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Research Training of Students in Minority and International Settings: Lessons Learned from Cancer Epidemiology Education in Special Populations

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Abstract

This article describes the development and evaluation of an NCI-sponsored short-term summer cancer research education program. The study questions examined: the feasibility of conducting a cancer education program in special populations at multiple US and international field sites for masters students; the merit and worth that students and faculty attribute to the program; and students' scholarly and cancer-related career outcomes. Developing a new curriculum, increasing the pool of mentors, utilizing and increasing the number of field sites, and program dissemination were also evaluated. Evidence of the program's success included students' completion of field experiences at multiple sites and their subsequent 70% project-related publication rate, with 79% of trainees reporting themselves as likely to pursue future cancer-related careers. Evaluation-guided future plans for the program include implementing faculty development to further enhance the program outcomes.

Keywords

Research training; Minority; Lessons; Cancer epidemiology; Education; Special populations

Introduction

The comprehensive World Cancer Report cautions the global burden of cancer, presently responsible for 12% of the nearly 56 million deaths worldwide from all causes, could increase by 50% to 15 million new cases in the year 2020 [1]. In the USA, the Institute of Medicine's "Unequal Treatment" report confirms minority populations experience considerable disparities in cancer mortality [2]. Globally, the largest increases in cancer rates are predicted to occur among people in developing countries [1]. Epidemiologists have urged that the international portfolio of cancer studies needs to include developing countries, as a way to increase our knowledge of cancer etiology: "collaboration between researchers in the developed and developing world can often foster studies leading to increased knowledge and may improve well-being of local and global populations struggling against cancer [3]." Our experience with such collaborative cancer research indicated these sites offer promising opportunities for educating students in the field of cancer epidemiology in special populations

This article describes the development and evaluation of a National Cancer Institute (NCI)-sponsored cancer research education program. Our objective was to develop an educational program to prepare masters students in public health in the field of cancer epidemiology in special populations. The study questions examined:

1. What is the feasibility of conducting an educational program in special populations at multiple field sites?
2. What merit and worth do students and faculty attribute to the program?
3. What scholarly and career choice outcomes are associated with the students' participation in the program?

Methods

Measures

The evaluation drew on structured surveys completed by students. The faculty mentors from the internship sites independently rated the quality of the trainees' work, professional attributes, and likelihood students would succeed in careers in cancer epidemiology and control. Outcome measures included the proportion of the students who completed their internship, identified career aspirations related to cancer, and scholarly products related to their field experience.

Statistical Analysis

Analyses were conducted using SPSS Version 17.0 software. Analyses included frequency distributions and measures of central tendency and variability. All tests of statistical significance were set at a predetermined alpha level of .01 to minimize the likelihood of type I errors from multiple testing. To test for changes across cohorts, we used analysis of variance for interval level data and chi-square for ordinal-level data.

Results

The results are presented in three parts: (a) student and program progress, (b) students' and faculty evaluations of the program, and (c) students' career and scholarly outcomes.

(A) Student Selection and Program Progress

The demographic profile of our students from the first three cohorts is shown in Table 1. The pool of applicants for cancer-related field experiences dramatically increased, from 1–2 applicants per year prior to the program's implementation, to 14, 13, and 18 students in years 1–3, respectively.

Students' projects built upon existing research infrastructure of the University of Michigan (UM) faculty research mentors. In international settings, the projects were located in Morocco, Tunisia, Egypt, Jordan, Israel, Uganda, and Tanzania, Mexico, and India. Domestic internships with minority populations were located in Michigan (UM, Arab American Health Center, Karmanos Cancer Institute and the SEER registry, and the Native American Health Center in Northern Michigan). All projects included data and or specimens from minority populations.

Domestic internships comprised 55% of internships in year 1, 40% in year 2, and 46% in year 3. About 30–40% of students in international settings came to the program with fluency in languages related to their summer internship site (Arabic, Hebrew, Hindi, French, and Swahili). The program provided language training to other students who did not have such language skills.

Course Development—The program created a new course on cancer epidemiology in special populations, a seminar on cancer epidemiology, and a seminar on the translation of cancer epidemiology to cancer control and prevention. The favorable evaluations students gave to all these courses meant that they were among the most highly rated courses at UM-SPH. Another indication of the value of these courses is that the school adopted them as permanent courses.

(B) Student and Faculty Evaluations

Table 2 identifies the research activities in which students participated and the value they attributed to their experience. Research-related activities varied with the projects in which students engaged. The research activities in which the majority of trainees participated included: participating in project meetings; collecting, analyzing, and summarizing quantitative data; designing a research study; generating reports; working with collaborators in and outside the USA; and preparing and giving oral presentations.

On a scale that ranged from a low of “1” (“little or no value”) to a high of “3” (“highly valuable”), students' ratings of the value of the program activities was 2.5 or greater for all activities. Students gave their highest ratings to their experience with: learning new data analysis techniques; collecting clinical measures; designing the research study; designing and implementing recruitment strategies; designing sampling protocols; pilot testing

questionnaires and instruments; interviewing; and collecting, coding, and summarizing both quantitative and qualitative data.

Table 3 illustrates students' ratings of the quality and impact of the program. For most (14 of 19) of the identified program aspects, 90% or more of the students rated the component as "moderately" or "highly valuable." The program aspects eliciting mean ratings of 2.5 or higher accrued from: overall knowledge and skills acquired in the laboratory or field setting; the amount of time your UM faculty mentor spent communicating with you away, both at and away from the intern site; feedback provided about the trainee's project from the UM faculty; the overall laboratory or field setting; the stipend; career advice provided by your UM faculty mentor; and the lab facilities available at the intern site.

As an overall judgment about the merit and worth of the program, students were asked to reflect about whether they would again have chosen the program and recommend the program to others. Almost all (97%) of students indicated they would indeed again choose to take the program. Similarly, almost all (96%) indicated they would be "moderately likely" (34.5%) or "highly likely" (62.1%) to recommend the internship site to other students.

Students' open-ended comments served to nuance their structured ratings. For example, although the students rated their access to data extraction and analysis as valuable, their comments clarified that some students wished the allocation of time left more opportunity for interaction with people in the setting.

All of the students' concluding comments commended the program. These included:

"I really enjoyed the CEESP program and I think I received a great education here at Michigan because of it. I am very thankful for this experience."

"I felt I had a very successful internship and feel that the CEESP program is one of the best internship programs offered by SPH."

"I think it was a great experience. It allowed me to experience, first hand, the challenges of public health in Egypt."

"CEESP is a great program. I met smart, wonderful students and faculty through the program, in the US and in Israel."

"I very much appreciate the program and I think it has really inspired me to continue with cancer epid research. Thanks a lot for everything."

Table 4 summarizes faculty-mentor ratings of the skills students demonstrated in conducting internship activities. Faculty rated 80% or more of the students as "moderately" or "highly skilled" on 23 of the 25 identified research activities. Faculty perceived students demonstrated highest levels of skills in: coding qualitative and quantitative data; isolating DNA; collaborating with researchers from non-US institutions; designing and giving oral presentations; analyzing data from existing data sets; analyzing samples in a lab setting; and designing questionnaires and instruments.

Faculty perceived that their trainees demonstrated very high levels of skills on defined professionalism behaviors during the internship. Faculty accorded trainees the highest level

of skills in their ability to work with the resources and facilities provided at the internship site. Faculty ratings were also consistently high in their rating of students' demonstration of professional judgment and decision-making skills, personal maturity and poise, interpersonal communication skills and tactfulness, and ability to work with diverse groups of people. Students were also perceived to be able to organize and prioritize work tasks and meet professional deadlines. Slightly more variability was reported in students' reliability in adhering to routine work schedules, but all were characterized as at least “moderately skilled” in this professionalism attribute (Table 5).

Mentors reported that they “would strongly support” their mentee for a research position or admission to a graduate/postgraduate program. The career potential for which faculty gave students highest ratings was for field researchers in Public Health, followed by careers as cancer researchers in epidemiology or other fields of public health. Students were rated as having “moderate” (50%) or “high potential” (50%) for careers as field researchers in epidemiology.

Faculty comments about the students and the CEESP program included:

“I enjoyed working with (the student). Her analysis uncovered an issue with one of a question on our instrument. It caused us to rethink some things, which was very good. This is exactly what we wanted. I viewed this as a major contribution. I welcome the opportunity to work with another student from this program.”

“It was a real pleasure to work with (the student) who is bright, energetic, and fully involved in her work. She demonstrated her ability to adapt to all situations and to deal with field constraints.”

“En lo general puedo decir que fue una excelente colaboradora durante el tiempo que estuvo con nosotros.”

“Time is very limited. Students need more time—at least 4–6 months.”

(C) Students' Scholarly and Career Preference Outcomes

Evidence of the extent and quality of scholarly productivity related to cancer is reflected in the proportion of students completing posters and submitting manuscripts for peer-reviewed publications. The approximately 70% publication rate in peer-reviewed journals is significantly higher than the usual publication rate of <5% among students in the UM School of Public Health and in epidemiology programs in other schools of public health. All publications included the data and/or results of analysis of biological specimens collected during the summer field research experience.

Students are first authors on ten of the 12 articles currently published. The publications highlight findings based on research with populations in the USA of Native Americans [4], Asian Indian women [5], and Arab Americans [6]. Published research from international settings also includes knowledge of human papilloma virus [7] and reliability of reproductive history recall among North African women [8]. Student publications in international training sites also have examined inflammatory breast cancer [9], bladder cancer [10], pancreatic adenocarcinoma [11], pediatric brain tumors [12], cervical cancer

[13], and the concordance of plasma and tumor DNA methylation in hepatocellular carcinoma [14].

Students were asked to reflect on the likelihood that they would choose a career in cancer epidemiology. A majority (70%) of students indicated that they were “somewhat likely” (20%) or “highly likely” (50%) to choose a career in cancer epidemiology.

Of the 20 students in the first two cohorts, three are admitted to top-tier programs in cancer epidemiology and 12 are currently working in cancer epidemiology research and cancer-related careers in international and/or minority settings.

Conclusions

With the award of the R25 E grant from NCI, this program was able to grow and develop a new curriculum to prepare students for summer cancer research experience in international and minority settings and to provide mentoring, evaluation, and dissemination to other US institutions. This program includes the first structured field internship program for a large number of cancer epidemiology students in any public health graduate program in the USA.

The impact of the program on the students' scholarly productivity and continuing career aspirations is reflected in the high proportion that completed scholarly manuscripts related to their internship and who identify themselves as likely to choose cancer-related careers. Although the program has been successful in motivating students to pursue cancer-related careers in special populations, such programs require institutional support for the commitment of faculty who are committed to collaborative research.

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Table 1Characteristics of CEESP students ($N=32$) for the 3 years of the program (2007–2009)

	Summer 2007 ($n=11$)	Summer 2008 ($n=10$)	Summer 2009 ($n=11$)	All summers ($N=32$)
Age in years (mean)	25.3	25.2	24.8	25.3
Race of applicants ($n=45$)	$n=14$	$n=13$	$n=18$	$N=45$
White	8 (58%)	7 (54%)	13 (72%)	28 (62%)
Black	3 (21%)	2 (15%)	1 (6%)	6 (14%)
Asian	3 (21%)	4 (31%)	4 (22%)	11 (24%)
Race of admitted students ($n=32$)				
White	8 (73%)	7 (70%)	11 (100%)	26 (81%)
Black	1 (9%)	1 (10%)	0 (0%)	2 (6%)
Asian	2 (18%)	2 (20%)	0 (0%)	4 (13%)
MPH concentration—epidemiology				
General epidemiology	8 (73%)	4 (40%)	5 (46%)	17 (54%)
International health epidemiology	2 (18%)	4 (40%)	4 (36%)	10 (31%)
Hospital and molecular epidemiology	0 (0%)	2 (20%)	0 (0%)	2 (6%)
Biostatistics	0 (0%)	0 (0%)	1 (9%)	1 (3%)
Health behavior and health education	1 (9%)	0 (0%)	0 (0%)	1 (3%)
Environmental health sciences	0 (0%)	0 (0%)	1 (9%)	1 (3%)
Withdrew from UM-SPH after year 1 for medical reasons	1 (9%)	0 (0%)	0 (0%)	1 (3%)
Cumulative GPA at graduation from SPH (out of 9.0)	6.83	7.29	7.8	7.23
Pre-internship GPA at acceptance to the program [(mean) out of 9.0]	6.79	7.01	7.17	6.95
Undergraduate GPA (mean) out of 4.0	3.35	3.5	3.64	3.49
Undergraduate area				
Biological sciences	8 (72%)	10 (100%)	9 (82%)	27 (84%)
Social sciences	3 (28%)	0 (0%)	2 (18%)	5 (16%)
Fluency in language in research site	3 (27%)	4 (40%)	4 (36%)	11 (34%)
Internship site				
Domestic	6 (55%)	2 (20%)	3 (28%)	11 (34%)
International	5 (45%)	6 (60%)	6 (54%)	17 (53%)
International followed by domestic	0 (0%)	2 (20%)	2 (18%)	4 (13%)
Previous work experience (yes)	8 (73%)	10 (100%)	7 (64%)	25 (78%)
Previous field experience (yes)	4 (36%)	8 (80%)	2 (18%)	14 (44%)
Publication status				
Published or in press	6* (60%)	5 (50%)	**	11 (55%)
Submitted	0 (0%)	3 (30%)	**	3 (15%)
Years between undergrad and joining CEESP				
0	7 (64%)	6 (60%)	6 (55%)	19 (59%)
1–3 yrs	2 (18%)	4 (40%)	2 (18%)	8 (25%)
More than 3 years	2 (18%)	0 (0%)	3 (27%)	5 (16%)

* Counted 6 out of 10 students who completed the program in Year 1

** Publications are in progress as students will finish the program in May 2010

Table 2

Activities completed by students at internship site and students' ratings of value completing activities

Percentage of all students Activity	Percentage among students who participated in the activity				Mean	SD
	Yes, completed	Little or no value	Moderately valuable	Highly valuable		
Designed a research study	73.3		9.1	90.1	2.91	0.29
Designed sampling protocols	36.7		27.3	72.7	2.73	0.47
Designed questionnaires/instruments	43.3	7.7	23.1	69.2	2.62	0.65
Pilot tested questionnaires/instruments	23.3		14.3	85.7	2.86	0.38
Designed and gave oral presentations	63.3		47.4	52.6	2.53	0.51
Designed and implemented recruitment strategies	30.0		22.2	77.8	2.78	0.44
Participated in project meetings	86.7		46.2	53.8	2.54	0.51
Collected quantitative data	80.0		20.8	79.2	2.79	0.42
Collected qualitative data	60.0		16.7	83.3	2.83	0.38
Coded quantitative data	63.3	5.3	10.5	84.2	2.79	0.54
Coded qualitative data	46.7		14.3	85.7	2.86	0.36
Abstracted/summarized data from existing records/data sets	73.3		22.7	77.3	2.77	0.43
Interviewed people in person or on the phone	26.7		12.5	87.5	2.88	0.35
Analyzed samples in a lab setting	30.0		22.2	77.8	2.78	0.44
Analyzed quantitative data	70.0		14.3	85.7	2.86	0.36
Analyzed qualitative data	43.3	7.7		92.3	2.85	0.56
Learned new data analysis techniques	43.3			100.0	3.00	0.00
Compiled data bases	50.0		26.7	73.3	2.73	0.46
Prepared written reports and presentations for others	73.3		27.3	72.7	2.73	0.46
Collaborated with researchers from US institutions	56.7		23.5	76.5	2.76	0.44
Collaborated with researchers from non-US institutions	70.0	4.8	14.3	81.0	2.76	0.54
Collected biological samples/specimens	36.7	9.1	18.2	72.7	2.64	0.67
Collected clinical measures, such as blood pressure	3.3			100.0	3.00	-
Separated serum from blood	6.7			100.0	3.00	0.00
Isolated DNA	23.3		28.6	71.4	2.71	0.49

Table 3

Students' ratings of satisfaction with aspects of internship experience

Aspect of internship experience	Percentage among students who participated in the activity				
	Percentage of students	Little or no satisfaction	Moderately satisfied	Highly satisfied	Mean SD
The overall laboratory or field setting	86.7	3.8	34.6	61.5	2.58 0.58
Your overall knowledge/skills acquired in the laboratory or field setting	85.7	3.8	15.4	80.8	2.77 0.51
The amount of time your UM faculty mentor spent with you at the internship site	86.7	3.8	38.5	57.7	2.54 0.58
The amount of time your UM faculty mentor spent communicating with you while she/he was not at the internship site	100.0	3.3	33.3	63.3	2.60 0.56
The amount of time your onsite mentor(s)/research supervisor(s) spent with you at the internship site	100.0	6.7	46.7	46.7	2.40 0.62
The amount of time your onsite mentor(s)/research supervisor(s) spent communicating with you while they were not at the internship site	86.7	11.5	42.3	46.2	2.35 0.69
Feedback about your research project by your UM faculty mentor	96.7		34.5	65.5	2.66 0.48
Feedback about your research project by your onsite mentor(s)/research supervisors	100.0	10.0	36.7	53.3	2.43 0.68
Career advice provided by your UM faculty mentor	80.0	4.2	37.5	58.3	2.54 0.59
Career advice provided by your onsite mentor(s)/research supervisor(s)	60.0	27.8	38.9	33.3	2.06 0.80
Skill training provided by your UM faculty mentor	73.3		54.5	45.5	2.45 0.51
Skill training provided by your onsite mentor(s)/research supervisor(s)	80	16.7	50	33.3	2.17 0.70
The lab equipment and lab supplies available at the internship site	46.7	7.1	21.4	71.4	2.64 0.63
The computers provided by your use at the internship site	60	11.1	33.3	55.6	2.44 0.71
The office work space provided for you at the internship site	76.7	4.3	43.5	52.2	2.48 0.59
The laboratory bench space provided for you at the internship site	33.3		40.0	60.0	2.60 0.52
The library facilities made available to you at the internship site	43.3	7.7	38.5	53.8	2.46 0.66
The stipend paid to you for your time at the internship site	76.7	8.7	21.7	69.6	2.61 0.66
The assistance from Dr. Soliman's staff while you were at the internship site	96.7	17.2	31	51.7	2.34 0.77

Table 4

Faculty ratings of students' skill in completing internship activities

Activity	Percentage of students					Mean	SD
	Little or no skill	Moderately skilled	Highly skilled				
Designed a research study		41.2	58.8	2.59	0.51		
Designed sampling protocols	7.7	30.8	61.5	2.54	0.66		
Designed and gave oral presentations	18.2	27.3	54.5	2.60	0.51		
Coded qualitative data			100.0	3.00	0.00		
Abstracted/summarized data from existing records/data sets	13.3	13.3	73.3	2.60	0.74		
Analyzed samples in a lab setting	20.0		80.0	2.60	0.89		
Analyzed qualitative data	25.0		75.0	2.50	1.00		
Learned new data analysis techniques	40.0	30.0	30.0	1.90	0.88		
Compiled data bases	7.1	28.6	64.3	2.57	0.65		
Collaborated with researchers from US institutions	18.2	27.3	54.5	2.36	0.81		
Collaborated with researchers from non-US institutions	7.1	21.4	45.5	2.64	0.63		
Collected biological samples/specimens	11.1	22.2	66.7	2.56	0.73		
Collected clinical measures, such as blood pressure	25.0	25.0	50.0	2.25	0.96		
Separated serum from blood	33.3		66.7	2.33	1.15		
Isolated DNA			100.0	3.00	0.00		
Prepared written reports and presentations for others							
Designed questionnaires/instruments		40.0	60.0	2.60	0.51		
Collected qualitative data		12.5	87.5	2.88	0.35		
Coded quantitative data		33.3	66.7	2.67	0.49		
Collected quantitative data	4.5	22.7	50.0	2.59	0.62		
Designed and implemented recruitment strategies	9.1	27.3	63.6	2.54	0.69		
Analyzed quantitative data	15.4	38.5	46.2	2.31	0.75		
Participated in project meetings	7.1	28.6	64.3	2.57	0.65		
Interviewed people in person or on the phone	16.7	16.7	66.7	2.50	0.84		
Pilot tested questionnaires/instruments	10.0	50.0	40.0	2.30	0.67		

Table 5
Mentors' ratings of trainees' demonstration of professionalism during the internship experience

Professional skills	Percentage of students			Mean	SD
	Not demonstrated	Moderately demonstrated	Highly demonstrated		
Professional judgment/decision-making skills	9.1	13.6	77.3	2.68	0.65
Personal maturity and poise	9.1	13.6	77.3	2.68	0.65
Interpersonal communication skills and tactfulness	9.1	13.6	77.3	2.68	0.65
Professional reliability/adhering to routine work schedules	9.5	23.8	66.7	2.57	0.68
Ability to organize work tasks	9.5	28.6	61.9	2.52	0.68
Ability to prioritize work tasks	9.5	19	71.4	2.62	0.67
Ability to meet professional deadlines	4.8	19	76.2	2.71	0.56
Ability to work with diverse groups of people	4.5	13.6	81.8	2.77	0.53
Ability to work with the resources/facilities provided at the site	4.8	19	76.2	2.71	0.56