

Nurturing the Global Workforce in Clinical Research: The National Institutes of Health Fogarty International Clinical Scholars and Fellows Program

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Abstract. The Fogarty International Clinical Research Scholars and Fellows Program's goal is to foster the next generation of clinical investigators and to help build international health research partnerships between American and international investigators and institutions. Through June 2012, 61 sites in 27 countries have hosted 436 Scholars (American students or junior trainees from the host countries) and/or 122 Fellows (American and host country postdoctoral fellows) for year-long experiences in global health research. Initially, the program was oriented toward infectious diseases, but recently emphasis on chronic disease research has increased. At least 521 manuscripts have been published, many in high-impact journals. Projects have included clinical trials, observational studies, translational research, clinical-laboratory interface initiatives, and behavioral research. Strengths of the program include training opportunities for American and developing country scientists in well-established international clinical research settings, and mentorship from experienced global health experts.

INTRODUCTION

In the past decade, a groundswell of interest in experiences and training opportunities in global health has occurred among students of medical, public health, and other health professions in the United States. This trend is shown by substantial increases in numbers of medical students seeking international rotations;¹ the creation of partnerships between U.S. health care institutions and teaching hospitals in developing countries;² and increased numbers of training experiences in research, clinical care, and public health in resource-limited settings.^{3–6}

The optimal venue in which to provide global health research training for U.S. and international trainees is *in situ*, embedded in public health, treatment, and research programs in low-income and middle-income countries that are designed to provide mutual benefit to both sending and hosting institutions.⁷ Recognizing this fact, in 2003 the Fogarty International Center (FIC) of the U.S. National Institutes of Health (NIH), with additional support from other NIH institutes and centers and the Ellison Medical Foundation, established a program to provide training opportunities for professional and doctoral students in global clinical research. In 2008, the program was expanded in size and scope, with postdoctoral clinical and research fellows included. We provide a program description and report early outcomes.

PROGRAM DESCRIPTION AND TRAINEE SELECTION

Scholars Program. The Fogarty International Clinical Research Scholars Program (FICRS, www.fogartyscholars.org) was initiated in 2003 with the goal of fostering the next generation of clinical investigators and to help build international health research partnerships between American and international investigators and institutions. It is a one-year mentored training experience that provides opportunities for

U.S. graduate students and matched international trainees in the health professions and medical sciences to participate in clinical research, gaining hands-on experience at vetted research centers funded by the U.S. NIH in low-income and middle-income countries in Africa, Asia, Central and South America, the Caribbean, and eastern Europe (Table 1).

The U.S. Scholars are professional or graduate students in doctoral programs in all disciplines of the health sciences who express serious interest in potential careers in global health research. They are selected through a competitive application and interview process. Typical cohorts comprise doctoral candidates in allopathic or osteopathic medicine, public health (e.g., epidemiology, international health, and behavioral sciences), veterinary medicine, dentistry, nursing, and pharmacy. All U.S. Scholars are matched or twinned with foreign national Scholars chosen by the international research sites through individually administered selection processes. The non-U.S. Scholars need not be students, but can be junior postgraduate trainees. The U.S. and international Scholars may collaborate on common research projects, or they may engage in different projects. International Scholars serve as resources for the U.S. Scholars in research, cultural understanding, and, typically, friendship. In turn, U.S. Scholars may bring specific clinical or research skills that are shared in-country with their counterparts. By completing research training entirely in the international sites, the program provides a mentored opportunity for both training and capacity building in the foreign research sites.

Scholar candidates from the United States apply online annually, and finalists selected by an external review committee are interviewed individually by representatives of the international training sites at a meeting held on the NIH campus. Applicants and site representatives then submit rank order preference lists that are used to match applicants to sites.

Fellows Program. The program was expanded in 2008 to include postdoctoral trainees. The Fogarty International Clinical Research Fellows (FICRF) Program is intended to fill a critical gap in global health research training between the completion of a professional or academic doctoral program and readiness to apply for more advanced career development awards or research grants. Eligible applicants are U.S. and

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TABLE 1
Research training sites, countries, and affiliated U.S. institutions*

Country (city)	Performance site	U.S. or other partner institution	Scholar site	Fellow site
Argentina (Buenos Aires)	Institute for Clinical Effectiveness and Health Policy (IECS)	Tulane University School of Public Health and Tropical Medicine		x
Argentina (Buenos Aires)	Fundacion Infant	Vanderbilt University Medical Center		x
Bangladesh (Dhaka)	International Center for Diarrheal Disease Research	Massachusetts General Hospital	x	x
Bangladesh (Dhaka)	International Center for Diarrheal Disease Research	None	x	x
Botswana (Gaborone)	Botswana-Harvard School of Public Health AIDS Initiative Partnership (BHP)	Harvard University, Harvard School of Public Health	x	x
Botswana (Gaborone)	Botswana-University of Pennsylvania Partnership	University of Pennsylvania School of Medicine		x
Brazil (Fortaleza)	Federal University of Ceara, Institute of Biomedicine; Clinical Research Unit	University of Virginia, Center for Global Health		x
Brazil (Rio de Janeiro)	Fundacao Oswaldo Cruz (Fiocruz)	None		x
Brazil (Salvador)	Federal University of Bahia	Weill Cornell Medical College, Division of International Medicine and Infectious Diseases	x	x
Chile (Santiago)	Universidad del Desarrollo	University of New Mexico Health Sciences Center		x
China (Beijing)	National Center for AIDS/STD Control and Prevention, China CDC	Vanderbilt University Institute for Global Health	x	x
China (Beijing)	The George Institute for International Health	None		x
China (Beijing)	National Center for AIDS/STD Control and Prevention, China CDC	University of North Carolina at Chapel Hill (UNC) Gillings School of Global Public Health	x	x
China (Nanjing)	National Center for STD and Leprosy Control, Chinese Academy of Medical Sciences, Peking Union Medical College	UNC Institute for Global Health and Infectious Diseases	x	x
China (Nanjing)	National Center on AIDS/STD Control and Prevention	University of California, San Francisco		x
China (Shanghai)	Shanghai Municipal Center for Disease Control and Prevention	Vanderbilt University, Epidemiology Center	x	x
Costa Rica (San José) and Mexico (Chiapas)	Comprehensive Center for the Prevention of Chronic Diseases in Mesoamerica and the Dominican Republic	RAND Corporation		x
Guatemala (Guatemala City)	Institute of Nutrition of Central America and Panama (INCAP)	RAND Corporation		x
Haiti (Port Au Prince)	Haitian Group for the Study of Kaposi's Sarcoma and Opportunistic Infections (GHESKIO)	Weill Cornell Medical College, Division of International Medicine and Infectious Diseases	x	x
Honduras (Santa Rosa de Copan)	Hospital Regional del Occidente	None		x
India (Chennai)	YR Gaitonde Center for AIDS Research and Education (YRG CARE)	The Miriam Hospital; Brown University	x	
India (Mumbai)	Partners for Urban Knowledge, Action, and Research (PUKAR)	None		x
India (New Delhi)	All India Institute of Medical Sciences	None		x
India (New Delhi)	Public Health Foundation of India	Rollins School of Public Health, Emory University	x	x
India (Vellore)	Christian Medical College	Tufts University School of Medicine	x	x
India (Bangalore)	St. John's Medical College and Research Institute	None		x
Jamaica (Mona)	University of the West Indies, Mona Campus	None		x
Kenya (Eldoret)	Moi University School of Medicine	The Miriam Hospital; Brown University	x	x
Kenya (Nairobi)	University of Nairobi	University of Washington, International AIDS Research and Training Program (IARTP)	x	x
Kenya (Nairobi)	Kenya Medical Research Institute	University of Washington, International AIDS Research and Training Program (IARTP), Tufts University Medical Center		x
Malawi (Lilongwe)	UNC Project	University of North Carolina Institute for Global Health and Infectious Diseases	x	x
Mali (Bamako)	University of Bamako/Mali Service Center, Malaria Research and Training Center	University of Maryland School of Medicine, Baltimore	x	x
Mexico (Baja)	Universidad Autonoma de Baja California, Instituto Mexicano del Seguro Social	Scripps Health		x
Mexico (Juarez)	Mexico-Juarez-UTEP	University of Texas at El Paso		x
Mozambique (Maputo)	Faculty of Medicine, University of Eduardo Mondlane; Friends in Global Health	Vanderbilt University Institute for Global Health		x

(Continued)

TABLE 1
Continued

Country (city)	Performance site	U.S. or other partner institution	Scholar site	Fellow site
Nigeria (Ibadan)	University of Ibadan, University College Hospital	University of California, Los Angeles		x
Nigeria (Ilorin)	Sobi Specialist Hospital (Ilorin, Kwara)	Vanderbilt University Institute for Global Health		x
Peru (Lima)	Universidad Peruana Cayetano Heredia, Universidad Nacional Mayor de San Marcos, Investigación Médica en Salud (INMENSA)	University of Washington IARTP	x	x
Peru (Lima)	Universidad Peruana Cayetano Heredia, A.B. PRISMA	Johns Hopkins Bloomberg School of Public Health, Department of International Health	x	x
Peru (Lima)	Universidad Peruana Cayetano Heredia	The University of Texas Medical Branch		x
Rwanda (Kigali) and Zambia (Lusaka)	Rwanda–Zambia HIV Research Group	Emory University, Rollins School of Public Health		x
Rwanda (Kigali)	Rwinkwavu Hospital	Brigham and Women's Hospital		x
South Africa (Cape Town)	Department of Medicine, University of Cape Town	None		x
South Africa (Cape Town)	Desmund Tutu HIV Center and Institute of Infectious Diseases and Molecular Medicine, University of Cape Town	None		x
South Africa (Cape Town)	Stellenbosch University	None		x
South Africa (Durban)	Center for the AIDS Program of Research in South Africa (CAPRISA)	Mailman School of Public Health, Columbia University	x	x
South Africa (Durban)	Nelson Mandela School of Medicine, University of Kwazulu-Natal	None		x
South Africa (Johannesburg)	Reproductive Health and HIV Research Unit, University of Witwatersrand	None		x
Tanzania (Dar es Salaam)	Muhimbili University of Health and Allied Sciences (MUHAS)	Harvard School of Public Health	x	x
Tanzania (Moshi)	Kilimanjaro Christian Medical Center (KCMC)	Duke University, Hubert Yeargan Center for Global Health	x	x
Thailand (Bangkok)	Chulalongkorn University	None		x
Thailand (Chiang Mai)	Research Institute for Health Educations Sciences, Chiang Mai University	Johns Hopkins Bloomberg School of Public Health	x	x
Thailand (Mae Sot)	Shoklo Malaria Research Unit	None		x
Tunisia (Sousse)	University Hospital Farhat Hached	Duluth Medical Research Institute, University of Minnesota Medical School		x
Uganda (Kampala)	Joint Clinical Research Center, Makerere University	Case Western Reserve University (CWRU), AIDS International Training and Research Program	x	x
Uganda (Kampala)	Mulago Hospital Complex, Makerere University, Infectious Diseases Institute	None	x	x
Uganda (Mbarara)	Mbarara University of Science and Technology	None		x
Vietnam (Ho Chi Minh City)	Oxford University, Clinical Research Unit	Oxford University		x
Vietnam (Hanoi)	Vietnam National University	None		x
Zambia (Lusaka)	Center for Infectious Disease Research in Zambia (CIDRZ)	University of Alabama at Birmingham, Division of International Women's Health	x	x
Zambia (Lusaka)	University of Zambia School of Medicine	Vanderbilt University, Institute for Global Health		x

* AIDS = acquired immunodeficiency syndrome; STD = sexually transmitted disease; Div. = Division; CDC = Center for Disease Control; UTEP = University of Texas at El Paso; HIV = human immunodeficiency syndrome.

international medical residents and Fellows, and postdoctoral scientists enrolled in health-related training programs.

Fellow applicants apply online annually, including a description of a research project. Finalists selected by an external review committee are subsequently interviewed via telephone by members of a separate committee. Fellowships are awarded on the basis of evaluations of the applications and interviews, and the priorities of the available funding sources for the given year. Together, the Scholars and Fellows programs are called the Fogarty International Clinical Research Scholars and Fellows Program (FICRS-F).

Site selection. The initial 14 training sites were selected from supplemental award proposals received from FIC training grant recipients. Eligibility was restricted to sites with NIH-

funded research, post-graduate educational programs, on-site full-time mentors, and consideration of other factors such as housing, safety, and language requirements. Subsequent sites were added to provide greater geographic diversity and breadth of research activities. In 2008, all the sites were re-competed; 25 sites were selected for the Scholars and the Fellows programs and an additional 24 sites were approved for the Fellows program alone. As Fellow applicants have applied to work in new sites, additional Fellows sites have been added.

Training experience. The training experience for all U.S. and international Scholars and Fellows begins with a two-week July orientation and training session held on the NIH campus. The orientation reviews key principles of clinical and translational

research, the histories and contributions of key organizations involved in global health, particularly the NIH, issues in cultural competency and integration, and talks by global health scientists and leaders from NIH and around the world. Typically, Scholars and Fellows visit the U.S. institutions affiliated with their respective training sites for a brief orientation to their specific programs (Table 1), and then depart for 10–11 months at the training sites. Several U.S. Scholars and Fellows have brokered additional resources to continue their overseas training for an extended stay abroad to complete ongoing research projects.

The FICRS-F Program defines clinical research as research directly related to human health and designed to clarify a problem in human physiology, pathophysiology or disease, human behavior, public health, or disease etiology. Typical disciplines engaged during training include epidemiology, behavioral science, physiology, molecular biology, immunology, information technology, behavioral sciences, implementation science, health services research, development of new technologies, therapeutic interventions, and clinical trials. Work related to prevention of disease is encouraged.

Funding and administration. To provide programmatic support to the FICRS-F Program, the FICRS-F Support Center at Vanderbilt was established through an R24 research support grant by FIC in 2007.⁸ The Support Center provides overall program management, information dissemination and applicant selection, communication, program coordination and logistics, program monitoring and evaluation, organization of educational programs and conferences, and tracking and maintenance of relationships with program alumni. Assessment of mentorship and the quality of the training experience, as well as the productivity of the trainee, are vital components of the Support Center's responsibilities. Outreach to numerous health-science fields is also conducted by the original partner in the Support Center, the Association of American Medical Colleges, with its focus on medical students and clinical residents and Fellows, complemented by the Association of Schools of Public Health, which focuses on all other health science disciplines.

The cost of a Scholar pair or a single Fellow is approximately \$100,000, although costs vary significantly depending on the country of training and type of trainee. Approximately 70–90% of the funds support the trainees' direct costs, such as stipends, insurance, training funds, travel, and orientation. The remainder supports infrastructure and capacity-building at the host international sites, and program administration costs. Significant economies of scale were achieved by having a central support center that required only approximately 7% of total costs. Several NIH Institutes and Centers (ICs) partner with the FIC by contributing support to the program to increase trainee numbers and to focus some Scholar and Fellow placements on research activities related to the participating ICs' areas of scientific interest. As more ICs have shown interest in the FICRS-F Program (Table 2), research diversity for trainees has expanded to encompass not only infectious diseases, but oncology, chronic disease, ophthalmology, nursing, and veterinary medicine. For example, 11 FICRS-F sites are also Collaborating Centers of Excellence in the National Heart, Lung, and Blood Institute/United Health Chronic Disease Initiative in low- and middle-income countries (<http://www.nhlbi.nih.gov/about/globalhealth/>). Participation as FICRS-F sites was a requirement for eligibility for

TABLE 2
Participating NIH institutes and centers*

NIH institute or center	Year of initial FICRS-F participation
John E. Fogarty International Center (FIC)	2003
Office of the Director (OD)	
Office of AIDS Research (OAR)	2007
Office of Research on Women's Health (ORWH)	2008
Office of Behavioral and Social Sciences Research (OBSSR)	2009
National Center on Minority Health and Health Disparities (NCMHD)†	2004
National Institute of Allergy and Infectious Disease (NIAID)	2005
National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS)	2009
National Cancer Institute (NCI)	2007
Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD)	2007
National Eye Institute (NEI)	2008
National Institute of Dental and Craniofacial Research (NIDCR)	2007
National Institute on Drug Abuse (NIDA)	2005
National Heart, Lung, and Blood Institute (NHLBI)	2008
National Institute of Mental Health (NIMH)	2007
National Institute of Neurological Disorders and Stroke (NINDS)	2007
National Institute of Nursing Research (NINR)	2007

* NIH = National Institutes of Health; FICRS-F = Fogarty International Clinical Research Scholars and Fellows Program.

† In 2010, the NCMHD was re-designated as the National Institute on Minority Health and Health Disparities (NIMHD).

the Centers of Excellence network in an effort to bridge the training and research mission of the National Heart, Lung, and Blood Institute-supported sites.

Tracking and outcome evaluation. Scholars' and Fellows' career trajectories are followed-up for 20 years after completion of their FICRS-F year, as required by the FIC/NIH, to estimate the program's impact on the global health research workforce. Mid-year and end-of-year assessments of the training experience are administered by the Support Center through the Vanderbilt University online survey and database tool, REDCap™.⁸ Survey topics include quality of the training experience and evolving interest in global health and research.

In this follow-up, trainees submit updated *curricula vitae* every year to the Support Center, including a report of presentations, publications, and other activities. Field training site principal investigators help ensure completeness of documentation. Captured in the REDCap™ database, productivity indices are reported in a Research Accomplishments book maintained by the Support Center and in CareerTrac, an online reporting system developed by the Fogarty International Center. Publication outcomes reported here are based on records as of July 2011.

RESULTS

Through June 2012, eight cohorts of Scholars have engaged in mentored international clinical research, including 221 U.S. Scholars and 215 international Scholars selected by the foreign sites (Figure 1 and Table 3). The four cohorts of Fellows have totaled 70 U.S. Fellows and 52 international Fellows, bringing the total to 558 trainees to date, working in 61 sites in 27 countries (Table 4). All but three of 391 (0.8%) Scholars

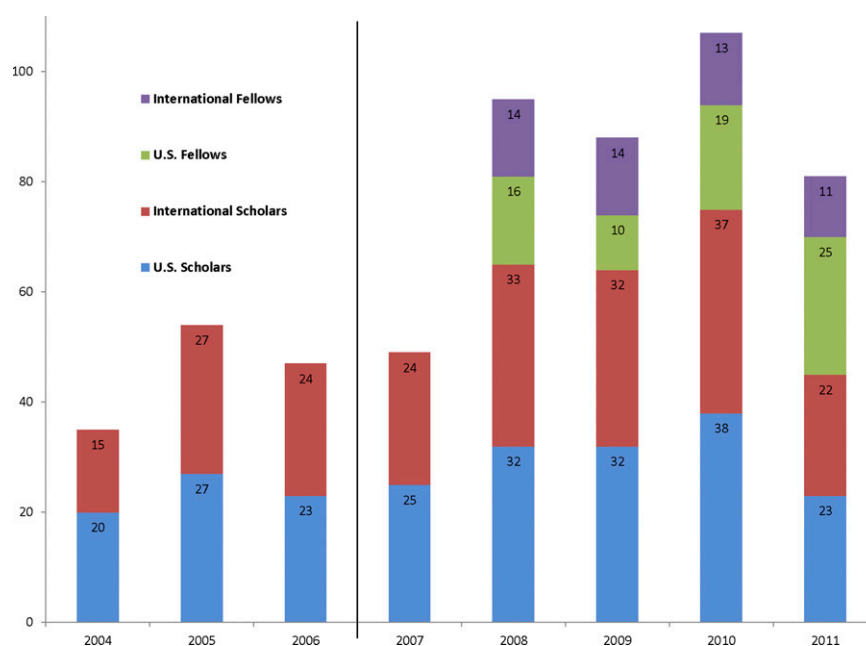


FIGURE 1. Numbers of U.S. and international scholars and fellows by year deployed, 2004–2011. Vertical line indicates the year in which the Support Center grant was awarded to the Vanderbilt Institute for Global Health.

in the completed cohorts to date (2004–2011) have completed the program, and all but one (1.1%) of 87 Fellows in the finished cohorts (2008–2011) have completed the program.

Basic demographics of the trainees are shown in Table 3. Except for international Scholars, most trainees have been women. The U.S. Scholars have tended to be younger than their international twins, who had typically completed all formal training before being selected for the Program. Most cohorts have been physicians; public health comprised the second most common background.

Scholars and Fellows have pursued research in a wide variety of topic areas (Table 5). The preponderance of research is related to infectious diseases, especially human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS), including disease transmission, diagnostic methods, treatment, and detection and management of complications.

However, projects focusing on chronic conditions such as cancer, cardiovascular disease, diabetes, respiratory disease, trauma, and mental illness are growing with support from partnering NIH ICs (Table 2).

At least 521 manuscripts have been published by FICRS-F alumni from the 2003–2010 cohorts from their work during and after FICRS-F support, including many in relatively high-impact journals (Table 6). A FICRS-F trainee appears as first author in 223 publications, and at least 105 publications have more than one trainee as a coauthor. Among these are publications that influenced international guidelines for co-treatment of HIV/AIDS and tuberculosis⁹; documented social determinants of the resurgence of syphilis in China¹⁰ and proposed worldwide adoption of rapid syphilis testing¹¹; modeled a nationwide analysis of the utility of high-risk human papillomavirus DNA testing as a primary screen for cervical

TABLE 3
Demographics of scholars and fellows*

Characteristic	U.S. scholars	International scholars	U.S. fellows	International fellows
No.	221	215	70	52
Female, %	56.4	46.5	58.6	60
Age, median (IQR)	27 (26–29)	32 (29–35)	32 (31–35)	34 (32–38)
Current discipline, %				
Biomedical sciences	0.0	15.0	5.7	3.9
Dentistry	1.4	1.4	0.0	0.0
Medicine	80.0	53.3	71.4	64.7
Medicine and public health	2.7	7.5	7.1	13.7
Mental and behavioral health	0.5	1.4	7.1	2.0
Missing or other	0.9	9.8	0.0	2.0
Nursing	1.4	0.5	0.0	0.0
Nutrition	0.0	0.9	0.0	0.0
Ophthalmology	0.5	0.5	4.3	0.0
Osteopathic medicine	2.3	0.0	0.0	0.0
Pharmaceutical sciences	0.9	1.4	1.4	2.0
Public health	6.8	6.1	2.9	7.8
Veterinary medicine	3.2	1.9	0.0	3.9

*IQR = interquartile range.

TABLE 4
Scholars and fellows by country

Location	Center	Scholars	Fellows	Totals
Africa	Botswana	18	2	20
	Kenya*	29	21	50
	Malawi	6	9	15
	Mali	14	0	14
	Mozambique	0	1	1
	Nigeria	0	3	3
	Rwanda	0	2	2
	Rwanda/Zambia	0	3	3
	South Africa*	27	19	45
	Tanzania*	26	4	30
	Uganda*	25	1	26
	Zambia	25	9	32
	11 countries			244
Asia, Eastern Europe	Bangladesh*	22	0	22
	China*	39	7	46
	India*	43	7	50
	Russia	4	0	4
	Thailand	24	3	28
	Vietnam	0	2	2
	6 countries		151	
Central and South America, Caribbean	Argentina	4	8	12
	Brazil	29	2	30
	Haiti	17	1	18
	Honduras	0	1	1
	Jamaica	0	1	1
	Mexico	0	1	1
	Peru*	85	14	98
7 countries		163		

* Countries with more than one site and more than one affiliated U.S. institution.

cancer in China¹²; and outlined opportunities for research training in cardiology in the developing world.¹³ Fellows are more advanced in their careers than are Scholars and often publish several papers while still in their year of FICRS-F support (Figure 2).

TABLE 5
Trainee research project topics

Research focus	No.
Behavioral studies, stigma	40
Bioassays, diagnostics, drug resistance	8
Cancer	18
Cardiovascular disease, diabetes	8
Child or infant health, adolescent health	30
Chronic disease, aging	8
Climate	4
Dental/oral health	3
Diarrheal and gastrointestinal diseases	15
Economics, education, trauma and injury	3
Eye or ear disease	5
Genetics	9
HIV/AIDS, opportunistic infections	91
Infectious diseases, disease transmission	28
Maternal/women's health, pregnancy, contraceptives	20
Mental health, neurological disorders, stroke	12
Nutrition	12
Parasitic disease, including malaria	23
Sexually transmitted infections	18
Substance abuse, tobacco-related diseases	10
Tuberculosis	24
Vaccines, viral diseases including hepatitis	10
Zoonoses, including leptospirosis	4

* HIV/AIDS = human immunodeficiency virus/acquired immunodeficiency syndrome. Many trainees work on more than project during their training year. This list reflects all projects with Fogarty International Clinical Research Scholars and Fellows Program trainee participation. Topics that covered two topics, such as oral health manifestations of HIV, are listed under both topics.

We have further catalogued 461 scientific posters, 147 oral conference presentations, 35 book chapters, 69 post-training funding awards (27 from NIH), and 122 additional honors or awards; alumni have mentored at least 36 students after their research years. The program is young enough that many of even the earliest Scholar alumni have only recently completed their final training, and many are still in postdoctoral clinical or research training fellowships. Thus, the final career paths of the alumni are largely yet to be determined. Nonetheless, career paths of FICRS-F alumni include many positions of note. One alumna is a University of KwaZulu Natal faculty member and Head of Treatment Research Program at a large HIV/AIDS clinic at the Center for the AIDS Program of Research in South Africa. Another alumna is Assistant Professor of Medicine (Infectious Diseases) at the University of North Carolina, spending six months each year researching syphilis onsite in Guangzhou, China. One alumna is Instructor in Medicine (Infectious Diseases) at Harvard Medical School and Brigham and Women's Hospital, spending nine months each year in research on HIV and cancer in Botswana. Some U.S. alumni now conduct research full-time overseas, and nearly all international alumni continue to work in their home countries.

An Alumni Symposium held near the NIH campus in September 2010 brought 138 U.S. and foreign FICRS-F alumni to present their scientific output, showcase their career trajectories, and interact with mentors, program faculty, and NIH officials, including the NIH director and several IC directors. Nine alumni of the Doris Duke Clinical Research Fellowship for medical students (<http://www.ddcf.org/mrp-crf>) who had conducted their fellowships in developing countries also participated. Trainees cited the huge impact the program has had on their career development. The Alumni Symposium also renewed and strengthened the international interdisciplinary network among FICRS-F alumni, site mentors, and NIH staff.

DISCUSSION

The Fogarty International Clinical Research Scholars and Fellows Program was founded to train and inspire doctoral students in the health professions and medical scientists for careers in global health research. Now expanded to include postdoctoral Fellows, the FICRS-F program has made a substantial contribution to the numbers of young U.S. and international scientists and health professionals trained specifically to conduct research in resource-limited settings. By placing trainees in sites that already have substantial biomedical and biobehavioral research underway, dedicated national staff closely linked to U.S.-based scientists and academic institutions help mentor the U.S. and local Scholars and Fellows within world-class research teams. Scholars and Fellows participate in top-quality ongoing research projects and, with the approval of the site directors, may initiate ancillary projects of their own design or add components to the ongoing research that could not be done without their input.

The program periodically encounters challenging issues. Some relate to the level and availability of on-site mentorship. Obtaining Institutional Review Board and ethical review certifications and approvals across multiple institutions and countries can cause delays that, although unavoidable, can threaten the relatively short training period. Safety can be tenuous in

TABLE 6

Number of Fogarty International Clinical Research Scholars and Fellows Program alumni publications in high-impact journals as of December 2010

Journal name	No.	Impact factor*
<i>New England Journal of Medicine, Lancet, Journal of the American Medical Association, Science</i>	12	30–47
<i>Journal of Clinical Oncology, Lancet Infectious Diseases, Circulation, Lancet Oncology, British Medical Journal, PLoS Medicine</i>	15	13–18
<i>American Journal of Respiratory and Critical Care Medicine, Annual Review of Medicine, Archives of Internal Medicine, PLoS Genetics, Proceedings of the National Academy of Science USA, PLoS Pathogens</i>	9	9–11
<i>Clinical Infectious Diseases</i>	20	8.2
<i>Neurology, Emerging Infectious Diseases, American Journal of Clinical Nutrition</i>	6	6.3–8.2
<i>Journal of Infectious Diseases</i>	12	5.9
<i>Journal of Immunology, American Journal of Epidemiology, Bulletin of the World Health Organization, Journal of Virology, Mayo Clinic Proceedings</i>	10	5.0–5.7
<i>AIDS</i>	12	4.9
<i>Antimicrobial Agents and Chemotherapy, Current Opinion in Infectious Diseases, Breast Cancer Research and Treatment, PLoS Neglected Tropical Diseases, Atherosclerosis, Antiviral Therapy</i>	12	4.3–4.8
<i>PLoS One</i>	13	4.4
<i>Journal of Acquired Immune Deficiency Syndromes</i>	17	4.2
<i>Infection and Immunity</i>	10	4.2
<i>Journal of Clinical Microbiology, Cancer Immunology, Immunotherapy, Gynecologic Oncology, Applied and Environmental Microbiology, Vaccine, Journal of Vascular Surgery</i>	15	3.5–4.2
<i>Cancer Causes and Control, Preventive Medicine, Menopause (New York, NY), Virology, Malaria Journal, Obesity Surgery, Pediatric Infectious Disease Journal</i>	16	2.9–3.2
<i>American Journal of Tropical Medicine and Hygiene, World Journal of Surgery, Sexually Transmitted Diseases, Transactions of the Royal Society of Tropical Medicine and Hygiene, BMC Infectious Diseases, International Journal of Tuberculosis and Lung Disease, AIDS Research and Human Retroviruses, Sexually Transmitted Infections, International Journal of Infectious Diseases, Revista Panamericana de Salud Publica</i>	63	2.2–2.8

*Impact factors from the Journal Citations database of the Information Sciences Institute Web of Knowledge (www.isiknowledge.com/).

environments that have inherent risks from motor vehicle accidents, violence, or tropical diseases. Trainees have experienced all of these, most tragically in the case of a U.S. scholar in Uganda who died after a motor vehicle accident in 2010, the only fatality in the program’s history. Comprehensive safety counseling is part of the orientation at the NIH, but risks are extant nonetheless. Results of end-of-year trainee evaluations and first-hand experiences with such challenges are examined on an ongoing basis to strengthen FICRS-F programming. The Support Center maintains basic standard procedures that are

available, and plans to share obstacles and lessons learned in future publications.

As the FICRS-F Program matures, the Support Center at Vanderbilt is engaged in monitoring and documenting career paths of FICRS-F alumni. A significant limitation with regard to documenting the impact of the FICRS-F Program is the lack of an appropriate comparison group, making it difficult to prove that it was participation in FICRS-F and not a prior passion or other factors that were responsible for ultimate career paths in global health research.

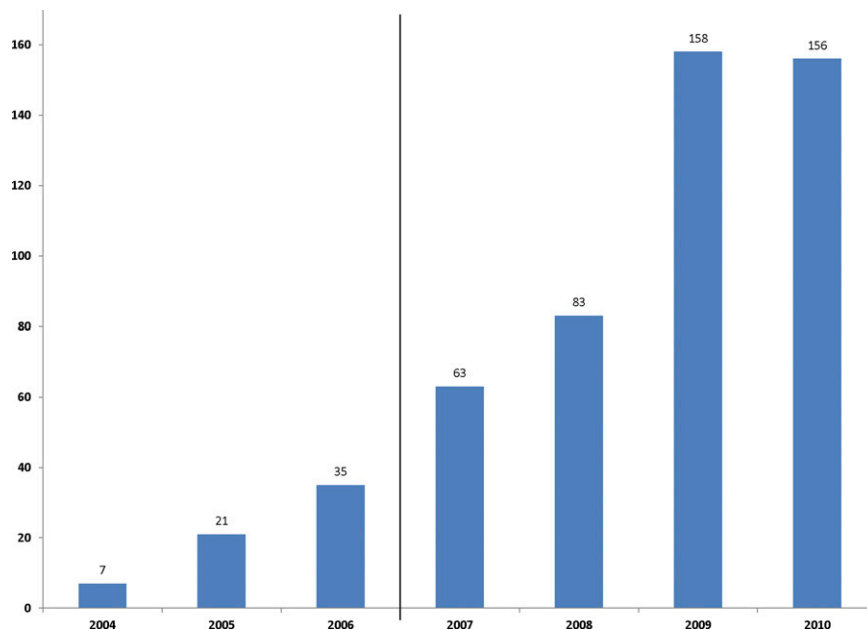


FIGURE 2. Alumni publications by year, 2004–2010. Vertical line indicates the year in which the Support Center grant was awarded to the Vanderbilt Institute for Global Health. Includes only trainees who have completed a Fogarty International Clinical Research Scholars and Fellows Program-supported year.

The lifeblood of the FICRS-F Program is clearly the consistent and passionate support of the FIC and its co-sponsoring NIH ICs and engaged U.S. and international mentors. The total size of the trainee cohort depends heavily on the degree of IC co-funding. A minority of the 27 NIH ICs participate currently (Table 2), and substantially greater opportunity could be opened, and impact anticipated, if more ICs participated.

In summary, the FICRS-F Program is a groundbreaking effort to nurture a new generation of researchers focused on chronic and infectious diseases in low- and middle-income countries. Since it was established by the Fogarty International Center in 2003, U.S. and international alumni of the FICRS-F Program are scientists and health professionals with substantial exposure to field research. These individuals are primed for future leadership positions in research, health care, governmental and nongovernmental organizations, and academic institutions in the United States and in low-income and middle-income countries worldwide. The long-term impact of the program on the global health research workforce will evolve and will be documented through tracking of outputs and impacts of FICRS-F alumni. The investment of NIH vision and resources into this program will yield results for decades to come, building U.S. and international research human power and improving the health of persons in resource-limited nations.

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