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Global Chronic Disease Research Training for Fellows: Perspectives, Challenges, and Opportunities

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INTRODUCTION

The growing interest in global chronic disease research is not matched by workforce capacity at present. [1] The dearth of researchers with global chronic disease backgrounds and training has led to the creation of novel funding opportunities for young researchers, particularly fellows. As two cardiology fellows in global cardiovascular disease research training through the US NIH Fogarty International Clinical Research Fellows' (FICR-F) Program, we have a unique perspective to discuss the challenges and opportunities in this area. Here, we present our perspective on potential funding pathways, areas of interest germane to global cardiovascular disease research, the importance of an overseas training component, forms of "home" institutional support that can be helpful, and personal challenges and opportunities which merit consideration.

BACKGROUND OF GLOBAL CHRONIC DISEASE RESEARCH

Global chronic disease research has garnered greater attention recently with several widely publicized reports describing its scope and importance. [1–3] The creation of the Millennium Development Goals (MDGs) by the United Nations in 2000 led to a groundswell of interest in pursuing data-driven research and goal-directed programs toward global development. [4] Three of the MDGs have direct health targets—Reduce Child Mortality, Improve Maternal Health, and Combat HIV/AIDS, Malaria, and Other Diseases—whereas the other MDGs have indirect effects on health through development. Since the creation and subsequent adoption of the MDGs by various global government, non-government, and research organizations, some have argued for the specific inclusion of chronic diseases in the MDGs given their prevalence. [5]

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DISCLOSURES

None.

Publications from the World Health Organization, the Global Alliance for Chronic Disease, the Institute of Medicine, and the National Heart, Lung, and Blood Institute (NHLBI) have outlined the rationale for such global health research, particularly in chronic diseases. [1,6–8] These organizations argue that global chronic disease research has the potential to blunt the economic impact of an unchecked epidemic of chronic diseases. [3,9] Global health research—at least as it pertains to development—is also part of US national policy, with nearly 350% growth in global health program spending by the United States Agency for International Development (USAID) and the State Department from 2001–2008. A recent proposal for the Global Health Initiative includes a request for \$63 billion for funding over the next five years. [1]

Reasons to pursue global health are myriad and include increased immigration to the US and travel of United States residents, globalization of the economy and overseas business interests, more Americans living abroad, the pursuit of global disease reduction, the desire for bidirectional information transfer, intellectual fascination with diseases not commonly seen in one's home country and ethical, humanitarian, and spiritual motivations. Promotion of global health has even been considered to play an important role in improving US national security; one rationale for the development of the President's Emergency Plan for AIDS Relief (PEPFAR) was the potential for destabilization of Africa due to the impact of this disease. [10]

Global chronic disease research, similar to cardiovascular research, requires dedicated time, focus, and mentorship in order to succeed. [11,12] Fellowship is a common time to develop specific areas of research interest and may provide an excellent opportunity to initiate global chronic disease research endeavors before major family and personal ties make prolonged periods away from one's home institution more challenging. As the field of cardiology research expands to overlap with global chronic disease research, it is crucial to produce trainees who will devote a substantial commitment to basic or clinically advanced cardiovascular research and teaching. Such trainees will usually be required to complete a Level 3 Research Track consisting of a minimum of two full years devoted to mentored clinical research. [13]

POTENTIAL FUNDING PATHWAYS

The Table provides a list of selected online resources for trainees to pursue global chronic disease research, including funding sources. Both authors are supported by the NIH FICR-F Program, which is coordinated by the Vanderbilt University Global Health Institute. [14] The fellowship provides: salary stipend, travel expenses, pre-departure expenses (e.g., passport/visa costs, immunizations), overseas health insurance, and direct research support. Applications, including detailed research proposals, are due during November-December, with interviews in February, award announcements in March, and departure in late July/early August. A ten-day orientation at the NIH in early July is also included, which prepares fellows for their experiences through didactic sessions, small group sessions, and meetings with key thought leaders at the NIH.

K level funding (career development grant) is available for postdoctoral scientists to support development of independent scientific careers and for fellow-to-faculty transitions. The K01 International Research Scientist Development Award (IRSDA) has been developed by the NIH Fogarty International Center. This award requires grantees to spend 50% of the grant period conducting research in low-and middle-income countries. Both U.S. and foreign mentors are needed, preferably with a prior collaborative research relationship. The grant is awarded for up to four years. U.S. citizens and permanent U.S. residents are eligible. Other

K levels awards (K08, K23, K99) can be pursued through the various institutes within the NIH, including the NHLBI.

In 2009, The NHLBI in partnership with United Health Group established an overarching network of Collaborating Centers of Excellence (COE) with an ultimate goal of countering the burden of non-communicable cardiovascular and pulmonary diseases (CVPD) in developing nations by enhancing infrastructure and training necessary to conduct innovative and locally-relevant clinical research. [8] Given the NHLBI's investment into the Centers of Excellence, these Centers and others with mature research programs may provide an excellent match for a given interest. K awards give young researchers protected time for this work, which is essential for the development of research projects and careers.

Other prominent funding sources for global chronic disease research training include: NIH T32 training grants or other intramural funding mechanisms through one's home institution, Fulbright Fellowships through the US State Department and *Lancet's* International Fellowship. The Fulbright Fellowship provides support for 9 to 12 months of research in one of over 140 countries. The stipend covers transportation, living expenses, limited health benefits and some support for research. Applications are usually due in October for fellowships commencing in July of the following year. *Lancet* International Fellowships, usually two, are awarded yearly to medical graduates aiming to work in a country very different from their own in delivery of health care, research priorities or educational facilities. The *Lancet* Fellowship must be taken for a minimum of 6 months with applications due in November.

Organizations such as the World Health Organization, the American Heart Association, American College of Cardiology, Oxford Health Alliance, Bill & Melinda Gates Foundation, Doris Duke Charitable Foundation, Foundation LeDucq, and others have funding opportunities for faculty-level global chronic disease research as well. The Consortium of Universities for Global Health can provide the reader a list of universities engaged in global health to help seek additional funding sources.

Another avenue in which to interact with cardiovascular researchers from around the globe and learn about relevant opportunities is the Ten-Day International Teaching Seminar on Cardiovascular Disease in Epidemiology and Prevention. The seminar concluded its 42nd annual session in October 2009 in Hyderabad, India and was hosted by the International Society of Cardiovascular Disease Epidemiology and Prevention, the World Heart Federation, and the Initiative for Cardiovascular Health Research in Developing Countries (IC-Health).

AREAS OF GLOBAL CARDIOVASCULAR DISEASE RESEARCH

Disease Epidemiology

Baseline cardiovascular disease (CVD) epidemiologic data collection and analysis are critical to curbing the CVD epidemic because they provide detailed understanding and context to the problem. Such data collection and analysis help to develop research infrastructure by engaging multiple levels of research activity in the targeted country/locality from biostatisticians to nurses to trainees to senior physicians. Ultimately, as it relates to non-communicable chronic diseases in resource-constrained settings, epidemiologic data will inform policy decisions. [15] Global CVD research also offers the opportunity to study "neglected" cardiovascular diseases, which are not commonly seen in high-income countries. [16] Regions such as sub-Saharan Africa—where tuberculous pericarditis, cardiomyopathies including endomyocardial fibrosis, and rheumatic heart disease are important causes of CVD death and disability[17]—offer unique research opportunities in

understudied areas of global chronic disease. The targets of research should match the needs of the country or region based upon local expertise. Chagas-induced cardiomyopathy in South America is another regional example. Many other types of research can develop once a baseline understanding of the degree and scope of the problem is locally available.

Genetic Epidemiology

Studying the diversity of human life is an important aspect of global chronic disease research. As the scientific interest in chronic diseases grows to encompass regions of the world that have been overlooked, we are presented with an opportunity to understand how the human genome influences an individual's risk for these diseases. Developing countries have been under-represented in genome-wide surveys of human variation. [18] In India, allele frequency differences between groups are larger than in Europe, reflecting thousands of years of endogamy, the practice of preferring marriage within a group. [19]. Africa is the origin of all modern humans, yet, despite the importance of African population genetics, the pattern of genetic diversity across diverse African populations is largely uncharacterized. [20] Characterizing the pattern of genetic variation among ethnically diverse populations is critical for determining the proper design and interpretation of genetic disease association studies. [21] As an example, recently our understanding of the human metabolomic and genomic signatures associated diabetes, insulin resistance and premature coronary artery disease has expanded to consider the etiologic importance of branch-chained amino acids and other metabolites. [22] Considered in a global chronic disease framework, as the authors do, these findings and future research may lend insight into the global epidemiologic transition that underlies established risk factors for disease. The unique ancestry, migration patterns, marrying habits, and resultant genetic architecture of different parts of the developing world carry great implications for our ability to predict and screen for diseases genetically. More research emanating from these regions is necessary to fully optimize our ability to do so.

Health Services and Comparative Effectiveness

Efficient and effective health care delivery for chronic diseases is paramount to manage costs in resource-limited settings. Although lifestyle, diet and medication-based interventions are important for primary prevention, imparting the skills and resources for effective application of knowledge is more crucial. This requires an intact health care delivery system. [23] A cost-effectiveness analysis by Gaziano in 2005 showed that the cost-savings achieved by the use of inexpensive medication in resource-constrained settings are lost when access to hospitals is limited. [24] Meanwhile, hospital-and physician-based care is expensive and not available in many parts of the world.

The implementation of both basic and technologically advanced measures are also unequally distributed. Implementation science, therefore, is key to converting knowledge into improved health in regions of the world where chronic cardiovascular diseases are increasingly prevalent. Although we have not yet proven many cardiovascular treatments in all regions of the world, implementation science encourages health care providers to act and study the best ways to do so when life-saving, proven solutions exist. A 2009 report from the World Health Assembly underscores that in the case of global chronic disease research "...[W]e can always have more evidence but...[W]e now have enough evidence to take action". [25] Understanding how different regions allocate care for primary and secondary prevention of chronic non-communicable diseases is another burgeoning area of research. Observational studies and clinical trials that compare preventive and treatment strategies are needed hand-in-hand with implementation science, quality improvement, safety, health economics, medical anthropology, and health policy research.

Clinical Trials

Clinical trials offer another avenue for global chronic disease research. Large trials are increasingly conducted in low-and middle-income countries, due, in part, to reduced costs. [26] Questions remain about the rigor and standardization of data collection and management in these countries. [27] Participation in global clinical trial research offers a research trainee a unique opportunity to learn about complex challenges specific to the field, such as international ethics board review, informed consent of many participants with cultural and language barriers, and logistical planning with collaborators spread over the globe. As increasing numbers of large clinical trials are performed globally, the US and other high-income countries will be better positioned to lead future trials by preparing trainees in global research.

Social and Environmental Determinants of Health

Unlike the controlled setting of the conventional laboratory, the social realities of populations contain variables that are unknown and unforeseen. [28] To improve the lives of people around the globe, global chronic disease investigators should pay heed to the determinants of health that transcend the traditional biomedical model and contribute to the greater than 30-year difference in life expectancy across selected countries. [29] Climate change, over-crowding, indoor cooking with solid fuels, urban sprawl and deforestation are just a few examples of important non-medical issues in many developing nations that may have effects on cardiovascular health. The WHO Commission on Social Determinants of Health aims to improve the daily living conditions of children, tackle the inequities in power, money, and resources, measure and understand the problem of inequality and assess the impact of action. The creation of dedicated governance addressing health inequalities and of national and global health inequity surveillance systems are two overarching action plans recommended by the Commission. [29] As an increasing number of agencies and organizations become involved with global chronic disease research, the potential to collaborate with investigators from many disciplines and leverage respective expertise also increases.

Basic Science

Global basic science chronic disease research training has often involved trainees from low-and middle-income countries spending several years in a laboratory based in a high-income country. The Fogarty International Research Collaboration Award (FIRCA) affords researchers from low-and middle-incomes the opportunity to partner with NIH-funded US researchers to help develop longer-term collaborations and improve local biomedical research infrastructure. The reverse situation in which a high-income country trainee may now train in a low-and middle-income country is also feasible and may be desired when studying those diseases that are not only understudied but also endemic to a particular region (e.g., Chagas disease basic science research in Peru).

IMPORTANCE OF TRAINING AT FOREIGN SITE

Spending extended time abroad is a critical part of global chronic disease research, particularly for trainees. Research training at a foreign site helps to foster such relationships and demonstrates both an individual and institutional commitment to global health. An ideal experience will include substantial protected time for research, formal mentorship from experienced faculty and opportunities to engage in health care delivery. Sites will vary in their need for research capacity building but an ideal site will at least have mentors and research administrators with a research track record in the field of interest. At least 1–2 years is recommended in order to develop a strong relationship with collaborators, learn the local logistics and develop a greater understanding of regionally-relevant chronic disease

research questions. Dedicated time working with overseas mentors helps to develop a long-term research relationship whereby the trainee has a sufficient opportunity to learn from their overseas mentors and to form professional relationships with other trainees at the foreign site. Intensive experience at a foreign site also affords the trainee an opportunity to interact with that country's national professional societies and attend local scientific meetings.

Field research also develops a skill set rich in problem solving through tackling of the unanticipated logistical problems and working outside one's comfort zone while learning local Good Clinical Practices for research. Trainees who cannot spend extensive time abroad may lack credibility if they are not adequately focused while at their home institution.

Training at the foreign site is essential, and this point cannot be overemphasized; however, when this is not possible, state-side opportunities also exist within universities, foundations, US governmental agencies, non-governmental organizations, international organizations and think tanks (see www.cugh.org for a full listing).

HOME INSTITUTIONAL SUPPORT

Institutional support for fellows interested in global cardiovascular research can take many forms. Because research projects will usually require at least a modest investment of a trainee's time, short site visits (1 to 2 weeks) by the trainee to the international site are important to make sure there is a good fit between the trainee and the site. Financial and logistical support from the home institution to support site visits is critical, since these visits can be the nidus of a successful research endeavor and can be part of a larger undertaking such as vetting sites for future clinical rotations or exchange programs between overseas partners. The objectives of a site visit should include meeting with the principle investigator(s) and mentor(s), introductions to the clinical and research programs, collaborative consultations to identify feasible research priorities, ensuring the ancillary services are en par with Good Clinical Practices, if applicable, and identifying preparations that may need to be made to overcome potential personal, family or professional challenges at the site. Prior to visiting the site, sufficient communication and exchange should occur so that the time on-the-ground is well spent. A site visit, as opposed to medical tourism, is an investment in a research project and involves thoughtful deliberations between the trainees and mentors.

Investigators at the beginning of their careers in global cardiovascular health may have to spend time in activities that are not usually perceived as productive efforts. Home institutions should be cognizant of this characteristic. In 2010, the efforts devoted towards global chronic disease research will initially focus on capacity building in many instances. Within the field of cardiology, the capacity building may take the form of education, clinical training, technical training, database development, procurement of equipment, hiring and training of staff or building infrastructure. Often these tasks will fall to one or few people. Moreover, the time it takes to accomplish these tasks may be difficult to forecast in novel settings. Institutional recognition of the importance of this initial capacity building, however, cannot be overstated as these types of investments are exceedingly important in global health research despite this being a period of few, if any, publications or grants awarded. The next generation of clinical leaders in global cardiovascular health, like prior generations, needs appropriate resources, time, and support to maintain a scholarly culture that is crucial for medicine's preferred future. [30] Senior members of the faculty serving in mentorship and "protective" roles are important in this regard. Mentors can also help trainees stay connected to their home institution and avoid being "out-of-sight, out-of-mind". The limited number of US-based global chronic disease research mentors within

cardiology is a challenge for the trainee who may have to reach across departments, schools or universities to find a good match.

Efforts directed towards capacity-building early in one's career as a clinician-investigator leave relatively less time to engage in other important activities such as scholarship, teaching, clinical duties and contributions to the community. It follows then that the portfolio for a global health researcher also deserves particular attention as it relates to guidelines for promotion and tenure. Similarities can be found in the development of guidelines for promotion and tenure for clinician-educators in the mid-1990s. [30] At that time, the increase in the number of faculty interested in a clinician-educator track preceded the development of academic policies regarding reappointment, promotion, tenure and institutional commitment. Most departments of medicine established special promotion tracks as a response to a growing need. However, prior to the institution of guidelines by the Society of General Internal Medicine criteria were not standard across universities. [32] As a result, criteria related to reappointment, promotion, scholarship and research were delineated. [33]. At the outset, however, it was the recognition of the unique attributes, interests and trajectory of this growing group of young investigators that fostered the establishment of a new faculty track.

Although global health is experiencing an unprecedented surge of attention on university campuses, as a discipline, global chronic disease research is in its infancy. [34] Within US academic medical subspecialties, mentors with the interest, experience and successes in global chronic disease research are few. This can be a strain for the few mentors in the field in junior faculty positions as a growing number of trainees contact a finite number of potential mentors. In the last five years across all 27 national institutes and centers of the NIH, there have been fewer than ten new R level awardees whose projects encompass some form of global health endeavors in cardiovascular disorders; the majority of these awards have been through the John E. Fogarty Center (RePORTER database). K level awardees are even fewer.

Among traditional rewards for medical faculty, promotion and tenure remain the most valued. Most young faculty would ultimately like to attain the rank of full professor. [35] Thus, guidelines maybe necessary to assist academic departments in the important task of selecting, supporting and rewarding clinical investigators in global chronic disease research. Guidelines could enhance the contributions and impact of academic clinical departments to the discipline of global health, particularly for those that fall outside of traditional venues of global health research(e.g., Schools of Public Health, Departments of Community or Preventive Medicine, Divisions of Infectious Disease).

PERSONAL CHALLENGES

There are two other challenging aspects of this novel field that deserve mention: family and finances. Many trainees at this level have spouses, significant others and/or children. In our cases, we have both chosen to take our families overseas with us during this year. The decisions to do so have taken into account spouses' foregoing employment in the US and potential employment at the foreign site, special needs children, quality of primary education available at the foreign site and region-specific challenges such as diet, language, transportation safety, quality of emergency medical services and the political climate. Interpretations of the concepts of privacy, personal space, social interactions and interpersonal communication can also be a challenge for a newcomer to a different culture. The availability of email, text-messaging, smart phones, high-bandwidth internet access and voice over internet protocols (VOIP) at the foreign site can virtually shorten the distance between loved ones.

We have also experienced novel financial costs associated with exploring our interests in global health cardiology. One-time costs for vaccinations, visas, travel and foreign medical licenses can be expected. These costs for significant others and children are not included in the funding mechanisms mentioned above. Income generating activities that may have been available at the home institution (i.e., moonlighting, locums, etc.) are usually not replicable or feasible at the foreign site. Other practical issues such as renting one's home, storage of vehicles or other property and property management may be individually pertinent.

PERSONAL OPPORTUNITIES

The collaborations that are possible within global chronic disease research are unique and stimulating. The coming together of different perspectives, cultures, habits, languages and educational experiences can offer a trainee an invaluable research experience. These differences, when properly analyzed, can significantly improve one's ability to generate questions both at home and abroad. Perhaps more important, however, is the opportunity to challenge one's own inherent assumptions and allow for fresh perspectives to address these questions.

Exposure to clinical cardiology in developing countries is a rare opportunity that offers several advantages. (1) The spectrum of disease is different. Nutritional, congenital, rheumatic and infectious cardiovascular diseases are likely to be more prevalent than in most developed areas of the United States. (2) Common diseases (by US standards) present differently. Where primary and preventive care and emergency medical services are lacking, hypertension, diabetes and ischemic heart disease are more likely to present at advanced stages. (3) Treatment options vary by region. These differences can range from a different formulary of medications to the presence or absence of echocardiography or a cardiac catheterization lab. (4) Clinical skills therefore become more important. It has been said that excessive fear of lawsuits and technology has led to the demise of the physical exam. [35] Free from these impediments, clinicians in resource-constrained settings must learn to make clinical decisions based on what they see and hear. Acquisition and honing of these skills are directly applicable in developed country settings, especially when there is economic hardship.

In addition to the scholarship associated with these global chronic disease research experiences, the bi-directional exchange of knowledge and collaboration between institutions can also be fruitful. Students, residents and fellows may engage in clinical exchange programs. Virtual case conferences using high-speed Internet and VOIP are possible as is the exchange of curricula and coursework. At the faculty level, symposia and continuing medical education activities can be arranged between US-based and foreign experts in the field during site visits. These relationships can also serve as an institutional bridge for D43 International Training Grants and other significant training collaborations.

Finally, there is the potential for personal growth that goes along with a portfolio of global experiences. Cultural competence, interpersonal and communication skills, compassion, problem-solving, resourcefulness and appreciation of the global context of one's circumstance are just a few of the lasting benefits of a meaningful global chronic disease research experience. [37] Paraphrasing Mark Twain, "Broad, wholesome, charitable views of men and things..." are difficult to acquire without travel. [38]

SUMMARY

Global chronic disease research is in its infancy and appears to be a growing field, in response to the rise of chronic diseases worldwide and with commensurate increases in funding opportunities and avenues of research. Overseas training and home institutional

support are two keys to successful research collaborations for fellows as they transition to junior faculty positions. The professional and personal challenges within global health research may be unique to this field, but the potential opportunities seem to be boundless.

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References

1. Institute of Medicine. National Academies Press; Washington, DC: 2009 [Accessed 20 August 2009]. The U.S. Commitment to Global Health: Recommendations for the Public and Private Sectors. Available through <http://www.nap.edu/catalog/12642.html>
2. WHO Global Burden of Disease: 2004 Update. Geneva: World Health Organization; 2004.
3. Leeder, S.; Raymond, S.; Greenberg, H.; Liu, H.; Esson, K. A Race against Time: The Challenge of Cardiovascular Disease in Developing Countries. Trustees of Columbia University; New York, NY: 2004.
4. UN Millennium Development Goals. [Accessed 20 August 2009]. Available at: <http://www.un.org/millenniumgoals>
5. Fuster V, Voute J. MDGs: chronic diseases are not on the agenda. *Lancet* 2005;366:1512–4. [PubMed: 16257330]
6. WHO Global Report. Preventing chronic diseases: a vital investment. [Accessed 27 August 2009]. Available at: http://www.who.int/chp/chronic_disease_report/part1/en/index.html
7. Daar AS, Singer PA, Persad DL, Pramming SK, Matthews DR, Beaglehole R, Bernstein A, Borysiewicz LK, Colagiuri S, Ganguly N, Glass RI, Finegood DT, Koplan J, Nabel EG, Sarna G, Sarrafzadegan N, Smith R, Yach D, Bell J. Global Alliance for Chronic Disease. Grand challenges in chronic non-communicable diseases. *Nature* 2007;450:494–6. [PubMed: 18033288]
8. National Heart, Lung, and Blood Institute's Global Commitment. [Accessed 27 August 2009]. Available at: <http://www.nhlbi.nih.gov/about/globalhealth/commitment/index.htm>
9. Mathers CD, Adam T, Ortegón M, Strong K. The burden and costs of chronic diseases in low-income and middle-income countries. *Lancet* 2007;370:1929–38. [PubMed: 18063029]
10. Pereira, R. PEPFAR as counter in surgency technology: How does HIV/AIDS relief relate to U.S. global security doctrine relate?. International Studies Association 2009 Meeting; [Accessed 27 August 2009]. Abstract available at: http://www.allacademic.com/meta/p312792_index.html
11. Fuster V. Symposium presentations: how to become a cardiovascular investigator. *J Am Coll Cardiol* 2005;46:A5–A70. [PubMed: 16182079]
12. Braunwald E. Adventures in cardiovascular research. *Circulation* 2009;120:170–80. [PubMed: 19597062]
13. Loscalzo J, Tomaselli GF, Vaughan DE, Walsh RA. Task Force 7: Training in cardiovascular research. *J Am Coll Cardiol* 2008;51:380–3. [PubMed: 18206756]
14. Vermund SH, Sahasrabudhe VV, Khedkar S, Yujiang Jia, Etherington C, Vergara A. Building global health through a center-without-walls: the Vanderbilt Institute for Global Health. *Acad Med* 2008;83:154–64. [PubMed: 18303361]
15. Mbewu, A.; Mbanya, JC. Chapter 21: Cardiovascular Disease. In: Jamison, DT.; Feachem, RG.; Makgoba, MW.; Bos, ER.; Baingana, FK.; Hofman, KJ.; Rogo, KO., editors. *Disease and Mortality in Sub-Saharan Africa*. 2. World Bank; 2006.
16. Commerford P, Mayosi B. An appropriate research agenda for heart disease in Africa. *Lancet* 2006;367:1884–6. [PubMed: 16765744]
17. Damasceno A, Cotter G, Dzudie A, Sliwa K, Mayosi BM. Heart failure in sub-saharan Africa: time for action. *J Am Coll Cardiol* 2007;50:1688–93. [PubMed: 17950152]

18. Reich D, Thangaraj K, Patterson N, Price AL, Singh L. Reconstructing Indian population history. *Nature* 2009;461:489–94. [PubMed: 19779445]
19. Chakravarti A. Human genetics: Tracing India's invisible threads. *Nature* 2009;461:487–8. [PubMed: 19779444]
20. Tishkoff SA, Reed FA, Friedlaender FR, Ehret C, Ranciaro A, Froment A, Hirbo JB, Awomoyi AA, Bodo JM, Doumbo O, Ibrahim M, Juma AT, Kotze MJ, Lema G, Moore JH, Mortensen H, Nyambo TB, Omar SA, Powell K, Pretorius GS, Smith MW, Thera MA, Wambebe C, Weber JL, Williams SM. The genetic structure and history of Africans and African Americans. *Science* 2009;324:1035–44. [PubMed: 19407144]
21. Campbell MC, Tishkoff SA. African genetic diversity: implications for human demographic history, modern human origins, and complex disease mapping. *Annu Rev Genomics Hum Genet* 2008;9:403–33. [PubMed: 18593304]
22. Shah SH, Hauser ER, Bain JR, Muehlbauer MJ, Haynes C, Stevens RD, Wenner BR, Dowdy ZE, Granger CB, Ginsburg GS, Newgard CB, Kraus WE. High heritability of metabolomic profiles in families burdened with premature cardiovascular disease. *Molecular Systems Biology* 2009;5:258–61. [PubMed: 19357637]
23. Mensah GA. Ischaemic heart disease in Africa. *Heart* 2008;94:836–43. [PubMed: 18552223]
24. Gaziano TA. Cardiovascular disease in the developing world and its cost-effective management. *Circulation* 2005;112:3547–53. [PubMed: 16330695]
25. Time to act: the global emergency of non-communicable diseases. Geneva: World Health Assembly; 2009. World Health Assembly Report on 'Health and Development: Held Back by Non-Communicable Diseases'.
26. Institute of Clinical Research (India) forecasts. [Accessed 27 August 2009]. Available at: <http://www.icriindia.com/forecasts.htm>
27. Glickman SW, McHutchison JG, Peterson ED, Cairns CB, Harrington RA, Califf RM, Schulman KA. Ethical and scientific implications of the globalization of clinical research. *N Engl J Med* 2009;360:816–23. [PubMed: 19228627]
28. Schuftan, C. The role of ethics and ideology in our contribution to global health; *Global Health Action*. 2009 [Accessed 18 January 2010]. p. 2 Available at: <http://www.globalhealthaction.net/index.php/gha/issue/view/282>
29. WHO Commission on Social Determinants of Health: Closing the gap in a generation. Geneva: World Health Organization; 2008.
30. Califf RM. Key issues for global cardiovascular medicine. *Lancet* 2009;374:508–10. [PubMed: 19683629]
31. Jacobs MB. Guidelines for the evaluation and promotion of clinician-educators. *Acad Med* 1993;68:126–8. [PubMed: 8431229]
32. Jones RF, Froom JD. Faculty and administrative views of problems in faculty evaluation. *Acad Med* 1994;69:476–83. [PubMed: 8003167]
33. Lubitz RM. Guidelines for promotion of clinician-educators. The Society of General Internal Medicine Education Committee. *J Gen Int Med* 1997;12 (Suppl 2):571–8.
34. Merson, M.; Page, K. Dramatic expansion of university engagement in global health: implications for U.S. policy. Washington, DC: CSIS Global Health Policy Center; 2009.
35. Clawson D. Infrastructure, tenure and the future of the University. *Science* 2009;324:1147–1148. [PubMed: 19478168]
36. Jauhar S. The demise of the physical exam. *N Engl J Med* 2006;354:548–51. [PubMed: 16467540]
37. Kollar SJ, Allinger RL. International clinical experiences: long-term impact on students. *Nurse Educ* 2002;27:28–31. [PubMed: 11840069]
38. Twain, M. *The innocents abroad*. New York, NY: Literary Classics of the United States Inc; 1984.

Table

Selected online resources for trainees in global chronic disease research.

Resource	Website
<i>Funding</i>	
Fogarty International Clinical Research Fellowship (FICR-F) Program	www.fic.nih.gov/programs/training_grants/nih_fogarty.htm
Fogarty International Research Scientist Development Award	www.fic.nih.gov/programs/training_grants/irsd.htm
National Institutes of Health Career Development (K-level) Awards	www.grants.nih.gov/training/careerdevelopmentawards.htm
Fulbright Fellowship	www.fulbright.org
Lancet International Fellowship	www.thelancet.com
Bill and Melinda Gates Grand Challenges	www.grandchallenges.org
Doris Duke Charitable Foundation	www.ddcf.org
Foundation LeDucq	www.fondationleducq.org
<i>General Information</i>	
Consortium of Universities for Global Health	www.cugh.org
WHO Department of Chronic Disease and Health Promotion	www.who.int/chp/about/en/index.html
National Heart, Lung and Blood Institute Centers of Excellence Global Health Program	www.nhlbi.nih.gov/about/globalhealth
ProCor	www.procor.org
Vanderbilt Global Health Institute	www.globalhealth.vanderbilt.edu
Oxford Health Alliance	www.oxha.org
The Initiative for Cardiovascular Health Research in Developing Countries(IC-Health)	www.ichealth.org
National Forum for Heart Disease and Stroke Prevention, Regional & Global Partnerships (Implementation Group)	www.hearthealthystrokefree.org/implementation-partnerships.aspx