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Evaluation of the Impact of NCI Summer Curriculum on Cancer Prevention's on Participants from Low- and Middle Income Countries

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Abstract

The NCI Summer Curriculum on Cancer Prevention provides scientists and health care professionals training in principles and practices of cancer prevention and control, and molecular biology and genetics of cancer. Originally intended for U.S. scientists, the Curriculum's enrollment of international scientists has increased steadily. The objective of the current study was to evaluate the Curriculum's impact on knowledge, skills and career accomplishments of the international participants from low- and middle-income countries (LMIC). International participants from 1998 to 2009 completed questionnaires regarding knowledge, overall experience and accomplishments directly associated with the Curriculum. Almost all respondents agreed the Curriculum enhanced their knowledge and skills, prepared them to contribute to cancer control activities in their home countries and addressed specific needs and achieve research goals. The NCI Summer Curriculum on Cancer Prevention gives international participants a unique opportunity to enhance their knowledge and effectively contribute to cancer control activities in their home country.

Introduction

Cancer has a major impact on global health. In 2008, almost 13 million people were diagnosed with cancer and 7.6 million people died of cancer worldwide [1]. By 2030, it is estimated that 13.1 million people will die from cancer [1]. Also, low- and middle income countries accounted for 70% of cancer deaths in 2008[1], where weak health systems, limited financial support, human resource challenges, and lack of priority for cancer prevention and control may exist. Population growth, increasingly aging populations, and lifestyle add to the global cancer burden [2, 3]. However, cancer has not received widespread attention and financial support when compared to infectious diseases, such as AIDS, tuberculosis and malaria [4, 5].

Prevention plays a key role in reducing the global burden of cancer. Thirty percent of cancer deaths can be prevented by reducing lifestyle risk factors such as tobacco use, obesity, unhealthy diet, and lack of physical activity. [1]. Hepatitis B (HBV), Hepatitis C (HCV) and Human Papillomavirus (HPV) are the leading risk factors for cancer in low- and middle-income countries [1]. Training health care professionals and researchers is also important in building capacity to address the global burden of cancer [6]. Cancer prevention strategies focused on avoidance of cancer-linked risk factors, early detection, vaccinating for chronic infections, and strengthening health care systems are critical in cancer prevention and control.

The National Cancer Institute (NCI), the world's largest cancer research entity, has played a historically significant and widespread role in training foreign clinicians and scientists in cancer prevention, control and research. The NCI's Summer Curriculum in Cancer Prevention provides scientists and health care professionals training on principles and practices of cancer prevention and control, and molecular biology and genetics of cancer [7].

The NCI Summer Curriculum is comprised of two courses. The first course, *Principles and Practices of Cancer Prevention and Control* Course, is a four-week course that includes concepts, methods, issues and applications related to cancer prevention and control. The second course, *Molecular Prevention* Course, is a one-week course focusing on basic laboratory approaches applied to cutting-edge research in the fields of molecular epidemiology, chemoprevention, biomarkers, and translational research. The Curriculum also includes a special keynote lecture, *Annual Advances in Cancer Prevention Lecture*, featuring a renowned researcher in cancer control and prevention. The Curriculum's faculty is comprised of leading scientists at NCI, NIH, other government agencies, academia, cancer centers, and public and private organizations.

Originally intended for U.S. scientists, the Curriculum enrolled its first international participants in 1998. In 2009, the curriculum had 40 participants from low- and middle-income countries (LMICs) in addition to participants from Ireland and Northern Ireland under the auspices of the Ireland-Northern Ireland-NCI Cancer Consortium. By offering travel and subsistence scholarships, NCI's Office of International Affairs, which is now incorporated into NCI's Center for Global Health (CGH), has proactively sought to increase the number of international participants from LMICs to enhance the global cancer workforce to address the global burden of cancer via prevention (Figure 1). The following URL includes the course syllabus: <https://cpfp.cancer.gov/summer/summer.php>.

Using publications as a research outcome measure, Dores et al's [8] evaluation of NCI's CPFP found that overall publications for fellows increased post-CPFP, thus supporting the strength of the program. An evaluation of the NCI Summer Curriculum, specifically the knowledge transfer and outcomes for international participants, has yet to be evaluated. The purpose of this evaluation was to describe the knowledge, skills and career accomplishments of the NCI's Summer Curriculum international participants from LMIC's.

Methods

The NCI Summer Curriculum is open to a variety of individuals with interest in cancer prevention and control. Applicants with a doctoral degree (MD or PhD) and/or relevant experience in cancer prevention and control are preferred, although nurses, public health professionals and social workers participate. Curriculum participants have included individuals from cancer centers, universities, health departments, U.S. Federal Government, and industry from the U.S. and around the world.

Since 1998, the Curriculum has allotted seats to international participants. Curriculum LMIC participants are derived from two categories:

1. International Atomic Energy Agency's (IAEA) Programme of Action for Cancer Therapy (PACT) nominees. NCI's major collaboration with IAEA has been through education and training, more specifically the NCI Summer Curriculum [9]. IAEA nominees are recommended by its partners in LMICs.
2. Self-directed participants: applicants who apply via the NCI Summer Curriculum website.

International applicants are evaluated and selected by NCI CGH's based on the potential likelihood of using the knowledge gained, geographic balance, academic background and strong interest/work experience relevant to cancer prevention and control. As shown in Figure 1, there has been an overall balance in the five LMIC regions that have participated in the Curriculum to date; NCI's collaboration with IAEA since 2007 has extended the opportunity to more LMIC participants. NCI CGH has a limited amount of funding available for selected participants from low-and middle-income countries.

Two hundred and thirty-two participants from Ireland and Northern Ireland have completed the Curriculum since 2000. They are derived from NCI's commitment to the All-Ireland NCI Cancer Consortium [10]. A separate evaluation of the Ireland-Northern Ireland-NCI Cancer Consortium participants has been completed [11].

This evaluation focused on IAEA PACT and self-directed LMIC participants only.

Data Collection and Analysis

Along with participant background information, the questionnaire focused on enhanced knowledge, overall experience and accomplishments directly associated with the curriculum. Participants were also asked how they learned about the curriculum, if they had relocated since the curriculum, and if they have received research grants.

Participants were emailed the questionnaire in three batches: early August 2009, early September 2009 and late September. For those participants who did not have an email address or whose emails bounced back, the questionnaire was post-mailed.

From 1998 to 2009, the NCI Summer Curriculum had 269 LMIC participants (Table 1). Contact information for 214 LMIC participants was available and used to send the questionnaire.

Descriptive data on the participants and questionnaire variables were analyzed. Also, crosstabulations were calculated to evaluate the relationship between certain questionnaire variables.

Results

Participants' Characteristics

Of the 214 participants contacted, 123 (57%) responded to the questionnaire. The most recent participants contacted (2009 participants) had the highest response rate (87.5%), followed by 2008 participants (62.86%) and 2006 participants (59.26%). It is perhaps not surprising that there would be attrition in response rate with time. Almost 27% of respondents were from Asia, 44% of respondents had a medical degree and 75% completed both courses. At least 50% of participants contacted responded to the questionnaire, with Eastern Europe having the highest response rate (64.11%). Almost 30% of respondents relocated from their home country since the Curriculum (Table 1).

The majority of respondents learned about the Curriculum from a cancer research organization (26%), previous Curriculum participant (19%) or by a referral from their home institution (15%) (Table 2). Only 2% of respondents reported conducting an internet search to learn about the Curriculum. By region, more Asian respondents (24%) and Sub-Saharan African respondents (33%) learned from a cancer research organization, whereas 41% of North Africa/Middle East respondents learned from a previous Curriculum participant.

NCI Summer Curriculum Questionnaire

Knowledge—To learn about the respondents' knowledge, we asked if the Curriculum enhanced their knowledge, prepared them to contribute effectively to cancer control activities, and if they used the knowledge and skills gained from the Curriculum in their home countries. Almost all respondents reported that they agreed their knowledge and skills were enhanced (98%), they were prepared to contribute to cancer control activities (97%), and used the knowledge and skills from the Curriculum in their home countries (89%). Respondents were also asked if the Curriculum addressed specific needs to achieve research goals. Ninety percent responded that they agreed the Curriculum assisted them in reaching their research goals.

Collaborations—Respondents were asked about their interactions with colleagues in the Curriculum and NCI staff. Thirty-one percent of respondents reported they collaborated with NCI staff who participated in the Curriculum. Also, 91% of respondents reported they maintained contact with their colleagues who participated in the Curriculum.

Accomplishments—To learn more about how the Curriculum impacted the respondents, we inquired about their accomplishments and participation in professional activities directly related to their Curriculum experience. Sixty-seven percent of respondents reported that they published and/or presented information on cancer prevention based directly on their Curriculum experience (Table 1). Forty-three percent of respondents reported having received grants, of which 22% of respondents reported receiving cancer prevention grants. Questionnaire variables are described in Table 2.

For receiving grants (cancer and non-cancer) by geographic region, 42% of Asian respondents, 30% of Eastern European respondents, 25% of Eastern European respondents, 41% of North Africa/Middle East respondents, and 23% of Sub-Saharan African respondents reported receiving grants. Also by geographic region, 30% of Asian respondents, 15% of Eastern European respondents, 31% of Latin American/Caribbean respondents, 38% of North Africa/Middle East respondents, and 23% of Sub-Saharan African respondents reported having peer-reviewed cancer prevention publications. For scientific presentations by geographic region, 63% percent of Asian respondents, 70% of Eastern European respondents, 68% of Latin American/Caribbean respondents, 58% of North Africa/Middle East respondents, and 57% of Sub-Saharan African respondents reported they presented at conferences, symposiums, and/or scientific meetings. Overall, many of the respondents did not report receiving grants or having peer reviewed publications, however more respondents reported they conducted scientific presentations.

Additional Information—The questionnaire collected additional information reported by respondents. When asked how they learned about the Curriculum, 26% of respondents reported they learned about the Curriculum from a cancer organization, 19% of respondents reported they learned from a previous Curriculum participant and 15% of respondents reported they were referred by their home institution.

Regarding their participation, 23% took only the Principles and Practices of Cancer Prevention Course, 2% took only the Molecular Prevention Course and 75% took both courses. Of the respondents who participated in both Curriculum courses, 29% of respondents reported publishing scientific peer-reviewed articles, 30% of respondents reported publishing non-scientific peer-reviewed articles and 65% of respondents reported making presentations at conferences/symposiums/scientific meetings. Variables for reporting the publishing of scientific peer-reviewed articles, non-scientific peer-reviewed articles and presentations were not mutually exclusive.

Respondents were also asked about relocation from their home country since participating in the Curriculum; 29% of all respondents relocated. By region, relocation was reported by 30% of Sub-Saharan African respondents, 29% of North Africa/Middle East respondents, 38% of Latin American/Caribbean respondents, 10% of Eastern European respondents and 36% of Asian respondents. Of all the respondents who relocated, 25% of respondents published scientific peer-review articles related to cancer prevention while 75% of respondents did not. Also, of the respondents who did not relocate, 29% respondents published scientific peer-review articles related to cancer prevention while 71% of respondents did not. Therefore, relocation did not have a significant effect on whether respondents reported published scientific peer-review articles related to cancer.

Chi Square Test of Independence

The Chi Square Test of Independence was conducted to analyze the association between certain variables in the questionnaire data, specifically for grants, publications (non-peer reviewed and peer-reviewed) and presentations. We found that there was no association between presentations and receiving grants [χ^2 (2, $N=123$) = 4.69, $p < 0.05$], or association between non-peer reviewed cancer prevention publications and receiving grants [χ^2 (2, $N=123$) = 4.07, $p < 0.05$]. However, there was an association between peer-reviewed cancer prevention publications and receiving grants [χ^2 (2, $N=123$) = 6.84, $p < 0.05$].

Discussion

The vast majority of questionnaire respondents reported that the NCI Summer Curriculum enhanced their knowledge and skills in cancer prevention, prepared them for cancer control, prevention activities in their home country, and addressed their research goals. Respondents reported participation in activities in their home country that were directly related to their participation in the Curriculum. Almost 68% of respondents reported publishing and/or presented information on cancer prevention. Cancer research organizations, previous Curriculum participants and home institutions provided respondents an opportunity to learn more about the Curriculum. Also, very few respondents reported they received grants (cancer or non-cancer), had publications (peer-reviewed or non-peer reviewed) and made presentations at conferences/symposiums/scientific meetings.

Our evaluation results allowed us to reflect on different perspectives of challenges in international cancer research capacity, training and resources. The Sub-Saharan African Medical School Study (SAMSS) evaluated sub-Saharan African medical schools' capacity, curriculum, infrastructure and role in health care system[11]. Our evaluation showed that 29% of respondents reported relocating from their home country, which is almost identical to SAMSS's estimate that 28% of medical school graduates relocated after graduation. This "brain flight" pressures the academic system as there are less faculty, clinicians and leadership for medical programs. Reasons cited for the migration in SAMSS include salaries, research opportunities, resources, and overloaded teaching responsibilities. The small percentages of cancer prevention grants reported by our respondents are also similar to SAMSS' report. They found that less than 10% of faculty members were involved in sponsored research, which may be due to faculty shortages, less experienced young faculty, or school resources[12]. In many low- and middle-income countries, research is not a priority and more focus is put upon treatment and care. Research resources (e.g. funding, infrastructure, subject matter experts) may not be available to Curriculum participants, which also hinder their research goals and capacity building initiatives in their home country.

More than half of the respondents (approximately 55%) reported they did not receive grants (cancer or non-cancer), and close to one-third of all respondents did not have publications

and/or made scientific presentations. These results could infer that there may not be a strong culture and/or resources for research, in comparison to treatment and care in LMICs. Also, our results could suggest that career advancement may not be closely linked to receiving grants, conducting research and having publications. For the few respondents who reported receiving grants, the Chi Square Test of Independence results showed a relationship with respondents who had peer-reviewed publications. This relationship is not surprising, as many grantees are required to publish their research findings in peer-reviewed journals, may leverage their peer-reviewed publications to be more competitive for research funding and possible career advancement, as well as trying to establish themselves as subject matter experts in their field.

Also, the evaluation showed that networks or social capital were effective helping respondents to learn more about the Curriculum. The majority of respondents learned about the Curriculum through networking referrals instead of an internet search or the NCI website. Building or strengthening existing research and training collaborations between Ministries of Health, academic institutions and cancer organizations, such as IAEA or the Union for International Cancer Control (UICC), may assist in building capacity for well-trained health care professionals and researchers.

Findings from this study may be useful for evaluating research training programs and curriculum development, especially for LMIC participants. Several limitations to this study should be noted. First, this questionnaire was the first of its kind specifically geared for the NCI Summer Curriculum LMIC participants, thus it has not been used in previous evaluation studies. Second, contact information provided by the participants may have been unavailable or emails bounced back. This affected the response rate and generalizability of the results. Third, the reporting of publications may be affected by timing for those respondents who recently completed the course. Fourth, the majority of respondents were from 2006 to 2009; IAEA began nominating participants in 2007 which dramatically increased the number of LMIC participants. A final study limitation was selection bias due to the use of self-report data. Respondents may not have accurately responded to the questionnaire, therefore underestimating or overestimating their responses. Respondents with accomplishments, such as publishing peer-review scientific articles or having research grants, may have tended to respond to the questionnaire as opposed to those who may not have had significant accomplishments.

Based on the evaluation results, certain recommendation for the questionnaire and Curriculum came forth. Regarding the questionnaire, probing further on relocation, barriers to publishing, presenting and/or grants for cancer prevention would provide a better perspective on the issues that cancer researchers from LMIC's face. Fifty-five percent of respondents reported not receiving research grants. Adding a grantsmanship module to the Curriculum may help inform participants on the grant application process, grant writing techniques, and possible grant opportunities applicable to LMICs. Beyond the Curriculum, NCI CGH has conducted a grant writing and scientific peer review workshop for scientists in Latin America (Bogota, Colombia), with plans to have workshops in Sub-Saharan Africa, Asia, and The Caribbean. Also, developing organizational collaborations to create research funding opportunities for LMICs is important. The Beginning Investigator Grant for Catalytic Research (BIG Cat) is a collaboration between NCI and the African Organization for Research and Training in Cancer (AORTIC) to support exploratory data collection by African scientists engaged in cancer research in Africa. More partnerships similar to NCI-AORTIC's BIG Cat should be explored for other regions with LMICs. For researchers from LMICs who are not able to attend the Curriculum, a couple of options could exist. A "train-the-trainer" Curriculum could be administered and taught by former Curriculum participants who have high-yield outcomes (e.g. published, presented and successful grants). Also, a

select number of Curriculum staff could travel to certain LMICs to present an abbreviated version of the Curriculum.

Conclusion

As infectious disease control becomes more enhanced and populations continue to age rapidly, the morbidity and mortality rate of non-communicable diseases, such as cancer, will increase. In LMICs where cancer care and research facilities are sub-optimal or non-existent, cancer prevention and control should be a high priority in addressing the growing burden of cancer.

The NCI Summer Curriculum on Cancer Prevention gives international participants a unique opportunity to enhance their knowledge on cancer control, network with cancer experts, develop future research partnerships and effectively contribute to cancer control activities in their home country.

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Figure 1.
Number of Participants from Low-and Middle-Income Countries (LMIC) in the NCI Summer Curriculum from 1998 to 2009

Table 1

Questionnaire Response Rate and Percentage of Respondents who Published and/or Presented on Cancer Prevention, by year of participation

Year	Number of Participants	Number of Participants Contacted*	Number of Respondents	Response Rate	% of Respondents who Published and/or Presented on Cancer Prevention
1998	9	1	0	0%	0%
1999	15	6	1	16.7%	100%
2000	8	5	2	40%	100%
2001	15	14	7	50%	85.7%
2002	15	12	3	25%	100%
2003	15	11	7	63.6%	71.4%
2004	14	8	4	50%	100%
2005	24	11	3	27.3%	66.7%
2006	31	27	16	59.3%	87.5%
2007	45	44	23	52.3%	69.5%
2008	35	35	22	62.9%	50%
2009	40	40	35	87.5%	54.2%
Total	269	214	123	57.5%	67.4%

* Many participants were unable to be contacted due to unavailable files and/or bounced back emails.

Table 2

NCI Summer Curriculum in Cancer Prevention Questionnaire Variables (N = 123)

Questionnaire Variables	No. of Respondents (%)
Learned about NCI Summer Curriculum*	
NCI Website	10 (8.1)
NCI or NIH Scientist	15 (12.2)
Cancer Research Organization	32 (26)
Previous Participant of the NCI Summer Curriculum	23 (18.7)
Internet Search	2 (1.6)
Referral from home institution supervisor/staff	18 (14.6)
Other	8 (6.5)
Program enhanced knowledge and skills*	
Strongly Agree/Agree	121 (98.3)
Strongly Disagree/Disagree	1 (0.8)
Program prepared for effective contributions to home country activities*	
Strongly Agree/Agree	120 (97.6)
Strongly Disagree/Disagree	2 (1.6)
Program addressed specific needs and helped achieve research goals*	
Strongly Agree/Agree	110 (89.4)
Strongly Disagree/Disagree	9 (7.3)
Grants*	
Currently or in the past received cancer prevention grants	27 (22)
Received grants not related to cancer prevention	26 (21.1)
None	68 (55.3)
Published or presented information on cancer prevention (mutually exclusive)	
Published only	8 (6.5)
Presented only	33 (26.8)
Published and Presented	42 (34.1)
Did not publish and/or present	40 (32.5)