Impact of Global Health Research Training on Career Trajectories: The Fogarty International Clinical Research Scholars and Fellows Program

Douglas C. Heimburger,* Catherine Lem Carothers, Meridith Blevins, Tokesha L. Warner, and Sten H. Vermund

Departments of Medicine, Biostatistics, and Pediatrics, Vanderbilt Institute for Global Health, Vanderbilt University School of Medicine, Nashville, Tennessee; Fogarty International Clinical Research Scholars and Fellows Support Center at Vanderbilt, Vanderbilt University, Nashville, Tennessee

Abstract. From 2004 to 2012, the Fogarty International Clinical Research Scholars/Fellows Program (FICRS-F) provided 1-year research training opportunities for U.S. and international doctoral “Scholars” and postdoctoral “Fellows” at low- and middle-income country (LMIC) centers. We collected data prospectively and then surveyed a representative sample of 100 alumni (94% response), assessing Program impacts on their careers and collaborations. Frequently, collaborations continued beyond the formal training period with U.S.- (63%) and site-based mentors (66%). U.S. Fellows reported the highest post-training focus on research (88 on a 100-point scale), and the highest Program impact on competitiveness for career or training positions and choices of post-training topics and institutions (95 points). Interest in global health research increased markedly during the training period, especially for LMIC trainees, and was sustained post-training. LMIC alumni reported a significantly higher focus on global health and research than did U.S. alumni. Alumni reported that their mentored research training had a substantial impact on their career trajectories.

INTRODUCTION

Interest in experiences and training in global health has increased substantially in recent years among students of medical, public health, and other health profession schools in the United States.¹ Structured training experiences in research,^{2–5} clinical care,^{6,7} and public health⁸ in resource-limited settings are now more widely available and sensitive to issues of relevance to host nations.^{9–11} Complementing training opportunities for students from higher-resource settings are programs strengthening low- and middle-income countries (LMICs) medical and nursing school infrastructures, as with the Medical and Nursing Education Partnership Initiatives in Africa.^{12,13} From 2004 to 2012, the Fogarty International Clinical Research Scholars and Fellows Program (FICRS-F; www.fogartyscholars.org) provided 1-year research training opportunities for U.S. and international doctoral and postdoctoral health profession students and trainees at research centers in LMIC.^{14,15} The Program was funded by the Fogarty International Center (FIC) and 15 other institutes, centers, and offices of the U.S. National Institutes of Health (NIH, see Acknowledgments). From 2007 to 2012, the Program was administered by the FICRS Support Center at the Vanderbilt Institute for Global Health through an R24 Institutional Capacity Building grant from the FIC.¹⁶

U.S. predoctoral Scholars and U.S. and LMIC postdoctoral Fellows were selected through centralized processes managed by the Support Center, and international Scholar “twins” were selected by the international sites to work alongside the selected U.S. Scholars.^{17,18} Traineeships began each year with a 10- to 12-day orientation held on the NIH campus in Bethesda, MD, during which trainees were instructed in safety and cultural competence, interacted with NIH officials, and met their counterparts from the international site. Subsequent training experiences including monthly webinars, presented by veteran global health faculty mentors

and FICRS-F Fellows, and competitive post-fellowship travel awards encouraged alumni to continue to interact with both junior and senior investigators. This included support for trainees returning to their LMIC training sites and presenting research results at national and international meetings.

The FICRS-F Program’s goals were to foster the next generation of global health-focused clinical investigators and to help build international health research partnerships between the U.S. and international investigators and institutions. Trainees gained hands-on experience at research centers funded by the NIH in LMICs in Africa, Asia, Central and South America, the Caribbean, and eastern Europe.¹ To support local institutions in their efforts to mentor research trainees entirely at the international sites, the Program provided both training and modest capacity building for research at the foreign sites. By 2012, when the FIC decentralized the Program among 20 institutions in five consortia (Global Health Program for Fellows and Scholars),¹⁹ FICRS-F had supported 558 U.S. and international Scholars and Fellows at 61 sites in 27 countries.¹ Of these, 536 individuals completed one or more training periods; 18 trainees participated as both Scholar and then Fellow and four did not complete the intended training period.

Little is known about the impacts of intensive global health research experiences on trainees’ future careers, and few research training programs have had such a large alumni pool, so we undertook an impact evaluation of the Program. We analyzed multiple variables of interest from data gathered throughout the Program and conducted a survey of alumni in 2013, after the Program’s completion. Here we report results related to Program alumni career paths, further training and employment positions, and ongoing research collaborations.

METHODS

Support Center staff prospectively collected extensive data of interest on all trainees and Program alumni and entered them into the FIC’s online CareerTrac database. CareerTrac data included basic demographic variables (sex; race [American alumni only], region of origin), training category (U.S. versus international and Scholar versus Fellow),

*Address correspondence to Douglas C. Heimburger, Vanderbilt Institute for Global Health, Vanderbilt University, 2525 West End Avenue, Suite 750, Nashville, TN 37203. E-mail: douglas.heimburger@vanderbilt.edu

year of training initiation, duration of FICRS-F-supported training, and region and country of training.

We also surveyed a representative sample of 100 of the 536 (18.7%) Program alumni between May 7 and October 23, 2013, using Vanderbilt's online survey and database tool, REDCap™ (<http://project-redcap.org/>).²⁰ Only the Program alumni who finished at least one fellowship training period and completed a privacy statement for CareerTrac were eligible for selection. The selection of survey participants was random, but selection probability was weighted such that the combination of program (U.S. and international, Scholar and Fellow) and year of training should have a distribution similar to that of the entire program. The evaluation included questions on accomplishments, ongoing collaborations, career influences, continuing research, and evolution of the trainees' interest in global health. We used a slider scale (0–100) to measure the impact of the FICRS-F training on four aspects of the trainees' professional development: competitiveness for career advancements or additional training; decisions to accept a career position or additional training; choice of any post-training specialty or topic area of focus; and choice of institution(s) for study, work, or training.

The 31-question survey, developed by the authors of this article and tailored for this program, asked alumni to report number of publications, posters presented, grant applications submitted and awarded, continued collaborations, return visits to the training sites, and trainees they had mentored. We asked the respondents to estimate the influence of the following on their post-training professional and/or career decisions: mentorship received in the FICRS-F Program, relationships with other Fogarty trainees and non-trainee colleagues, the experience of living abroad, and the research and topic they explored during fellowship. We asked what proportions of their post-fellowship professional experience have been focused on research and global health. We also asked them to indicate their levels of interest in global health before their FICRS-F fellowship, at the end of the fellowship, and now. Finally, we invited them to share narratives of impactful experiences in their fellowships, and anything else they wished to share, and we requested that they provide a current curriculum vitae.

We used multivariable logistic and linear regression to identify associations with Program outcomes. Outcome variables included "return to the training site" (yes/no); "interest in global health" at the end of the training experience, and presently (at the time of the survey); "number of trainees mentored" during or after FICRS-F training; and current (at the time of the survey) and cumulative (overall since completing FICRS-F training) proportions of their post-training "professional experience that have focused on global health and on research." For independent variables, we used year of training initiation (2004–2011); whether they were supported as a Scholar versus Fellow versus both (i.e., served as a Scholar and later as a Fellow); whether they were of U.S. versus LMIC origin; and their ratings (100-point scale) of the impact of the mentorship they received, relationships with other Fogarty trainees and non-trainee colleagues on site, the experience of living abroad, and their specific areas and topics of research. For the scales of "interest in global health" at the end of their FICRS-F support, we also included their ratings of prior interest in global health. If there was evidence of nonlinearity, continuous variables were expanded using restricted cubic

splines.²¹ We used R-software 2.15.1 (www.r-project.org) to select survey participants and conduct data analyses.

RESULTS

Through June 2012, the Program supported 436 Scholars (typically doctoral trainees—221 from the United States and 215 from other countries) and 122 Fellows (post-doctoral health professionals—70 U.S. and 52 international) in 1-year mentored clinical research training experiences at 61 NIH-funded research sites in 27 countries. These comprised 540 individuals, as 18 persons were supported as Scholars and subsequently reapplied and were supported as Fellows; 536 (99.3%) of them completed their intended year of research training. Additional demographics, graphs of trainees supported by year and of research topics proposed by Fellow applicants, and reports of factors associated with success in applying for the Program are included in our prior reports.^{1,17,18}

We achieved a survey response rate of 94%: 38 U.S. and 34 international doctoral Scholars and 15 U.S. and 7 international postdoctoral Fellows responded (Table 1). A median of 3 years (interquartile range = 2–5) had passed between completion of their supported training and response to the survey. The six nonrespondents included two U.S. Scholars, two international Scholars, and two international Fellows, deployed during six different Program years between 2004 and 2009. As shown in Table 1, 47% of U.S. Scholars and 80% of U.S. Fellows had returned to their training sites after completing the training period. They reported substantial ongoing collaboration with U.S.-based mentors (63%), site-based mentors (66%), other FICRS-F trainees at the training site (45%), FICRS-F trainee alumni who were no longer stationed at the site (24%), and FICRS-F trainees/alumni stationed elsewhere (32%). Collectively these 94 alumni had submitted 117 grant applications to a variety of extramural and intramural funding agencies, and 79 had been funded (67.5% success rate). U.S. Fellows and LMIC Scholars and Fellows had mentored a median of two other trainees; U.S. Scholar alumni reported rarely doing so. This was expected, as Scholars were typically more junior and had additional training to complete, often for 4–7 years after the FICRS-F period.

Figure 1 shows the survey's slider-scale questions and dot plots of the individual and median responses. Scales for subgroups (not shown) displayed variable responses from U.S. Scholars, U.S. Fellows, LMIC Scholars, and LMIC Fellows. Reflecting on their subsequent career trajectories, all groups considered the mentorship they received to be important (median scores = 80–91). Relationships with non-trainee colleagues at the training site appeared to exert more influence on subsequent professional and/or career decisions for LMIC Fellows and Scholars (90 and 80) than for U.S. Fellows and Scholars (71 and 76). Relationships with other Fogarty trainees were of more importance in this regard to U.S. Scholars (84) than to U.S. Fellows or LMIC Scholars or Fellows (64, 79, and 51, respectively). The experience of living abroad was deemed more influential by U.S. Scholars and Fellows (94 and 97) than by LMIC Scholars and Fellows (70), who conducted research in their own countries. The research and topic explored during the training year exerted strong influence on the future career decisions of LMIC Fellows (95), U.S. Fellows (90), and LMIC Scholars (90), and slightly less so for U.S. Scholars (80), many

TABLE 1
Characteristics of survey respondents (94% response rate)

	International Fellow (N = 7)	International Scholar (N = 34)	U.S. Fellow (N = 15)	U.S. Scholar (N = 38)	Combined (N = 94)
Supported as both Scholar and Fellow*	1 (14%)	4 (12%)	0 (0%)	4 (11%)	9 (10%)
Year of enrollment					
2004	0 (0%)	0 (0%)	0 (0%)	3 (8%)	3 (3%)
2005	0 (0%)	2 (6%)	0 (0%)	6 (16%)	8 (9%)
2006	0 (0%)	7 (21%)	0 (0%)	3 (8%)	10 (11%)
2007	0 (0%)	4 (12%)	0 (0%)	4 (11%)	8 (9%)
2008	2 (29%)	6 (18%)	5 (33%)	3 (8%)	16 (17%)
2009	0 (0%)	5 (15%)	3 (20%)	6 (16%)	14 (15%)
2010	2 (29%)	6 (18%)	4 (27%)	8 (21%)	20 (21%)
2011	3 (43%)	4 (12%)	3 (20%)	5 (13%)	15 (16%)
Female	3 (43%)	10 (29%)	8 (53%)	23 (61%)	44 (47%)
Please identify any individual(s) that you met in connection with your training year and continue to collaborate or work with?					
U.S.-based mentor(s)	3 (43%)	22 (65%)	10 (67%)	24 (63%)	59 (63%)
Site-based mentor(s)	5 (71%)	25 (74%)	14 (93%)	18 (47%)	62 (66%)
Fogarty trainees stationed with you at your training site	1 (14%)	21 (62%)	4 (27%)	16 (42%)	42 (45%)
Fogarty trainee alumni who were no longer stationed at your training site at your time of training	2 (29%)	14 (41%)	0 (0%)	7 (18%)	23 (24%)
Fogarty trainees and alumni with whom you interacted but were stationed at another training site (e.g., friends you met at NIH orientation)	2 (29%)	11 (32%)	4 (27%)	13 (34%)	30 (32%)
Returned to site since the end of fellowship	7 (100%)	28 (82%)	12 (80%)	18 (47%)	65 (69%)
Number of trainees mentored during and/or since training year (median, interquartile range)	2 (0–4)	2 (0–3)	2 (1–6)	0 (0–2)	1 (0–3)

NIH = the U.S. National Institutes of Health.

* Respondents who were supported as both Scholar and Fellow were asked to limit responses to one of those experiences. Responses are *n* (%) except where indicated.

of whom would have been in training still and would not yet have made final career decisions.

U.S. Fellows reported the strongest current and cumulative post-training focus on research, with scores of 88 and 90, respectively, as compared with LMIC Scholars Fellows (75 and 80) and U.S. Scholars (32 and 33). Similarly, LMIC Scholars and Fellows and U.S. Fellows reported the strongest current and cumulative focus on global health (75–84), whereas U.S. Scholars scored them as 32–40. With regard to subsequent career choices, median scores ranged from 80 to

86 for FICRS-F having influenced subsequent competitiveness for three elements: 1) career or training positions, 2) choices of post-training specialties or topic areas, and 3) of institutions. This was especially pronounced for U.S. Fellows, who scored all three areas as 95. Similarly, global health was influential in the respondents' decisions to accept future training or career positions (median = 83; U.S. Fellows = 90).

FICRS-F alumni reported a growing and sustained interest in global health research. Global research interest median

FIGURE 1. Alumni responses on survey impact scales. Individual survey responses are indicated by dots; vertical bars indicate median responses.

TABLE 2
Linear regression results for impact of training on interest and experience with global health and research

	Interest in global health (now)		Interest in global health (after)		Number of trainees monitored during/since training		Cumulative post-training professional experience focus on global health		Current post-training professional experience focus on global health		Cumulative post-training professional experience focus on research		Current post-training professional experience focus on research	
	Effect (95% CI)	P value	Effect (95% CI)	P value	Effect (95% CI)	P value	Effect (95% CI)	P value	Effect (95% CI)	P value	Effect (95% CI)	P value	Effect (95% CI)	P value
Year (per 1 year increase)	-0.7 (-2.4, 1.0)	0.40	-0.9 (-2.3, 0.5)	0.21	0.1 (-0.3, 0.4)	0.75	0.6 (-2.4, 3.7)	0.68	1.0 (-2.3, 4.2)	0.55	1.8 (-0.9, 4.5)	0.20	0.0 (-3.0, 3.0)	0.99
Global health interest before Program (per 20 points)	3.5 (0.0, 7.0)	0.051	1.3 (-1.6, 4.3)	0.36	Omitted	-	Omitted	-	Omitted	-	Omitted	-	Omitted	-
Program type														
Scholar (ref)	0	0.80	0	0.20	0	0.002	0	0.48	0	0.44	0	0.24	0	0.25
Fellow	3.5 (-8.0, 15.0)		8.4 (-1.3, 18.2)		3.7 (1.4, 6.0)		12.9 (-8.2, 34.1)		9.1 (-13.2, 31.4)		13.6 (-5.7, 32.8)		7.6 (-13.6, 28.9)	
Both	1.5 (-7.2, 10.3)		2.8 (-4.5, 10.1)		1.8 (0.1, 3.5)		0.8 (-15.2, 16.9)		-7.5 (-24.4, 9.4)		8.5 (-6.1, 23.0)		13.0 (-3.1, 29.0)	
Country of origin														
United States (ref)	0	0.073	0	0.062	0	0.14	0	< 0.001	0	< 0.001	0	< 0.001	0	< 0.001
Low and middle income	7.1 (-0.7, 14.8)		6.0 (-0.3, 12.3)		1.1 (-0.4, 2.6)		26.5 (12.7, 40.4)		26.1 (11.5, 40.6)		31.9 (18.4, 45.4)		26.0 (11.1, 40.8)	
Mentorship received (90 vs. 70 points)	5.4 (0.8, 10.0)	0.022	-0.5 (-8.6, 7.5)*	0.042	1.7 (-0.2, 3.7)*	0.11	9.2 (1.0, 17.3)	0.028	10.6 (2.0, 19.2)	0.016	8.4 (0.8, 16.1)	0.031	9.4 (1.0, 17.8)	0.029
Relationships with non-trainee colleagues on site (per 20 points)	-0.6 (-4.3, 3.2)	0.77	-0.4 (-3.5, 2.7)	0.81	0.3 (-0.5, 1.0)	0.49	-0.2 (-7.0, 6.6)	0.96	-4.0 (-11.2, 3.2)	0.28	-0.5 (-6.9, 5.9)	0.87	-4.2 (-11.2, 2.8)	0.24
Relationships with Fogarty trainees (per 20 points)	-0.9 (-4.2, 2.5)	0.62	0.6 (-2.2, 3.3)	0.67	-0.1 (-0.8, 0.5)	0.71	-3.1 (-9.1, 3.0)	0.32	-5.1 (-11.4, 1.3)	0.12	-0.4 (-5.9, 5.1)	0.89	-1.3 (-7.3, 4.8)	0.68
Living abroad experience (90 vs. 70 points)	1.7 (-1.5, 4.9)	0.30	2.8 (0.1, 5.5)	0.041	0.4 (-0.2, 1.0)	0.20	2.1 (-3.7, 7.9)	0.47	3.9 (-2.2, 10.1)	0.21	-2.4 (-16.5, 11.7)*	0.36	-6.7 (-22.3, 8.8)*	0.35
Research and topic area (90 vs. 70 points)	16.2 (5.8, 26.7)*	0.010	8.4 (4.0, 12.7)	< 0.001	-0.1 (-1.1, 0.9)	0.88	3.7 (-5.8, 13.1)	0.44	8.0 (-1.9, 18.0)	0.11	2.4 (-6.1, 10.8)	0.58	3.8 (-5.5, 13.2)	0.42

CI = confidence interval.
Significant results ($P < 0.05$) are shown in bold type.
*Continuous variable was expanded using restricted cubic splines due to evidence on nonlinearity ($P < 0.05$).

Figure 2, a word cloud, depicts the survey respondents' general reflections on the impact of the FICRS-F Program on their careers, gleaned from free-text comments. The figure qualitatively suggests that the global health research training experience provided by the FICRS-F Program influenced their careers as intended in the Program's design.

Our findings indicate that the concentrated, mentored clinical research training in global health settings provided by the FICRS-F Program exerted a major influence on the professional career trajectories of its alumni. The Program appears to have played an instrumental role in training and retaining researchers for global health careers. Program alumni indicated that the mentorship they received influenced their post-

training decisions and career investments. Relationships with non-trainee colleagues at the training site were also influential, especially for U.S. postdoctoral Fellows; relationships with other Fogarty trainees were more influential for U.S. doctoral Scholars than for Fellows.

U.S. postdoctoral Fellow alumni and all international alumni reported higher current and cumulative career focus on research and on global health than did U.S. Scholars, perhaps because the U.S. Scholars typically returned to several years of clinical specialty training after they finished their FICRS year. The FICRS-F training program also strongly influenced choices of future training and career positions and institutions, specialties or topic areas, and competitiveness for career advancement or training positions. This impact was highest for postdoctoral Fellows, whether from the United States or LMICs; it may become more evident for Scholar alumni in future years as they complete formal training and are more actively able to determine the directions of their careers. Participants reported very strong interest in global health research, with median scores increasing substantially during the training period and being maintained thereafter.

	OR (95% CI)	P value
Year (per 1 year increase)	1.02 (0.72, 1.43)	0.91
Mentorship received (per 10-point increase)	0.59 (0.32, 1.09)	0.09
Relationships with non-trainee colleagues on site (per 10-point increase)	1.45 (0.82, 2.58)	0.20
Relationships with Fogarty trainees (per 10-point increase)	0.77 (0.49, 1.22)	0.26
Living abroad experience (per 10-point increase)	3.16 (0.96, 10.44)	0.058
Research and topic area (per 10-point increase)	1.68 (0.89, 3.18)	0.11

CI = confidence interval; OR = odds ratio.

Any U.S. health sciences graduate student or postdoctoral candidate who met the Program's eligibility criteria could apply, along with foreign trainees who proposed to work at preapproved international field sites.^{17,18} Thus, being from a less well-networked university did not preclude engagement with the FICRS-F Program. The successor Fogarty Global Health Program for Fellows and Scholars highlights trainees from 20 U.S. institutions in five consortia (four universities per consortium).¹⁹ Fewer trainees come from outside of those institutions, and fewer foreign trainees are supported. Although this gives Americans from these 20 institutions special opportunities along a continuum of education beyond the 1 year-experience, it has disadvantages for trainees from other institutions and LMICs. We note that university of origin was not a factor highlighted by our survey respondents; positive experiences were reported overwhelmingly, regardless of institutional affiliation.

The principal strengths of our survey were the 94% response rate and the representative sampling strategy. The main limitation was the absence of a comparison group of motivated persons who did not access the Program's opportunity for mentored LMIC research training. In lieu of a contemporaneous control group, the pre-post experiential questioning is likely to provide some indication of impact, particularly given the objective nature of several of our indicators.

The FICRS-F Program provided the foundation for a network of emerging global health scientists and health-care providers, as evidenced by the substantial continuing collaborations reported by alumni. In addition (and anecdotally), the opportunity for U.S. Scholars and Fellows to meet, bond, collaborate, and communicate with LMIC Scholars, Fellows, and mentors during the 2-week orientation in Bethesda established relationships that have strengthened careers. We believe that training LMIC scientists in situ may encourage talent to stay at home, rather than migrate to high-income countries.²²⁻²⁵ Nearly two-thirds of the U.S. alumni had already returned to the LMIC research site after completion of the FICRS-F Program. This has laid a solid foundation for international, interdisciplinary collaboration in future global health research.

Received November 6, 2014. Accepted for publication June 4, 2015.

Published online July 20, 2015.

Note: Supplemental survey appears at www.ajtmh.org.

Acknowledgments: We thank Kenneth Bridbord, Pierce Gardner, Roger Glass, Aron Primack, and Myat Htoo Razak at the Fogarty International Center; the FICRS-F site principal investigators and mentors; participating NIH institute and center directors and staff; and Sarah Schlachter, Anne-Gordon Smart, and Aditi Thite.

Financial support: This work was supported by the NIH Office of the Director, Fogarty International Center, Office of AIDS Research, National Cancer Institute, National Eye Institute, National Heart, Blood, and Lung Institute, National Institute of Dental and Craniofacial Research, National Institute on Drug Abuse, National Institute of Mental Health, and the National Institute of Allergy and Infectious Diseases Health, through the Fogarty International Clinical Research Scholars and Fellows Program at Vanderbilt-AAMC (R24 TW007988). Additional support was received from the American Recovery and Reinvestment Act (ARRA, <http://recovery.nih.gov/>) in 2010–2011 and the Vanderbilt Institute for Clinical and Translational Research (VICTR: UL1TR000445 from NCATS/NIH). Study data were collected and managed using Research Electronic Data Capture (REDCap™) tools hosted at Vanderbilt University (<https://redcap.vanderbilt.edu>).

Disclaimer: The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Authors' addresses: Douglas C. Heimbürger, Catherine Lem Carothers, Meridith Blevins, and Sten H. Vermund, Vanderbilt Institute for Global Health, Vanderbilt University, Nashville, TN, E-mails: douglas.heimburger@vanderbilt.edu, catherineblevins@yahoo.com, meridith.blevins@vanderbilt.edu, and sten.vermund@vanderbilt.edu. Tokesha L. Warner, Office of the Vice President for Research, University of Georgia, Athens, GA, E-mail: tlwarner@uga.edu.

REFERENCES

1. Heimbürger DC, Lem C, Gardner P, Primack A, Warner TL, Vermund SH, 2011. Nurturing the global workforce in clinical research: the NIH Fogarty International Clinical Scholars and Fellows Program. *Am J Trop Med Hyg* 85: 971–978.
2. McElmurry BJ, Misner SJ, Buseh AG, 2003. Minority International Research Training Program: global collaboration in nursing research. *J Prof Nurs* 19: 22–31.
3. Primack A, Bloch M, Haverkos L, Gust S, Hare M, Smith R, 2006. Launching the Fogarty International Center International Tobacco Control Research and Training Program. *Tob Control* 15 (Suppl 1): i1–i2.
4. Glass RI, Razak MH, Said M, 2014. The importance of research in the MEPI program: perspectives from the National Institutes of Health. *Acad Med* 89 (Suppl): S9–S10.
5. Shah SK, Nodell B, Montano SM, Behrens C, Zunt JR, 2011. Clinical research and global health: mentoring the next generation of health care students. *Glob Public Health* 6: 234–246.
6. Freedman DO, Gotuzzo E, Seas C, Legua P, Plier DA, Vermund SH, Casebeer LL, 2002. Educational programs to enhance medical expertise in tropical diseases: the Gorgas Course experience 1996–2001. *Am J Trop Med Hyg* 66: 526–532.
7. Drain PK, Holmes KK, Skeff KM, Hall TL, Gardner P, 2009. Global health training and international clinical rotations during residency: current status, needs, and opportunities. *Acad Med* 84: 320–325.
8. Vian T, Koseki S, Feeley FG, Beard J, 2013. Strengthening capacity for AIDS vaccine research: analysis of the Pfizer Global Health Fellows Program and the International AIDS Vaccine Initiative. *BMC Health Serv Res* 13: 378.
9. Umoren RA, Einterz RM, Litzelman DK, Pettigrew RK, Ayaya SO, Liechty EA, 2014. Fostering reciprocity in global health partnerships through a structured, hands-on experience for visiting postgraduate medical trainees. *J Grad Med Educ* 6: 320–325.
10. Bennett S, Paina L, Ssengooba F, Waswa D, M'Imunya JM, 2013. The impact of Fogarty International Center research training programs on public health policy and program development in Kenya and Uganda. *BMC Public Health* 13: 770.
11. Short J, McDonald S, Turner T, Martis R; SEA-ORCHID Study Group, 2010. Improving capacity for evidence-based practice in southeast Asia: evaluating the role of research fellowships in the SEA-ORCHID Project. *BMC Med Educ* 10: 37.
12. Kolars JC, Cahill K, Donkor P, Kaaya E, Lawson A, Serwadda D, Sewankambo NK, 2012. Perspective: partnering for medical education in sub-Saharan Africa: seeking the evidence for effective collaborations. *Acad Med* 87: 216–220.
13. Mullan F, Frehywot S, Omaswa F, Sewankambo N, Talib Z, Chen C, Kiarie J, Kiguli-Malwadde E, 2012. The Medical Education Partnership Initiative: PEPFAR's effort to boost health worker education to strengthen health systems. *Health Aff (Millwood)* 31: 1561–1572.
14. Carothers CL, Heimbürger DC, Schlachter S, Gardner P, Primack A, Warner TL, Vermund SH, 2014. Training programs within global networks: lessons learned in the Fogarty International Clinical Research Scholars and Fellows Program. *Am J Trop Med Hyg* 90: 173–179.
15. Bearnot B, Coria A, Barnett BS, Clark EH, Gartland MG, Jaganath D, Mendenhall E, Seu L, Worjolah AG, Carothers CL, Vermund SH, Heimbürger DC, 2014. Global health research in narrative: a qualitative look at the FICRS-F experience. *Am J Trop Med Hyg* 91: 863–868.

16. Vermund SH, Sahasrabudde VV, Khedkar S, Jia Y, Etherington C, Vergara A, 2008. Building global health through a center-without-walls: the Vanderbilt Institute for Global Health. *Acad Med* 83: 154–164.
17. Heimbürger DC, Warner TL, Carothers CL, Blevins M, Thomas Y, Gardner P, Primack A, Vermund SH, 2013. Recruiting trainees for a global health research workforce: the NIH Fogarty International Clinical Research Scholars Program selection process. *Am J Trop Med Hyg* 89: 281–287.
18. Heimbürger DC, Warner TL, Carothers CL, Blevins M, Thomas Y, Gardner P, Primack A, Vermund SH, 2014. Recruiting postdoctoral fellows into global health research: selecting NIH Fogarty International Clinical Research Fellows. *Am J Trop Med Hyg* 91: 219–224.
19. Available at: <http://www.fic.nih.gov/Programs/Pages/scholars-fellows-global-health.aspx>. Accessed July 2, 2015.
20. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG, 2009. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform* 42: 377–381.
21. Harrell FEJ, 2001. *Regression Modeling Strategies with Applications to Linear Models, Logistic Regression, and Survival Analysis*. New York, NY: Springer.
22. Tankwanchi AB, Ozden C, Vermund SH, 2013. Physician emigration from sub-Saharan Africa to the United States: analysis of the 2011 AMA Physician Masterfile. *PLoS Med* 10: e1001513.
23. Tankwanchi AB, Vermund SH, Perkins DD, 2014. Has the WHO Global Code of Practice on the International Recruitment of Health Personnel been effective? *Lancet Glob Health* 2: e390–e391.
24. Tankwanchi AB, Vermund SH, Perkins DD, 2015. Monitoring sub-Saharan African physician migration and recruitment post-adoption of the WHO code of practice: temporal and geographic patterns in the United States. *PLoS One* 10: e0124734.
25. Silvestri DM, Blevins M, Afzal AR, Andrews B, Derbew M, Kaur S, Mipando M, Mkony CA, Mwachaka PM, Ranjit N, Vermund S, 2014. Medical and nursing students' intentions to work abroad or in rural areas: a cross-sectional survey in Asia and Africa. *Bull World Health Organ* 92: 750–759.