lessons learned while working across highly diverse environments. Finally, development of a data commons and harmonizing data for multisite analyses represents one of the highest levels of collaboration, where skills, resources, and data are shared, resulting in highly unique analyses and outputs. In addition, other partners joined the network. The U.S. Centers for Disease Control and Prevention, the American Thoracic Society, and Medtronic Foundation capitalized on the network structure and contributed financially and technically to the Program. Although many challenges arose and lessons were learned during both the Program's creation and during analytic efforts, the returns were substantial, reflected in several dimensions including publications,

presentation, media coverage, and trainee experiences (Table 2).

A legacy of collaboration now continues. First, the 11 COEs have created the Global Research Against Non-communicable Disease (GRAND South) Network [15] to continue sharing experiences and conducting relevant NCD research, capacity building, and policy engagement. The GRAND South Network goal is to combat NCDs at local and global levels by conducting innovative research to identify, understand, and overcome barriers to the adoption, adaptation, integration, scale-up, and sustainability of evidence-based interventions and policies. Second, Emory University has led development of the Network of U.S. Investigators in Global Noncommunicable Diseases, which targets U.S. academic institution investigators [34] and launched *The Atlanta Declaration: A 21st Century Vision for U.S.-based Global NCD Research* with the goal of creatively supporting the next generation of scientists in the global NCD arena through larger and sustained investments in global NCD research and encouraging nontraditional career paths that achieve innovation [35]. Finally, much of the initial work for the creation of a cardiac care unit and division in Kenya was facilitated by the energy and attention that the Kenya NHLBI COE program fostered [36].

Beyond this global Program, NHLBI is engaged in many other areas [37] including the Global Alliance for Chronic Disease [38], the Global Alliance for Clean Cookstoves [39], and the Medical Education Partnership Initiative [40], and is crafting a strategic way forward by incorporating NHLBI's Global Health Strategic Plan [41], recommendations from an NHLBI Global Health Think Tank [42], and the ongoing NHLBI Strategic Visioning Initiative [43], the latter focusing on identifying compelling research questions and critical research challenges for the next decade.

SUMMARY

As the Institute of Medicine recently affirmed, reducing the burden of cardiovascular and other chronic diseases worldwide, especially in low- and middle-income countries, is an achievable goal [5]. Tackling this challenge and achieving the Global Sustainable Development Goals for 2016 to 2030 [44] requires innovative strategies that invest in country-based research capacity development, create global networks of researchers, and expand collaboration between the United States and low- and middle-income countries. Such efforts can lead to scaling-up of the National Economic Forum's and World Health Organization's "best buys": effective, affordable interventions for specific real-world settings guided by country-driven health priorities [5,45,46]. The GRAND South Network and its successes clearly illustrates that it can be done.

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