

## Perspective Piece

### Interdisciplinary Postdoctoral Training in Global Health through a Novel Joint Project for Trainees from Diverse Disciplines: Benefits, Risks, and Observations

Richard A. Oberhelman,<sup>1,2\*</sup> Cynthia Anticona Huaynate,<sup>2,3</sup> Malena Correa,<sup>2,3</sup> Holger Mayta Malpartida,<sup>2,3</sup> Monica Pajuelo,<sup>2,3</sup> Valerie A. Paz-Soldan,<sup>1,2</sup> Robert H. Gilman,<sup>3,4</sup> Mirko Zimic,<sup>5</sup> Laura Murphy,<sup>1</sup> and Jose Belizan<sup>6</sup>

<sup>1</sup>Department of Global Community Health and Behavioral Sciences, Tulane University School of Public Health and Tropical Medicine, New Orleans, Louisiana; <sup>2</sup>Office of Global Health, Tulane University School of Public Health and Tropical Medicine, New Orleans, Louisiana; <sup>3</sup>Universidad Peruana Cayetano Heredia, Lima, Peru; <sup>4</sup>Department of International Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland; <sup>5</sup>Laboratory of Bioinformatics and Molecular Biology, Department of Cellular and Molecular Science, Faculty of Science, Universidad Peruana Cayetano Heredia, Lima, Peru; <sup>6</sup>Instituto de Efectividad Clínica y Sanitaria, Buenos Aires, Argentina

**Abstract.** Postdoctoral training programs are usually highly individualized arrangements between trainees and a limited number of senior mentors in their field, an approach that contrasts with current trends in public health education that promote interdisciplinary training to spur innovation. Herein, we describe an alternative model for postdoctoral training for a group of fellows from distinct disciplines. Fellows work with mentors from diverse fields to create a joint research project or a group of complementary projects, with the goal of developing a new device, intervention, or innovation to address a global health problem. The perceived benefits, challenges, and limitations of this team approach to interdisciplinary postdoctoral training are presented.

Postdoctoral training programs are a common mechanism for bridging the gap between the completing a doctoral degree and starting an academic career, especially in natural and biomedical science fields. Although these programs are often informal arrangements between the postdoctoral trainee and their senior mentor(s), they are usually highly specialized, with the goal of providing research training that will establish the trainee as a bona fide expert in the narrow field chosen. This deliberate, highly individualized approach with a limited number of mentors with expertise in the chosen field is somewhat at odds with current trends in higher public health education, which increasingly emphasize the value of interdisciplinary training, translational science, and solution-oriented, experiential learning—that is, interdisciplinary training that encourages researchers to evaluate public health problems and potential solutions from multiple perspectives (e.g., clinical, social/behavioral, technical/engineering, business, and financial) and to draw on these data to design and evaluate novel and innovative interventions to address these public health problems.<sup>1–4</sup> For the postdoctoral scholar, the conventional mode of interdisciplinary training is to work with a team of mentors from different disciplines, but the training is still largely led by the individual trainee who is charged with integrating and synthesizing input from the mentors.

We have implemented an alternative approach with a postdoctoral fellowship program designed for teams of trainees, breaking out of the individualized mold, to allow these young professionals to work together with an interdisciplinary team of mentors on a challenging issue that can be addressed from multiple perspectives (e.g., clinical, engineering, social, environmental, etc.). Over the past 4 years our program based on this model has been sponsored by the “Framework Programs for Global Health Innovation” D43

training program through the National Institutes of Health Fogarty International Center. We completed the 18-month training period for our first cohort of four postdoctoral fellows, and currently are halfway through the training period for the second cohort of three fellows. The purpose of this report is to describe this alternative approach to interdisciplinary training and to share experiences, benefits, and challenges.

#### PROGRAM DESIGN

The program is called Inter-American Training Program for Innovations in Emerging Infectious Diseases (IATIEID) based at Tulane University School of Public Health and Tropical Medicine. Consortium institutions include Johns Hopkins University (Baltimore, MD), Universidad Peruana Cayetano Heredia (Lima, Peru), Universidad Nacional de Ingeniería (Lima, Peru), and the Instituto de Efectividad Clínica y Sanitaria (Buenos Aires, Argentina). As described on our website:

*The primary objective of this training program is to foster true innovation by mixing program fellow trainees from diverse disciplines and creating an environment that requires trainees to get out of their “comfort zones” and “think outside the box.” Within the program theme of emerging infectious diseases, post-doctoral trainees receive individually tailored mentored training experiences and work together as a team. Together, the team identifies problems in the diagnosis, management, or control of infectious diseases. The trainees create a joint research project or a group of complementary projects, bridging disciplines to develop a new device, intervention, or innovation to address the problem.*

We solicited program applications from postdoctoral trainees with working conversational fluency in English and Spanish, with the goal that the majority of fellows in each cohort of 3–4 trainees would be from Latin American

\*Address correspondence to Richard A. Oberhelman, Department of Global Community Health and Behavioral Sciences, Tulane University School of Public Health and Tropical Medicine, 1440 Canal Street, Suite 2301, New Orleans, LA 70112. E-mail: oberhel@tulane.edu

institutions. We also sought diversity of disciplines, as eligible applicants could come from the liberal arts, social sciences, natural sciences, engineering, or public health.

Our initial cohort included four fellows, representing the following countries and disciplines: 1) a dentist from Peru with a PhD in Epidemiology and Public Health, with background in community and behavioral research; 2) a physician and infectious diseases specialist from Argentina; 3) a biologist from Peru with PhD in International Health, with background in molecular biology; and 4) a pharmacist and biochemist from Peru with PhD in International Health, with background in statistics. Disciplines represented by the mentors included medicine, public health, social sciences, computer sciences, implementation science, and engineering.

The 18-month training program consisted of the following components:

#### INITIAL TRAINING EXPERIENCE

Training began with a 10-day core group training session at Tulane University led by key faculty from Social Sciences, Biomedical Engineering, and Public Health. These core classes covered topics relevant to all trainees, such as responsible conduct of research, grant writing, scientific publication writing, research and grants strategy, and research design skills related to the various disciplines represented in the consortium. A novel component is that we offer training in social innovation for the postdoctoral fellows, to include instruction in methods of human-centered design or “design thinking.”<sup>5</sup> This is a collaborative, creative approach to problem-solving that is spreading to public health, humanitarian, and development sectors.<sup>6</sup> Fellows are guided to apply ethnographic and participatory investigations to understand the context and gain empathy with “users” (e.g., patients, medical professionals, technicians). From this deeper understanding emerge insights and reframing of problems. Diversity on the team—public health, engineering, clinical medicine—helps inspire creative “out of the box” solutions for specific users and contexts. Then, rapid and rough prototyping, rather than a single extended design phase, helps to quickly develop and test proposed solutions.

#### PERU- AND ARGENTINA-BASED RESEARCH EXPLORATORY PERIOD

After the introductory session, trainees traveled to Peru for a 2-month exploratory period to become familiar with an array of interdisciplinary research involving consortium faculty. Participants visited multiple project sites, including laboratory facilities and community field-based research sites.

During the exploratory period, the team identified a research problem and formulated an interdisciplinary research plan for the 9- to 11-month project. The cohort identified a faculty Mentoring Committee (primarily steering committee members) from the United States and overseas consortium institutions listed above. The mentoring committee met with fellows weekly, in person or by phone or Skype (Microsoft Corporation, Luxembourg, Luxembourg). During the final stages of the exploratory period, fellows proposed a joint research project that addresses a problem in the diagnosis, management, or control of an emerging infectious disease, with the objective of finding a solution—a new

device, intervention, or innovative technique designed to mitigate the problem.

#### JOINT RESEARCH PROJECT (9–11 MONTHS TOTAL)

The global health issue chosen as a research theme by the first cohort was the impact of childhood pneumonia in rural areas of developing countries, and low-cost, practical methods for detecting pneumonia in children in these settings. The interdisciplinary approach guided this team of postdoctoral scholars to examine the problem from multiple perspectives, with each fellow bringing different skill sets to address the problem. Each project was led by a single fellow, but all were team-based projects. Fellows pursued both high- and low-risk projects, with data from low-risk projects 2 and 3 serving to inform development of new technologies elaborated in Project 1. Risk levels for projects were assessed based on the complexity of the data generated and analytical methods required, accessibility of potential study participants, and perceived likelihood of negative results or inconclusive outcomes.

In Project 1, the fellows worked with mentors in biomedical engineering to design and refine an artificial intelligence algorithm for an ultrasound device to screen for pneumonia in children from resource-poor settings (Project 1: [high risk] “Low-cost non-imaging ultrasound [LoCoNiUS] for pneumonia detection in resource-constrained settings”). Parallel related projects explored 1) social determinants of severe/fatal pneumonia in the Peruvian Amazon, where mortality from pneumonia is higher than in other regions (Project 2: [low risk] “Biological, clinical, and social factors related to child pneumonia mortality in Loreto, Peru”), and 2) perceived needs and challenges for young medical doctors working in government-run clinics in rural Peru (recent medical graduates) regarding diagnosing diseases like pneumonia that depend on technologies that are often not available (Project 3: [low risk] “Innovations to address diagnostic needs and challenges in rural areas: insights of junior medical doctors at the frontlines of rural care in Peru”).<sup>7</sup>

#### FINAL SYMPOSIUM

The fellowship program for cohort 1 ended in October 2014. The program “graduation” was commemorated with a 2-day End of Training Symposium in Lima, Peru, attended by 60 people—fellows, Steering Committee, Advisory Committee, local collaborators and postdoctoral trainees from other Peruvian institutions. The program included presentations by each fellow, panel discussions about the fellowship program model, and guest presentations by local health research leaders and global health fellows.

#### STRENGTHS AND LIMITATIONS OF THIS NOVEL APPROACH

Both fellows and faculty have reflected on the benefits, challenges, and limitations of this team approach to interdisciplinary postdoctoral training in global health (Table 1). All participants identified many benefits, including:

1. Learning opportunities: The program provided a unique opportunity to branch out into new areas of study that the fellow would not ordinarily explore. One trainee who

TABLE 1

Perceived strengths, challenges, and limitations of the interdisciplinary team approach to postdoctoral public health research training based on input from program participants and faculty members

Perceived strengths	Perceived challenges and limitations
Expanded learning opportunities	Uncertainty about project directions, pending team-based decision-making
Multiple team members dedicated to specific tasks, so work was completed faster than usual	High maintenance by faculty leaders
Encouraged novel ideas and innovation	Uncertain group dynamics
	Balancing team and individual needs

had worked mostly in the laboratory chose to lead a project on social determinants, which she had always been interested in but had not pursued. One of the trainees commented: “We got to work as a team for most of the time, as we were able to develop a of sense of ownership and cohesiveness, while we were allowed to find our own path and create and develop a line of investigation, which in my opinion, is one of the biggest strengths of the program.” Having the freedom to choose their own research topic was key to develop a sense of ownership and provided motivation to pursue the projects.

Working together on multiple projects led by individual fellows, but having all fellows participate in each project offered both benefits and challenges. This arrangement increased the potential for publications and strengthened each project, but with fellows from diverse disciplines, their working relationship was more complex (i.e., more people involved in reaching a consensus) and at times more effort was needed to reach an agreement. Nevertheless, the fellows developed a strong group identity and were motivated to reach agreements when necessary, with assistance on occasion from faculty mentors, and the end products were often enriched by the team approach. For example, the choice of the research theme required extensive group discussion with mapping of “pros and cons” for several potential topics, but working through that process provided an excellent learning opportunity on negotiation and consensus-building.

2. **Faster teamwork:** Working as a team made it easier to share responsibility for tasks and progress more rapidly to complete these tasks, including protocol and standard operating procedure development, institutional review board approvals, staff training, etc. Several working rela-

tionships that developed within the cohort continued after the program ended, and joint projects and funding applications were initiated outside of the fellowship.

3. **Innovation:** Novel ideas were encouraged by the social innovation training (human-centered design, social entrepreneurship strategies) and disciplinary diverse disciplines represented by members of the fellows team. This led to other funding which in turn expanded the scope of the program and allowed the fellows to be key investigators, not just trainees. The LoCoNiUS project is continuing beyond the initial cohort training period and expanding, thanks to funding from two Grand Challenges Canada grants, one to IATIEID fellow Malena Correa and another to IATIEID faculty mentor Mirko Zimic.

A standard fellowship emphasizes individual scientific knowledge, professional development, academic careers, and science-based innovation process. Social innovation training complements these foundations in the sciences. A social innovation toolkit includes human-centered design to generate ideas in relation to the health challenge, as well as business and leadership skills to advance them in the world (Table 2). Exposure to creative business strategy tools, such the business model canvas and lean-launch pad, can help fellows develop ideas into social ventures, such as with the continued funding for the LoCoNiUS project.

Nevertheless, the program model also presents many challenges:

1. **Uncertainty:** Fellows and faculty do not have a fixed roadmap or scope of work when the program starts. This generates anxiety and pressure to define a project but with limited time and funding. This anxiety was fortunately diminished once the fellows began working together and generated concepts to pursue.
2. **High maintenance:** This model demands considerable attention, emotional intelligence, and discernment from faculty on the Steering Committee—much more than scientific expertise in individual fields. The weekly internet video conferences with fellows and Steering Committee members (faculty representing different disciplines, located in several locations in the United States and in Peru) were tedious to maintain over many months. Nevertheless, these were critical in setting short-term goals for specific tasks (weekly project recruitment, preliminary analyses, drafting reports, etc.) that were very useful for maintaining project progress on a limited time frame, keeping fellows and projects on track for successful completion.

TABLE 2

Contrasting skills applied through conventional and social innovation-inspired postdoctoral fellowships

Skills dimension	Fellowship	
	Conventional toolkit calls for	Social innovation toolkit can add
Knowledge basis	Scientific disciplines are central	Inter- and transdisciplinary approaches
Professional development	Traditional academic career	Academic + entrepreneurship/intrapreneurship
Individual, team	Individual career focus	Team-oriented, collaborative
Financial models	Traditional research grants	Prizes, phased challenge grants, social venture model
Innovation processes and incentives	Applied scientific research, technology-centered innovation, patents	Human-centered design, creativity, rapid prototyping, creative commons

The 18-month time frame for the fellowship was short enough that it made the time away from individual pursuits more appealing for applicants, but the short time frame also presented challenges. The time frame was partially a result of funding limitations, and it resulted in some feeling of urgency to “keep things moving.” Although the fellow team completed the research proposed in the allotted time, more time was needed for final analysis and drafting publications. However, the team spirit generated by the program also facilitated completion of remaining fellow tasks after the official end date.

3. Group dynamics: Group activities have predictable potential pitfalls, including personality conflicts, variations in individual effort, etc. Although all trainees were dedicated and invested, rough spots emerged. Faculty need to be attuned to group dynamics, cultivate “soft-skills” so as to guide fellows to resolve issues themselves as young professionals able to work on diverse teams (not just as individual scholars in their fields).
4. Balancing team versus individual needs: This team-based initiative contrasts with the traditional postdoctoral scholar program, which often involves a highly individualized scope of work that may include writing a K01 proposal. The novelty of the group fellowship and shorter program duration (18 months) make the program attractive despite lack of focus on their individual needs. Still, this is the period when young professionals need to develop the skills to succeed in academic research setting and advance professionally. Thus, we have made changes for the second cohort to address individual training needs (supporting time for individual activities such as conference presentations, individual training grant applications, etc.) while continuing with the group projects.

Most postdoctoral programs are not described in academic publications, and we were unable to find literature describing similar models in biomedical or global health training. Yet, many academic institutions, funding agencies, and certifying bodies promote the value of interdisciplinary training. This is often accomplished by having trainees seek out and consult specialists outside their field.<sup>8</sup> Thus, while many programs promote the value of interdisciplinary approaches, this is usually accomplished through diversity of faculty mentor disciplines rather than through programs that combine postdoctoral trainees from different disciplines, an alternative and complementary approach to achieving interdisciplinary training.<sup>9</sup> The interdisciplinary nature of our team of fellows, all of whom participated as coinvestigators on projects utilizing methodologies which might be outside of their fields (including computer science, social sciences, and clinical medicine), enriched the learning experience by periodically immersing the fellows in new disciplines and methods, as compared with simply “drawing on” complementary methods for ancillary support in the traditional postdoctoral fellowship.

Although our experience to date has been favorable, participating in this model implies some risks. There is no guarantee that a feasible joint project will emerge, so there is the risk of not accomplishing this major objective. Faculty and fellows from diverse disciplines need to sacrifice some personal goals for the sake of team goals and objectives. They need to set attainable, measurable research goals, recognizing

a fairly steep learning curve for fellows and faculty advisors in the early stages of working as a research team. The potential benefits of the interdisciplinary approach must outweigh the risk for the fellow (i.e., risk from what might seem a diversion of time); so the attitude and aspirations of the individual trainee is critical in this risk/benefit analysis. The goals need to be more flexible and less individually ambitious than for conventional training programs.

In sum, our experience with a postdoctoral training model based on an 18-month interdisciplinary joint project fellowship demonstrates that this higher-risk approach (more dependent on team dynamics and on effective guidance and support by interdisciplinary mentors) can have major rewards, while recognizing that there are risks involved and outcomes may not always be predictable.

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Authors' addresses: Richard A. Oberhelman, Valerie A. Paz-Soldan, and Laura Murphy, Department of Global Community Health and Behavioral Sciences, Tulane School of Public Health and Tropical Medicine, New Orleans, LA, E-mails: oberhel@tulane.edu, vpazsold@tulane.edu, and lmurphy2@tulane.edu. Cynthia Anticona Huaynate and Malena Correa, Office of Global Health, Tulane University School of Public Health and Tropical Medicine, New Orleans, LA, E-mails: cynthiaanticona@hotmail.com and malenacorrea1@gmail.com. Holger Mayta Malpartida, Office of Global Health, Tulane School of Public Health and Tropical Medicine, New Orleans, LA, and Laboratorio de Investigación de Enfermedades Infecciosas, Universidad Peruana Cayetano Heredia, Lima, Peru, E-mail: hmayta@gmail.com. Monica Pajuelo, Biochemistry and Molecular Biology, Universidad Peruana Cayetano Heredia, Lima, Peru, and Office of Global Health, Tulane University School of Public Health and Tropical Medicine, New Orleans, LA, E-mail: mjpajuelo@gmail.com. Robert H. Gilman, Department of International Health, Johns Hopkins University, Baltimore, MD, and Bioinformatics Unit, Biochemistry and Molecular Biology, Universidad Peruana Cayetano Heredia, Lima, Peru, E-mail: gilmanbob@gmail.com. Mirko Zimic, Bioinformatics Unit, Biochemistry and Molecular Biology, Universidad Peruana Cayetano Heredia, Lima, Peru, E-mail: mirko.zimic@upch.pe. Jose Belizan, Instituto de Efectividad Clínica y Sanitaria, Buenos Aires, Argentina, E-mail: jbelizan@iecs.org.ar.

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