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## Transdisciplinary training in cancer prevention: Reflections on two decades of training

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With release of an RFA in 1991 to promote cancer prevention and control training (Education Programs in Cancer Prevention and Control (RFA CA-91-20)), one of us (GAC) worked with colleagues (Drs. Frederick P. Li, Diana Chapman Walsh, and Walter C. Willett, at Harvard School of Public Health) to frame an innovative, new training program in cancer prevention. While Harvard School of Public Health had a long history of training classic cancer epidemiologists focused on pathobiology through an established T32 training program (T32-00001) and a training program in environmental epidemiology (T32 ES 07069), little attention had been paid to issues in the use of epidemiologic data to inform prevention strategies that might reduce the burden of cancer on society<sup>12</sup>.

Specifically, the RFA sought programs that combined multidisciplinary curricula with ongoing cancer prevention research so that trainees would “gain experiences ranging from research on innovative hypothesis testing and the impact of interventions on defined populations to the broad, systematic application of the research results.” We framed a training program and built support within the School and affiliated teaching hospitals (Brigham and Women’s Hospital and Dana Farber Cancer Institute) to place greater emphasis on cancer prevention and control training opportunities. In 1994, Dean of the School of Public Health, Harvey Fineberg, established the Center for Cancer Prevention as a school-wide priority, interdepartmental, and interdisciplinary in nature. The goals of the Center were: to promote research to speed development of cancer prevention strategies; to foster education programs for future leaders in cancer prevention; to communicate to the public what we know about cancer prevention; and to translate scientific findings into applied public health messages. With this institutional commitment and NCI funding, we built a program that would train future leaders in cancer prevention sciences. The training program became known as the Harvard Cancer Prevention Education Program.

The Center for Cancer Prevention was an underlying institutional structure and resource to support training and offer additional scholarship, particularly for those from foreign countries not eligible for NIH training support. Dr. Dimitrios Trichopoulos served as the Director and Dr. Graham Colditz as Education Director. Among the major goals of the Center were to foster interdisciplinary education in cancer prevention. At the same time, the Department of Health and Social Behavior (Dr. Diana C. Walsh, Chair, HSPH) and the Division of Cancer Epidemiology and Control (F.P. Li, Chair, DFCI) jointly established a research program in community based cancer prevention led by Drs. Glorian Sorensen and Karen Emmons.

The goal of the Harvard Cancer Prevention Education Program was to create a cadre of public health and clinical professionals who would be:

- a. knowledgeable about the current state of the science of cancer prevention;
- b. experts in a specialized research area in which they will be positioned to generate new knowledge and public health practice to advance cancer prevention;
- c. skilled in policy analysis; and
- d. sufficiently well anchored in professional networks that they will be able to monitor future developments in the field of cancer prevention and translate their knowledge into cancer control programs at a variety of institutional levels.

We established a multidisciplinary team of leaders to guide the training program. Leadership included faculty whose research spanned aspects of cancer prevention and who had disciplinary training in behavioral sciences, epidemiology, and health policy. Initially, trainees undertook coursework in disciplines underpinning cancer prevention and control, gaining familiarity with the vocabulary and concepts of the disciplines, and concurrently pursued related research in epidemiology, health behavior change, and communication sciences. Over time, we expanded the range of disciplines that we included in the training program, for example adding decision sciences in 2000. We built a mentoring program to foster the principles of cancer prevention, and required joint mentoring from a primary discipline and an additional related or “outside” discipline. We encouraged applied research projects from the beginning, as we saw the need to speed translation of research to practice to achieve the potential for cancer prevention <sup>3</sup>.

As a first step in implementing the vision for training in cancer prevention, we expanded the curriculum within the HSPH to include Screening (Drs. Colditz and Ichiro Kawachi); refocused a course on meta-analysis and research synthesis (Drs. Colditz, F. Mosteller, N. Laird), and built a core course in cancer prevention (Drs. Colditz and Walsh) that would expose trainees to the broad range of perspectives and scientific disciplines that bear on and underpin effective prevention initiatives. This course was required for all trainees and gave a grounding on which they might build research and training opportunities that fostered transdisciplinary research.

## Principles of Cancer Prevention course

The original training program proposal submitted to peer review promised a new course in cancer prevention, distinct from the existing cancer epidemiology course. Two faculty members (Drs. Colditz and Walsh) took responsibility for developing this new course after review of existing courses from other cancer centers and public health programs across the country. This review showed no existing courses were covering the breadth of disciplines we saw as fundamental to the future of cancer prevention, moving from biology of cancer to epidemiology, behavior, survivorship and prevention through health care providers, social and behavioral strategies, and regulatory approaches

Combining both a societal perspective as emphasized by Rose <sup>4</sup> and the biologic underpinnings of disease etiology and prevention (epidemiology, incidence, mortality, decision science, risk communication, behavior change, health policy), our instruction ranged from the basic biology of cancer to the social impact of cancer as recounted through the eyes of a childhood cancer survivor. In essence, we aimed to bring students to an understanding of the interplay of cancer biology, etiology, prevention, policy, and strategies to sustain healthier lives free from cancer. By completing the course, students were expected to be proficient in the language of these divergent scientific disciplines and understand how through a social ecologic approach <sup>5</sup> one can bring these disciplinary perspectives together to inform prevention priorities.

Considering strategies for prevention, we addressed the leading causes of cancer (tobacco, lack of exercise, diet, obesity, occupation, and sun exposure)<sup>3</sup>. Over time, this set of exposures evolved to consider broader environmental causes of cancer as well as the role of viruses and the range of strategies available to reduce risk within society from interventions through health care providers, through regulation, and through interventions at the individual and community level. Cancer prevention and control methodology for interventions and evaluation of programs rounded out the curriculum. See Table 1 for typical syllabus and readings (updated listing of references are available from the authors).

A fundamental issue in developing the course was the identification of a unifying approach to place the biology, evidence on population burden, strategies for prevention, and priority in society, in a coherent framework<sup>2</sup>. The Richmond model<sup>6-7</sup> became the central structure for the course, given that this model had not only been used by the US Department of Health and Human Services to frame Healthy People agenda ([http://www.cdc.gov/nchs/healthy\\_people.htm](http://www.cdc.gov/nchs/healthy_people.htm)), but it also offered the students a structure to insure they consider the scope of the challenge of moving cancer prevention forward. To make this applicable to the interests of the class participants we required a class team assignment – this emphasized collaboration across disciplines and required development of a strategy for cancer prevention or control.

Beyond the coursework, doctoral students in cancer prevention were encouraged to obtain experience outside their home discipline, either through collaboration on cancer prevention projects<sup>8</sup> or through participation in Harvard Center for Cancer Prevention / Dana Farber-Harvard Cancer Center activities that were structured to bring investigators together across disciplines<sup>9-11</sup>. At the post-doctoral level, medical oncologists gained training in epidemiology and behavioral sciences<sup>12-14</sup> as complements to their clinical skills. The training program required department chairs to buy-in to broader themes for dissertation research than the more traditional tight disciplinary focus at Harvard School of Public Health. For example, a thesis in the epidemiology department may include traditional cohort study prospective data analysis with repeated measures, and an evaluation of a behavioral intervention, and a paper addressing methods issues in prevention. In addition to these activities, the trainees attended a monthly session specifically for them to review progress on their research. When leaders in the field visited the Harvard School of Public Health to participate in the Cancer Prevention seminar series, trainees had the opportunity to share lunch with the visiting faculty and discuss career challenges, opportunities, and begin building professional networks.

## Preparation for Transdisciplinary Training

Emphasis on transdisciplinary training has grown over the past 20 years with substantial leadership from NCI through funding of TTURC and of other Transdisciplinary centers (<http://grants.nih.gov/grants/guide/rfa-files/RFA-CA-98-029.html>)<sup>15</sup>. Our program predated this emphasis. Priorities in training for a transdisciplinary research career extend beyond a single course and must be reflected in broader demands for doctoral level trainees that range from thesis committee membership, structure of mentoring, and expectations for thesis projects. At the post-doctoral level, this requires an individualized training program with specific career development objectives that build on prior training and bridge across disciplines through participation in seminars and ongoing research projects. Effective Transdisciplinary Centers in Health Disparities, for example, show 1) evidence of collaboration across schools, health care institutions, and community organizations; 2) capacity building through seminars etc; 3) development of new common conceptual language; 4) emergence of new lines of inquiry; and 5) innovation in development of new instruments and analytic methods<sup>16</sup>.

A central theme in the teaching and mentoring of trainees was an emphasis on applying knowledge to speed the translation of research to effective prevention programs.<sup>17</sup> Consistent with the goals of the program, trainees have subsequently pursued careers in a range of settings including at the NCI in the Division of Cancer Control and Population Sciences (e.g., Fagan<sup>18-19</sup>); in academic research settings (e.g., Fuchs<sup>12, 20</sup>; Linnan<sup>21</sup>); and at CDC (Sabatino<sup>22</sup>).

A more formal evaluation of this or other training programs would assess the long-term outcome of trainees in terms of their contribution to cancer prevention. This may be through service in any of the areas met by the goals of the training program. One might ask what the time frame for such an evaluation should be? Is 10 years after completing training insufficient to assess the benefits of the program? For example Fuchs, noted above, was a trainee in 1994-95. Other more recent trainees hold faculty posts in public health and as researchers in public health agencies (see table 2). In sum, evaluation may be more complex than for a traditional T32 where the primary research careers of trainees can be evaluated through national databases of grants and publications.

An integrated program that challenges trainees to apply knowledge to speed translation from research to effective prevention strategies and programs has led to a range of prevention scientists pursuing careers in cancer prevention. This funding mechanism from NCI appears to have been successful in speeding development of the discipline and training a new generation of academic and public health leaders. A diverse leadership team may be one of the key elements of modeling such an interdisciplinary program.

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**Table 1**

Topics for cancer prevention training, required course

Theme	Topics	Key reference
Introduction – overview	Causes of cancer Potential for prevention National goals for cancer prevention Richmond Model	Colditz et al. <sup>23</sup> Colditz et al. <sup>24</sup> Byers et al. <sup>25</sup> Atwood et al. <sup>7</sup>
Population perspective vs. individual risk	Rose model Risk perception and communication	Rose <sup>4</sup>
Cancer biology Patient perspectives	Etiology - biology Life course implications	Weinberg <sup>26</sup> Colditz <sup>27</sup>
Causes	Tobacco – cause of cancer Tobacco - strategies for control	Surgeon General reports Surgeon General Reports
	Obesity	Calle et al <sup>28</sup>
	Inactivity / Physical activity School based interventions to promote activity (design for dissemination)	Colditz et al. <sup>29</sup> IARC report <sup>30</sup> Gortmaker et al <sup>31</sup>
	Viruses and vaccines	Colditz <sup>23</sup>
	Environmental and occupational exposures	More recent e.g., Boffetta <sup>32</sup>
	Diet and alcohol Lessons from prevention trials	Key <sup>33</sup> Thun <sup>34</sup> Hunter <sup>35</sup> Schatzkin et al <sup>36</sup> Baron et al <sup>37</sup>
Chemoprevention	Principles, risk and benefits Challenge of prevention trials	ATBC <sup>38</sup> Beta-carotene <sup>39</sup> Zelen <sup>40</sup>
Screening	Methodologic issues Cervix example for methods Colorectal screening example	Colditz <sup>41</sup> IARC work group <sup>42</sup> Frazier <sup>13</sup>
Policy strategies for prevention		Colditz, Emmons <sup>1, 43-44</sup>
Media approaches for prevention	Working with media	DeJong <sup>45</sup> Viswanath <sup>46</sup>
Community based participatory research and prevention		Sorensen <sup>47</sup>
Contribution of trials and observational epidemiology to informing prevention	Aspirin, Folate, and other examples	WHI <sup>48,49</sup> , Aspirin <sup>50-51</sup>
Dissemination and sustainability	Models for dissemination Strategies for evaluation	Glasgow <sup>52</sup> Colditz <sup>53</sup>

**Table 2**

Prior trainees in cancer prevention, focus of training, institution and current position

<b>Trainee</b>	<b>Topic</b>	<b>Institution</b>	<b>Position</b>
Abroms, L	Tobacco control	George Washington University	Assistant Professor
Allen, JD	Screening and access	Dana-Farber / Harvard Medical School	Assistant Professor
Ahn, R	Social epidemiology	Massachusetts general Hospital	Manager, Center for Global Health
Barclay, G	Prevention – communication strategies	Aetna Foundation	V-P Programs
Bates, L	Social epidemiology	Columbia University	Assistant Professor
Case, P	Contraception	U Vermont	Assistant Res. Professor
De Moor, J S	Communication	Ohio State College of Public Health	Assistant Professor
Fagan, P	Tobacco control	NCI , Tobacco Control Research Branch	Program Director, Health Scientist
LaMontagne, A	Occupational health	U Melbourne, Australia	Associate Professor
Perry, M	Occupational health	Harvard School of Public Health	Associate Professor
Syngal, S	Colon cancer screening	Harvard Medical School	Associate Professor
Wolin, K	Colon Cancer Prevention /physical activity	Washington University in St Louis	Assistant Professor

Source: <http://www.hsph.harvard.edu/cancer-prevention-fellowship/past-nci-fellows/>

Accessed 4-April 24, 2011 and updated web pages of trainees