

Short- and Long-Term Outcomes of Student Field Research Experiences in Special Populations

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Abstract Global health education and training of biomedical students in international and minority health research is expanding through U.S. academic institutions. This study addresses the short- and long-term outcomes of an NCI-funded R25 short-term summer field research training program. This program is designed for MPH and Ph.D. students in cancer epidemiology and related disciplines, in international and minority settings (special populations) in a recent 7-year period. Positive short-term outcome of 73 students was measured as publishing a manuscript from the field research data and having a job in special populations. Positive long-term outcome was measured as having a post-doc position, being in a doctoral program, and/or employment in special populations at least 3 years from finishing the program. Significant factors associated with both short- and long-term success included resourcefulness of the student and compatibility of personalities and interests between the student and the on-campus and off-campus mentors. Short-term-success of students who conducted international field research was associated with visits of the on-campus mentor to the field site. Short-term success was also associated with extent of mentorship in the field site and with long-term success. Future studies should investigate how field research sites could enhance careers of students, appropriateness of the sites for specific training competencies, and how to maximize the learning experience of students in international and minority research sites.

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Introduction

Global health and health disparity education are expanding significantly in public health and biomedical academic institutions in the U.S. [1–3]. Hundreds of U.S. universities have developed and implemented programs with variable missions and objectives for global health and health disparity education. These programs have different disease foci, curricula, research concentrations, and components of evaluation [4, 5]. Exposure of students to international and U.S. minority settings confers unique opportunities for students to enhance their learning of disease etiology, disease management in underserved and low-resource settings, cultural competencies, applications of theoretical biomedical sciences, and translation of basic sciences to disease prevention [1, 6, 7].

Cancer incidence and mortality rates are increasing globally. Over the next two to three decades, over 75 % of the future global cancer-related deaths will be expected in low- and middle-income countries [8]. In addition, minority populations in the U.S.A. continue to have higher incidence and mortality rates for certain cancers [9]. The epidemiologic profiles of cancer in low- and middle-income countries and minority populations in the U.S.A. are possibly due to distinct genetic factors, lifestyle factors, and barriers to health care accessibility [10]. Studying such factors and gaining practical field research experience in global and minority research training context could enhance student learning and set the stage

for their productive research careers in eliminating cancer health disparities in the U.S.A. and globally.

Over the past 8 years, we have developed and implemented a program to introduce, educate, and enable public health students to conduct cancer epidemiology research in international and minority settings (special populations). The program aims to motivate students to pursue future careers in cancer epidemiology and prevention in special populations.

The field resources of the program were developed through the existing infrastructures of the University of Michigan School of Public Health and the University of Nebraska College of Public Health, where many faculty researchers have collaborators within and ties to minority communities and international institutions. Examples of field resources include data from foreign and domestic population-based state cancer registries, data and biological specimens from epidemiologic and cancer prevention studies, hospital and tumor registries and repositories, screening and vaccination records and databases, and access to populations for interviews, surveys, and cohort studies.

The multidisciplinary faculty of the program with strength in epidemiologic, biomedical, behavioral, and programmatic research and strong infrastructures and ongoing funded projects in the special populations constituted the core foundations for this program. At the beginning of the first 5-year grant cycle, we identified 13 possible international and 7 domestic research sites for student projects. This group of sites has been maintained and increased with the transfer of the program to the University of Nebraska. Based upon our experience in supervising students in international research sites, we focused on clusters of 11 sites in Africa and the Middle East (Tanzania, Ghana, Niger, Zambia, Burkina Faso, Uganda, Egypt, Morocco, Jordan, Tunisia, and Cyprus), and 6 minority sites in Michigan and Nebraska (Detroit SEER, Arab Americans in Dearborn, Native Americans in Northern Michigan, refugees in Nebraska, African Americans in North Omaha, and Native Americans in the upper mid-West). This clustering was necessary to adequately supervise the summer trainees with the required communication and travel. The field sites have a wide range of experiences for students ranging from cancer registries, to molecular and genetic epidemiology, to interviewing, to data collection and abstraction from ongoing hospital- and population-based epidemiologic and cancer prevention studies.

This program has two main evaluation components: (a) evaluating the satisfaction of students and their performance after finishing the summer field experience; and (b) evaluating the on- and off-campus mentors and their impression about the students.

In this paper, we describe the short- and long-term outcomes of trainees enrolled in this program in the first 7 years and factors associated with the outcomes.

Methods

The objective of this program has been to prepare masters' and doctoral students in public health in the field of cancer epidemiology and related disciplines, in special populations. The program started in 2006, through funding from the National Cancer Institute's R25 Program and was renewed in 2011, for a second 5-year cycle. During the first 5 years of funding, the aims of the program included recruiting and selecting first-year MPH students to fill 10 positions during each grant year. In the second 5 years, two of the ten annual slots were open to doctoral students and the remaining eight slots were designated for MPH students. The program was housed at the University of Michigan School of Public Health in its first 6 years; then was moved to the University of Nebraska College of Public Health with the move of its faculty leaders to Omaha. The program admitted students over the past 8 years. Students of the eighth year have not finished their research projects at the time of submission of the manuscript so the results included only the first 7 years.

Selection of student applicants to the program is the responsibility of the Advisory Committee. Applications are accepted on an annual basis, with committee members receiving complete application packets in December of each year. All committee members score every applicant by ballot on a scale of 1.0 to 10.0. Most successful applicants are anticipated to achieve scores in the range of 2.0–3.0, similar to the NIH scoring system. A completed application includes:

1. A proposal for admission to the Program. In this proposed educational plan, students include their suggested list of courses and how these courses can help their internship projects and future career. The educational plan also includes the following about the proposed 4-month research experience:
 - Description and timeline of the 4-month research project.
 - Description of the research resources, mentor's research program, lab resources, data availability, etc.
 - The student's existing skills that make the project feasible.
 - Student's learning objectives for the 4-month period, including new skills that the student will acquire during this short-term research experience.
 - In addition to the above, PhD students are expected to include in their plan a discussion of dissertation possibilities growing out of the 4-month summer research experience.
2. A letter of agreement from proposed faculty mentor and co-mentors from the College of Public Health or Cancer Center.

3. A letter of reference from the student's major professor attesting to the student's capabilities.
4. A brief curriculum vitae and transcript.

This funding and training opportunity attract the best applicants to the program to pursue careers in cancer epidemiology in international and ethnic minority populations in the U.S.A.

During the application process, student candidates meet with the program leaders and one or more faculty mentors to discuss the educational opportunities of various projects and to clarify mutual expectations. From this meeting, an educational plan is developed which describes the skills and/or knowledge that the students are expected to learn in courses and field experiences, their obligations to the project in terms of calendar and schedule, and the form of the student's report. Acceptance of the student's application is primarily influenced by the overall educational benefit and feasibility of the research plan along with evidence of satisfactory academic performance in their respective programs.

In addition to the recruitment and selection of students, cancer epidemiology and cancer prevention and control courses were available in the Schools of Public health and students were encouraged to take them. These optional courses prepare students for summer field research experiences in cancer epidemiology in special populations. Students are followed up after the summer field research experiences and a process and outcome evaluation and long-term tracking is maintained. Review and oversight functions of the program are facilitated by an Educational Advisory Committee, as required by the R25 grant mechanism. The advisory committee consists of internal faculty and external cancer educators. The committee evaluates all components of the program including recruitment, selection, curriculum, evaluation, and dissemination.

Dissemination of the R25 Program is mandated in the NCI PAR and this has been implemented by leading dissemination workshops in Ann Arbor, Omaha, and annual meetings of the American Association for Cancer Education.

Evaluation Measures

The dependent outcome variables of the field research experience were categorized into short- and long-term outcomes. Short-term outcomes of trainees of the first 7 years of the program were defined and scored (0 or 1) for the following variables: (a) returning after the field experience with research data, (b) writing a manuscript, (c) publishing a manuscript, (d) having a job in special population after the program, and/or (e) pursuing an advanced degree.

Short-term success was categorized into three categories based on the total score: (a) "least successful" for a total score

of 2 or less; (b) "Successful" for a total score of 3; and (c) "very successful" for a total score of 4 or higher.

Based on the observations of the co-authors and data of the annual evaluation of students and on-campus and off-campus mentors, the following independent variables were measured:

1. Sex (male/female).
2. Race (White/minority).
3. Undergraduate field of education (biomedical/social sciences).
4. Resourcefulness of the students (low, medium, or high), based upon the judgment of the program leaders. Low and medium resourcefulness was grouped together as "Low" in the analysis. This qualitative measure included judgments about; (a) student initiative in formulating the idea for their project, (b) initiative in identifying on-campus faculty mentors for their project, (c) intellectual curiosity, (d) dealing with ambiguity, (e) overcoming barriers and impediments such as missing and inconsistent data, and (f) dealing with unfamiliar communities and cultures.
5. On-campus mentor support (yes/no). This includes accessibility and involvement of the mentor as judged by the Program leaders.
6. Visit of the on-campus mentor to the field site during the student field experience (low/high).
7. Compatibility of personality characteristics between the student and the on-campus mentor (yes/no). This was based on Program leaders' judgment of characteristics including; gregariousness, verbal communication, and problem solving skills.
8. Compatibility of personality characteristics between the student and the off-campus mentor (yes/no). This was based on Program leaders' judgment of characteristics including; gregariousness, verbal communication, problem solving skills, working under stressful conditions, ambiguities, and limited resources.
9. Type of research experience (domestic/international).
10. Knowledge of local language (yes/no).
11. Total number of students in the field site (1 or more).
12. Inclusion of cancer registry data from the field site (yes/no).
13. Barriers and impediments encountered in execution of field research (none/several).
14. Inclusion of a lab component (yes/no).
15. Availability of office/desk space for the student at the field site location (yes/no).
16. Extent of mentorship/interaction with the field site mentor (limited, moderate, or extensive). This was based on Program leaders' judgment of regularity and frequency of meetings, feedback from students and field site mentors during the field experience and interaction during manuscript writing.
17. Returning after the field experience with research data (yes/no).

18. Wrote a manuscript from the research data (yes/no).
19. Published a manuscript (yes/no).
20. Long-term outcomes of trainees of the first 4 years of the program included the 19 measures listed above in addition to short-term outcomes and
21. Having a job focused on cancer (yes/no).
22. Employment in special population (yes/no).
23. Having a postdoctoral or faculty position (yes/no).

Long-term positive outcomes were defined by a score of 1 for any job or assignment in a special population after completing the program, a score of 2 for having a post-doctoral position after completing the program following a Ph.D., and a score of 3 for having a job focused on *cancer* in a special population after finishing the program. Most successful alumni were those who achieved a total score of more than 4 and least successful were those who achieved a score of 3 or less.

Independent ratings of the two co-authors were recorded at the student's admission, during the program, and at the time of constituting the database for this study. These independent ratings were then compared and the scoring was exactly identical except in fewer than 10 instances, and in those the scores were never more than one integer difference and these were resolved by discussion. Therefore, we believe that there was limited inter-rater disagreement bias in these evaluations. Also, notes and observations of the mentors during the program and during the annual program evaluations were considered in the evaluation and there was complete inter-rater agreement between the two co-authors. Also, the long list of variables included factual verified numbers and values about the students, their backgrounds, academic preparation, and the program (variables 1–3, 6, 9–15, and 17–22). Variables 4, 5, 7, 8, and 16 were created by the two co-authors based on the criteria listed above.

Data Analysis

Two tests, Chi-square and Cochran Mantel-Haenszel, were used to test for statistical significance. Data analysis was performed using SAS statistical software version 9.3 (Cary, NC). The study was approved by the IRB committees of the University of Michigan (2006–2012) and the University of Nebraska (2012–present).

Results

Over the first 7 years of the program, 73 students were selected from 111 applicants.

As shown in Table 1, the majority of students (60/71) included in this analysis were females (84.5 %), reflecting the sex distribution of students typical in Schools of Public Health. Minority students (25/71) represented over one third

(35.2 %) of the pool of students and that was slightly higher than minority representation of the general pool of students at the University of Michigan and University of Nebraska. The majority of students (54/71) in the program (76.0 %) had biomedical undergraduate education.

A slightly over half the students (37/71) were judged as resourceful (52.1 %), and the vast majority of the students (64/71) had on-campus mentor support (90.1 %) and the majority of students (52/71, 73.2 %) were visited during their field experience by an on-campus mentor. More than three quarters of the students (56/71, 78.9 %) were judged to have a compatibility of personality characteristics between them and the on-campus and off-campus (55/71, 77.5 %) mentor. International placement experiences comprised 63.4 % of experiences (45/71) and about one third (26/71, 32.4 %) of students had good knowledge of the local language of the population of the field site. Some (24/71, 33.8 %) of the students conducted their projects in the same location with other students of the program, while the majority were alone (47/71, 66.2 %). About half (36/71, 50.7 %) of the research projects utilized cancer registry data and no barriers or impediments were encountered in over half (41/71, 57.8 %) the off-campus sites. In addition to the field experience, the majority of students (59/71, 83.1 %) had a lab component during or after the field summer experience. The vast majority of students (60/71, 84.5 %) had moderate to high interactions with the off-campus mentors and about three quarters (53/71, 74.7 %) of students had assigned office/desk spaces at the off-campus summer field research site. Finally, the results showed that 83.1 % of students (59/71) returned to campus after the field experience with research data. Over half the students (48/71, 67.6 %) wrote a manuscript from the research data and the majority (57/71, 80.3 %) published at least a manuscript from the data of their field research experience (Table 1).

Table 2 illustrates the relationship between short-term outcomes and factors related to student characteristics, their research projects, and on-campus, and off-campus mentors and experiences. Several factors were statistically significant in association with short-term success. High level of resourcefulness was found in 30/43 students with highest short-term outcomes (69.8 %) compared to 2/9 students with moderate short-term outcomes (22.2 %), and 2/19 students with least short-term outcomes (10.5 %; $P=0.001$; Table 2). High level of compatibility between personality characteristics and interests of the students and their on-campus mentors was observed in 42/43 students with highest short-term outcomes (97.7 %) compared to 7/9 students with moderate outcomes (77.8 %) and 7/19 students with lowest short-term outcomes (36.8 %; $P=0.0001$; Table 2). High level of compatibility between personality characteristics and interests of students and their off-campus mentors was observed in 41/43 students with high short-term outcomes (95.4 %) and in 8/9 of students (88.9 %) with moderate short-term outcomes and 6/19

Table 1 Descriptive characteristics of the study population

	<i>n</i> =71	%
Sex		
Male	11	15.49
Female	60	84.51
Race		
White	46	64.79
Minority	25	35.21
Undergraduate field		
Biomedical	54	76.06
Social science	17	23.94
Resourcefulness		
Low	37	52.11
High	34	47.89
On campus mentor support		
Low	7	9.86
High	64	90.14
Visit of US mentor to field		
Yes	52	73.24
No	19	26.76
Compatibility of on-campus mentor and student personality and interests		
Yes	56	78.87
No	15	21.13
Compatibility of off-campus mentor and student personality and interests		
Yes	55	77.46
No	16	22.54
Type of research experience		
International	45	63.38
Domestic	26	36.62
Knowledge of local language		
Yes	23	32.39
No	47	66.20
Total number of students at site		
1	47	66.20
More than 1	24	33.80
Registry data		
Yes	36	50.70
No	33	46.48
Barrier of site		
None	41	57.75
Several	0	0.00
Inclusion of a lab component		
Lab	59	83.10
Field	12	16.90
Office space off campus		
Yes	53	74.65
No	18	25.35
Year of the program		
2007	10	14.08
2008	10	14.08
2009	12	16.90

Table 1 (continued)

	<i>n</i> =71	%
2010	10	14.08
2011	8	11.27
2012	11	15.49
2013	10	14.08
CEESP experience with off-campus location		
Limited	11	15.49
Moderate	15	21.13
Extensive	45	63.38
Returning with research data		
Yes	59	83.10
No	12	16.90
Writing manuscript		
Yes	48	67.61
No	23	32.39
Publishing manuscript		
Yes	57	80.28
No	14	19.72
Job in special population		
Yes	40	56.34
No	31	43.66
Job in cancer field		
Yes	15	21.13
No	27	38.03

students with least short-term outcomes (31.6 %; $P=0.0001$; Table 2). High success of students who conducted international field research was associated with visits of the on-campus mentors to the field site 26/28 (92.9 %) compared to 7/7 among students who had moderate success (100 %) and 6/10 (60 %) among students who had the least success ($P=0.02$; Table 2). High level/extensive supervision of the field site mentor was associated with high level of short-term success for 32/43 students (74.4 %) compared to 7/9 students among students with moderate short-term success (77.8 %) and 6/19 students (31.6 %) among students with least short-term success ($P=0.009$; Table 2).

Table 3 shows the factors associated with long-term success that included resourcefulness of students, compatibility between the student and on-campus and off-campus mentors, and short-term success. High level of resourcefulness was found in 6/6 students with highest long-term outcomes (100 %) compared to 5/11 students with moderate long-term outcomes (45.5 %), and 6/25 of students with least short-term outcomes (24 %; $P=0.001$; Table 3). High level of compatibility between personality characteristics of the students and their on-campus mentors was observed in 6/6 students with highest long-term outcomes (100 %) compared to 2/11 students with moderate long-term outcomes (18.2 %) and 10/25

Table 2 Factors related to short-term success

	Highest		Moderate		Least		<i>p</i> -value	
	<i>n</i> =43	%	<i>n</i> =9	%	<i>n</i> =19	%		
Sex								
	Male	8	18.60	1	11.11	2	10.53	0.66
	Female	35	81.40	8	88.89	17	89.47	
Race								
	White	28	65.12	8	88.89	10	52.63	0.17
	Minority	15	34.88	1	11.11	9	47.37	
Undergraduate field								
	Biomedical	26	60.47	5	55.56	9	50.00	0.99
	Social Science	11	25.58	2	22.22	3	16.67	
	Missing	6	13.95	2	22.22	6	33.33	
Resourcefulness								
	Low	13	30.23	7	77.78	17	89.47	0.001
	High	30	69.77	2	22.22	2	10.53	
On-campus mentor support								
	Low	5	11.63	0	0.00	2	10.53	0.56
	High	38	88.37	9	100.00	17	89.47	
Visit of US mentor to field								
	Yes	32	74.42	8	88.89	12	63.16	0.27
	No	11	25.58	1	11.11	7	36.84	
Visit of US mentor to field (international only)								
	Yes	26	92.86	7	100.00	6	60.00	0.02
	No	2	7.14	0	0.00	4	40.00	
Compatibility of on-campus mentor and student personality and interest								
	Yes	42	97.67	7	77.78	7	36.84	0.0001
	No	1	2.33	2	22.22	12	63.16	
Compatibility of off-campus mentor and student personality and interests								
	Yes	41	95.35	8	88.89	6	31.58	0.0001
	No	2	4.65	1	11.11	13	68.42	
Type of research experience								
	International	28	65.12	7	77.78	10	52.63	0.41
	Domestic	15	34.88	2	22.22	9	47.37	
Knowledge of local language								
	Yes	27	64.29	7	77.78	13	68.42	0.86
	No	15	35.71	2	22.22	6	31.58	
Knowledge of local language (international only)								
	Yes	16	57.14	5	71.43	5	50.00	0.67
	No	12	42.86	2	28.57	5	50.00	
Total number of students at site								
	1	29	67.44	3	33.33	15	78.95	0.07
	More than 1	14	32.56	6	66.67	4	21.05	
Registry data								
	Yes	21	48.84	6	66.67	6	31.58	0.20
	No	22	51.16	3	33.33	13	68.42	
Registry data (international only)								
	Yes	14	50.00	5	71.43	5	50.00	0.58
	No	14	50.00	2	28.57	5	50.00	
Barrier of site								
	None	43	100.00	9	100.00	19	100.00	1
	Several	0	0.00	0	0.00	0	0.00	

Table 2 (continued)

		Highest		Moderate		Least		<i>p</i> -value
		<i>n</i> =43	%	<i>n</i> =9	%	<i>n</i> =19	%	
Inclusion of a lab component								
	Lab	38	88.37	7	77.78	14	73.68	0.33
	Field	5	11.63	2	22.22	5	26.32	
Office space off campus								
	Yes	34	79.07	8	88.89	11	57.89	0.12
	No	9	20.93	1	11.11	8	42.11	
Period of the program								
	2007–2010	23	53.49	7	77.78	12	63.16	0.37
	2011–2013	20	0.00	2	0.00	7	0.00	
Period of the program								
	2007–2008	12	27.91	2	22.22	6	31.58	0.87
	2009–2013	31	72.09	7	77.78	13	68.42	
Extent of mentorship/interaction with the field site mentor								0.009
	Limited	3	6.98	1	11.11	7	36.84	
	Moderate	8	18.60	1	11.11	6	31.58	
	Extensive	32	74.42	7	77.78	6	31.58	

students with least long-term outcomes (40.0 %; $P=0.03$; Table 3). High level of compatibility between personality characteristics of the students and their off-campus mentors was observed in 6/6 students with high long-term outcomes (100 %) and in 9/11 students with moderate long-term outcomes (81.8 %) and in 14/25 students with least long-term outcomes (56.0 %; $P=0.02$; Table 3).

Discussion

This study shows that among student characteristics, student resourcefulness was the most important characteristic in relation to short- and long-term success. The study also showed that compatibility of personalities and interests between students and on- and off-campus mentors was significantly associated with short- and long-term success. Short-term success was associated with extensive supervision of the off-campus mentor and visits of on-campus mentor to the international field site was associated with the highest short-term success. Long-term success was associated with short-term success and the latter was a composite of returning from the field experience with research data and completing and publishing a manuscript. It is important to clarify that publishing a manuscript is not a requirement at the MPH level in Schools of Public Health. However, with the help of the mentors, more than 70 % of students published their research results, and 90 % of these were first authors. This program teaches students to build the cancer research experience from start to finish. It should be noted that over 90 % of the program

students had no previous experience in cancer research and many did not express strong interest in cancer research prior to applying to the program. However, optional courses related to cancer epidemiology and cancer prevention stimulate students' interest in this field. In addition, visiting and local scientists and speakers also enrich the scientific environment that helps students focus on cancer. In the process of planning their summer research experience and writing a proposal, students begin engaging in on- and off-campus mentorship.

While other R25 training programs have shown success in promoting short- and long-term outcomes of students engaged in cancer prevention research in general U.S. populations [11–14], the focus of this program is on cancer epidemiology in international and minority settings in the U.S. While global health is expanding in the vast majority of Schools of Public Health in the U.S., no systematic information is available on outcomes of career tracking of public health students involved in global health, global cancer research, or minority research. The information that is available from global health education is mainly focused on clinical education of medical and nursing students and residents which have shown values in career development [3, 15–17]. These studies report the importance of modifying the medical school curriculum to include global health, particularly to address disease burden, traveler's medicine, and immigrant health [1]. Also, these highlighted the importance of culturally competent health care delivery and the importance of global medical education to increase students' knowledge and possibly future practices in diverse populations.

Table 3 Factors related to long-term success

		Highest		Moderate		Least		<i>p</i> -value
		<i>n</i> =6	%	<i>n</i> =11	%	<i>n</i> =25	%	
Gender	Male	0	0.00	2	18.18	2	8.00	0.89
	Female	6	100.00	9	81.82	23	92.00	
Race	White	4	66.67	10	90.91	16	64.00	0.47
	Minority	2	33.33	1	9.09	9	36.00	
Undergraduate field	Biomedical	5	83.33	2	18.18	13	52.00	0.89
	Social Science	1	16.67	3	27.27	5	20.00	
	Missing	0	0.00	6	54.55	7	28.00	
Resourcefulness	Low	0	0.00	6	54.55	19	76.00	0.001
	High	6	100.00	5	45.45	6	24.00	
On-campus mentor support	Low	0	0.00	0	0.00	0	0.00	1
	High	6	100.00	11	100.00	25	100.00	
Visit of US mentor to field	Yes	5	83.33	8	72.73	21	84.00	0.57
	No	1	16.67	3	27.27	4	16.00	
Visit of US mentor to field (international only)	Yes	5	83.33	5	83.33	15	88.24	0.73
	No	1	16.67	1	16.67	2	11.76	
Compatibility of on-campus mentor and student personality and interests	Yes	6	100.00	9	81.82	15	60.00	0.03
	No	0	0.00	2	18.18	10	40.00	
Compatibility of off-campus mentor and student personality and interests	Yes	6	100.00	9	81.82	14	56.00	0.02
	No	0	0.00	2	18.18	11	44.00	
Type of internship	International	6	100.00	6	54.55	17	68.00	0.34
	Domestic	0	0.00	5	45.45	8	32.00	
Knowledge of local language	Yes	6	100.00	8	72.73	19	76.00	0.63
	No	0	0.00	3	27.27	6	24.00	
Knowledge of local language (international only)	Yes	6	100.00	5	83.33	12	70.59	0.13
	No	0	0.00	1	16.67	5	29.41	
Total number of students at site	1	3	50.00	7	63.64	13	52.00	0.87
	More than 1	3	50.00	4	36.36	12	48.00	
Registry data	Yes	1	16.67	5	45.45	10	40.00	0.45
	No	5	83.33	6	54.55	15	60.00	
Registry data (international only)	Yes	1	16.67	3	50.00	8	47.06	0.26
	No	5	83.33	3	50.00	9	52.94	

Table 3 (continued)

		Highest		Moderate		Least		<i>p</i> -value
		<i>n</i> =6	%	<i>n</i> =11	%	<i>n</i> =25	%	
Barrier of site	None	6	100.00	11	100.00	25	100.00	1
	Several	0	0.00	0	0.00	0	0.00	
Nature of field project	Lab	5	83.33	8	72.73	18	72.00	0.63
	Field	1	16.67	3	27.27	7	28.00	
Office space at field site	Yes	6	100.00	11	100.00	18	72.00	0.03
	No	0	0.00	0	0.00	7	28.00	
Year	2007–2010	6	100.00	11	100.00	25	100.00	1
	2011–2013	0	0.00	0	0.00	0	0.00	
Year	2007–2008	4	66.67	5	45.45	11	44.00	0.39
	2009–2013	2	33.33	6	54.55	14	56.00	

This report documents several strengths of the program. The evaluation by the same observers (the two co-authors) and their yearly ranking over the 7 years, using the same curriculum and courses in two Schools of Public Health where the program has been implemented, using the majority of the same off-campus sites, and the same evaluation tools are strengths to this study. While some of the variables were not statistically significant, this does not mean that these variables should not be considered relevant. For example, visits of the mentors to off-campus sites have been important in resolving field problems, streamlining field logistics, and better introductions between some students and off-campus mentors. This work is somewhat pioneering in that many variables are qualitative. Most variables have scores that are rank-ordered, not linear. Future studies might develop linear scoring methods, but these were not available in the literature for us to build upon.

A possible limitation of this evaluation is the relatively small sample size and limited number of years for long-term evaluation. Another possible limitation is the absence of a control group. However, our comparison with the rates of publication of the general pool of MPH students at the University of Michigan and University of Nebraska during the same period did not exceed 2 % of students compared to 70 % in this group.

Future studies should increase the sample size and the follow up period of students and focus on in-depth evaluation of the field research training sites. Future studies should also investigate how field research sites can help enhance the careers of students, appropriateness of the sites for specific training competencies, and how to maximize the learning

experience of students at off-campus locations in international and U.S. special population sites.

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Conflict of interest The authors declare that they have no conflict of interest.

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