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Mentoring in Global Cancer Research Training

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Abstract
This manuscript illustrates general concepts of mentoring in low- and middle-income countries (LMICs). The focus of this manuscript is on public health research based on our experiences with the Cancer Epidemiology Education in Special Populations (CEESP) Program which is further illustrated in this Supplement. While the CEESP Program provides research training in global and US minority settings, this manuscript is focused on the global aspects of the program. We describe the process of selecting students into the CEESP Program, the process of mentoring them, and the preparation of the mentoring sites. We emphasize the review of the CEESP mentors in LMICs and put forward recommendations for enhancing their mentoring skills and disseminating the experience to other US and global institutions interested in global cancer education.

Keywords Mentoring · Global · Low- and middle-income countries · Cancer education · Research training

Mentoring

The term mentor is based on a character in the Homer's Odyssey who, when his friend went off to the Trojan war, stayed behind to instruct his son and enable him to look after his father's affairs while he was gone. Mentoring has become synonymous with coaching or assisting someone to do a job effectively, skillfully, and to excel in a particular career. Mentoring is a professional relationship by which a senior, passionate, and experienced person shares experiences and helps guide the career of someone who is usually junior [1]. Mentoring was traditionally practiced by intuition and based on personal interest of a mentor [2]. Historically, mentoring emerged from investing in someone else's career development without formal mentoring of the mentor [3]. Mentoring has long been part of training both in and out of academia. For example, apprenticeship in the trades and medicine in the nineteenth and early twentieth century, mentoring originated as non-traditional in high-income countries' academics in the past few decades and is emerging today as a recognized and essential instructional method [4–7].

Mentorship has proven to be a key element in promoting and maintaining productivity and learning of students. This is more important for training the new generation of millennium students and their needs for non-traditional non-didactic and hands-on training and individualized learning and possibly curricula [8, 9]. Compacts between mentors and mentees about their responsibilities have been developed and used for training and proved their effectiveness and efficiency [10].

While mentoring was traditionally known in medicine as shadowing senior physicians, it has evolved in academic medicine as pro-active structured guidance and planning for career development [11]. In public health, well-trained scientists are essential to answering complicated and challenging health problems [12]. Complex problems, like cancer, require multidisciplinary teams equipped with advanced capabilities, creative non-traditional solutions, and readiness for innovation. Key attributes of a successful mentor include being active listeners, accessible, enthusiastic, empathetic, and non-directive facilitators [13].

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Global Health Mentoring

For decades, global health research in low- and middle-income countries (LMICs) has been focused on infectious diseases. Students from US academic institutions had opportunities for mentorship in field research in LMICs through the funding and field presence of their US faculty. Also, several NIH, CDC, and other federal funding mechanisms have provided mentorship for local faculty in LMICs in their home countries or in the USA. Also, the Fogarty International Center (fic.nih.gov) and other US academic institutions have conducted several workshops in LMICs to evaluate mentorship [14]. However, cancer in LMICs and mentoring for cancer research were not a major focus of the US funding agencies or academic institutions in the USA. It is not surprising that cancer has not been one the targets or main focal areas for research in LMICs because cancer rates are just emerging in LMICs as a result of increasing longevity of populations, control of competing causes of death, better diagnostic facilities, better tumor registries, population-based registries, and high rates of infections etiologically linked to cancer. New initiatives by the NCI are starting to assist capacity building through the D43 program that aims at encouraging research training programs to develop and strengthen the scientific leadership and expertise needed for research at LMICs.

In this manuscript, we describe the mentoring experience of the Cancer Epidemiology Education in Special Populations (CEESP) Program that is funded by grant R25 CA112383 from the National Cancer Institute since 2006. CEESP is an educational and research training program for MPH and PhD students from the USA. CEESP provides funding and mentored summer field research in special populations in foreign countries and underserved minority populations in the USA. This manuscript illustrates the global mentoring experience of the CEESP program in the following areas: (a) selection of the students and matching them with on-campus and on-site-campus mentors; (b) preparation and evaluation of the mentorship global sites; (c) students' evaluation of their global mentors; and (d) needs and opportunities for global mentorship.

Selection of Students and Matching them with On-Campus and Research-Site Mentors During the annual recruitment period of CEESP (September–January), students are presented with a menu of potential projects for summer research (May–August). The menu includes the different LMIC countries and US special populations where CEESP has strong research infrastructure and mentorship, possible ideas for future research, the possible local on-campus mentor(s) for each project, and the existing mentoring team in each field site. After the students review the possible menu of projects, they also review the CEESP website and create a list of 3–6 projects they are interested in. While the subsequent discussions with the potential student applicants focus on carving out the best research project for the student's learning, it is also important to match the student with the appropriate research site and field-site-campus mentor(s). The aim is to maximize and balance the benefit of the student, the interest of the field-site mentor, the requirements of the student's US public health academic program, and topic/mentor selection that will increase the student's interest in seeking future education or employment in cancer-related fields. After the student decides on the final research project, video conferences are arranged between the student and the field-site mentor (moderated by A.S.) to discuss the proposed project and to examine the fit between the student and the mentor as well as their mutual expectations.

It has been our experience that the most successful summer research opportunities occur when there is an affinity or mutual respect between the mentor and the trainee. !!!Thus, during our selection of the research site as well as the mentor, we consider the best matching of personalities between the mentor and the students [15], the mentor's availability, skills and experience, ability of the mentor to help the student navigate the local system and access any necessary samples, clinics' access, patients, and data, and the ability of the mentor to help the student meet the deadlines for completing the project during the summer. We also consider the mentor's skill in ensuring the student develops a publishable manuscript. This includes interpretation of the results after data analysis and assisting with finalizing the manuscript and the response to the reviewers' comments after submission of the manuscript for review.

All of these considerations are at the core of discussions by the 7-member CEESP Advisory Committee (AC) at its annual 3-day applicant review meeting in February. In the weeks before this meeting, the AC members review the students' brief written applications/research proposals and identify those that are unlikely to be competitive, usually about 50%. At the 3-day AC meeting in NYC, the most competitive student applicants (approx. 35–40) each present a 15–20-min remote video conference discussion of their research proposal and answer verbal questions from the AC members. An important part of the questioning concerns the roles that CEESP, home campus advisors, and field-site mentors have played in the student's thought process and research proposal. Students' research proposals are generally developed in the few months preceding the AC meeting with input from the local and LMIC mentors. On the last day of the AC meeting, members discuss and score the student applicants on key variables, including the proposed mentoring relationship. The successful applicants are then notified and urged to submit the appropriate IRB applications and

modify their research plans, based on recommendations offered at the AC meeting.

The CEESP Program has been in operation for over than 15 years and during this time has established a network of mentors across the USA and abroad in LMICs. As mentioned in the article in this supplement on infrastructure (pages –), we have created a supportive infrastructure for research training in 24 countries. The current number of mentors in those sites is approximately 76 mentors.

Over the past 15 years during the implementation of the CEESP Program, the role of mentors and matching between mentors and students were very clear and evident in maximizing learning and productivity of students [16,17]. During the summer (May–August), two of the co-authors (AS and RMC) visit the field sites at least twice during the summer. In the beginning of the summer, each student orally presents details of the project, methods, expectations, and timeline to the field-site mentor and the staff of the institution and receives feedback. The student meets with the field-site mentor at least once per week and sends weekly written reports to the mentor and CEESP leaders (AS and RMC), summarizing the progress during the week and the planned work for the next week. The report also includes any unexpected problems, any changes in the originally planned methods, needs for IRB amendments, and the plan for meeting the deadlines. Video conferences are also arranged between the weekly emails and meetings, as needed.

Our Review of Mentors The key points that we learned from observing our field site mentors in LMICs over the past 20 years could be categorized under 4 main categories, without reference to a specific country. The categories are the local academic and clinical cultures of mentors, academic preparation, practical knowledge, and mentoring skills.

1. **Academic and clinical cultures:** From a living environment and time management standpoints, most LMIC settings are welcoming, warm, and hospitable environments. With some variations, the local living and work environments are intriguing to students, especially students with inherent intellectual curiosity and passion for learning about diverse populations and cultures. The other important feature that may reflect on mentoring and education is the varied level of punctuality of appointments and deadlines of many mentors in LMICs. While punctuality is perceived as a sign of respect and duty in the USA, this perception is not part of the cultures or norms in many LMICs. Punctuality can definitely impact mentoring and training, but there are approaches that successful students have followed to remedy the lack of punctuality of mentors in LMICs. These approaches are variable based on the different countries, settings, and backgrounds of mentors, but in general, they fall under resourcefulness of the trainees in identifying and tailoring different communication methods to different cultures, training settings, and mentors (16; Mattick et al. In this supplement). Successful examples include different and multiple approaches for communication with mentors such as face-to-face, social media, cell phone calls, scheduling multiple appointments more than needed to consider delays and cancelation, and expressing the urgency in meeting deadlines, frequently and tactfully. The other significant barrier that is encountered in mentoring in LMICs is the seniority-based hierarchical system. This system informally entails that junior members of the institution do not have freedom to propose new ideas or make decisions without prior authorization from senior faculty or heads of institutions. Such local seniority-based systems should be considered in planning the mentorship of student research projects, during the implementation of the projects, while students are in the field, and after the end of the project during the publication phase. Students should be educated about these senior-based mentoring systems early on and throughout their research projects. While written approvals from the senior leadership might not be needed frequently, the protocol of keeping the senior leadership informed of the progress of the training and any deviation of the original plan should be followed to ensure successful mentorship and engagement of all mentors.
2. **Academic preparation and culture:** While the work and living environments may impact mentoring indirectly, the academic environment can or almost invariably does impact mentoring. The vast majority of sites for cancer epidemiology research training in LMICs is run by clinicians who graduated from local medical schools. The majority of cancer centers in LMICs has very limited cancer epidemiology units/departments, and those units/departments are not organized for research. While the discipline of epidemiology is usually included in academic departments of public health in medical schools in LMICs, those departments are mainly focused on teaching that is centered around communicable, not chronic diseases. Cancer research is not a priority in LMICs, although cancer incidence and mortality are increasing in most LMICs [18]. Furthermore, there is often little collaboration between medical schools and cancer centers in LMICs, particularly for research. Finally, the tenure and promotion systems in academic institutions in LMICs are more dependent on seniority and less dependent on scientific publications and grant funding of faculty. Therefore, there is limited competition with collaborators from the USA on authorship. However, the collaboration with US institutions may be beneficial for LMICs local faculty and clinicians

if they result in revealing important cancer patterns, highlighting cost-saving approaches, or documenting improved cancer staging due to local screening or diagnostic interventions. The results from the joint collaboration may induce the local mentors to collaborate and mentor US mentees who are dedicated to research and publications.

3. **Practical knowledge and skills:** The vast majority of mentors in LMICs lacks formal academic or professional education in mentoring. However, they have other essential knowledge and skills for research that can definitely empower collaborative research and learning of students from the USA. This knowledge and skill base mainly relates to best approaches for patient recruitment; development, testing, and delivery of questionnaires and research forms; identifying research materials; understanding incomplete and inconsistent medical records; tracking and follow-up of patients for participation in epidemiologic research; obtaining bio-specimens; and consenting and developing creative ways to approach patients for survivorship studies. All these challenges are likely to be encountered by non-native mentees in the course of their research. The resourcefulness of the local mentors can be enormous for accessing non-traditional data sources that are not known to US researchers or students, explanation of unusual demographic or patient seeking-care behaviors, and expediting processes of research permits and obtaining local customs and government approvals. The local mentors can help by providing local students' theses and dissertations, local government reports and internal publications, and local research data that may not reach the stage of publication locally or globally in peer-reviewed journals. However, it should be mentioned that most field site mentors have excellent teaching skills as they are instructors of formal local courses in their universities.
4. **Mentoring skills:** It is important to emphasize the educational backgrounds of mentors in LMICs. Most clinicians in LMICs graduate from local medical schools that follow ~ 6 years of education and admit students directly after earning high school diplomas. While the medical students in these systems usually are the top of their high school class, they typically do not have opportunities for learning about non-medical sciences. For example, medical students in LMICs do not have exposure to humanities, field research, group projects, and problem solving or writing. Medical school education is, for the most part, focused on memorization of medical topics. This is partly because medical school enrollments are quite large, sometimes in the thousands. Understanding this educational environment is crucial because when those physicians are in leadership positions for mentoring, whether for US students or local trainees, those skills of research mentoring, team science, and problem solving through innovative non-traditional approaches cannot be delivered. We observed these limitations during our encounters with different mentors in different countries in different cancer research mentoring experiences in LMICs. However, limited mentoring skills are compensated by the wealth of knowledge and skills in problem solving of logistical issues and finding creative ways for field research and overcoming limitations related to study design and recruitment procedures. It is important to note that field site mentors in LMICs who had prior exposure through education, travel, and or training in the USA or through US research opportunities in their countries were more likely to be engaged in informal mentoring experiences of US students.

Mentees' Perspectives about Mentors: We conducted a qualitative study with 20 of our past students who trained in LMICs through the CEESP Program to gather more information about their experiences with the local site mentors. Our survey included questions about the extent of help they received from the local site mentors with respect to navigating the local institution and country, understanding the translation of the epidemiologic research questions into clinical applications, problem solving abilities, availability for the mentors for meetings with the students, and mentors' understanding the nature of the project and local IRB requirements. All students indicated that the mentors were very helpful in navigating the institution, providing the needed data for their research; were available to meet with the students; and made every effort to make their experiences productive. However, points that were recommended for making students' experiences more productive included (a) providing more mentoring training to the local field site mentors, (b) training the mentors to prepare and deliver presentations about their institutions and its clinical and data resources, (c) organizing more communication with the field site mentors before student arrival to the research site, and (d) training of the mentors about timelines of each student project, and the importance of scientific publication for students.

Possible Future Directions

Based on what we have learned and described in this article, we recommend developing mentoring programs for cancer researchers in LMICs customized to local conditions taking into account availability of resources, topical research fields of interest of local mentors in LMICs, existing research infrastructure and scientific environment in the LMIC country or region, and the program evaluation outcomes and anticipated return on investment. There are different venues

that could be considered for developing such mentoring programs for LMICs' cancer researchers, and those may include mentoring on joint scientific publications (see the article on LMIC publications in this issue), utilizing online workshops that are becoming rich resources for global mentoring especially after the COVID pandemic [19], and/or face-to-face mentoring when resources and opportunities are available. Format of the mentoring could include self-reading about mentorship, didactic lectures, small group discussion, individual meetings between mentors and mentees, and individual meetings between the workshop instructors and the local mentors. Examples of specific topics that could be covered in mentoring sessions may include: (a) mentors and mentees expectations and responsibilities; (b) gender relationship between mentors and mentees; (c) ethics of scientific research; (e) using paper and electronic records in different hospitals and registries; (f) periodic reporting, corrective actions, and non-traditional research methods in underserved settings; (g) low-cost methods of implementing research in underserved settings; and (e) online and electronic mentoring. Such mentoring workshops must be video-taped, edited, and uploaded to the available websites of educational and cancer organizations, such as the American Association for Cancer Education, and shared with the NCI for possible wider dissemination.

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