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Faculty Development for Education for Sustainable Health Care: A University System-Wide Initiative to Transform Health Professional Education

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Abstract

Health professionals (HPs) are increasingly called upon to care for patients experiencing the health impacts of climate change, while working in the high eco-footprint health care system, which is starting to embrace a culture of sustainability. HPs are uniquely positioned to drive health care culture toward ecological responsibility and, consequently, improve patient care, health equity, and public health. Education for sustainable health care (ESHC or ESH) is the first step in developing health care practitioners able to think critically about and act upon the health impacts of the climate crisis. University of California Education for Sustainable Healthcare (UC-ESH) Faculty Development Initiative was developed to address the following goals: educate faculty on eco-medical literacy, empower faculty to build community and lead ESH at their institutions, and expand coverage of ESH to reach students beyond those for whom sustainability is already a focus. The initiative provided training to faculty across health professions and six health science campuses to integrate ESH into their courses using the train-the-trainer model, key knowledge and pedagogical skills, and longitudinal guidance and networking opportunities. Using a survey, questionnaire, and interviews the initiative was evaluated using the process/elements and product/outcomes steps of the Context, Input, Process, and Product evaluation model. The UC-ESH educated over 100 faculty members and led to ESH integration into 99 existing and new courses that subsequently reached over 7,000 learners. The UC-ESH increased empowerment, awareness, and knowledge about the climate crisis, and built an ESH community of practice. Initiative elements that contributed to these outcomes included engaging training; creation of supportive group dynamics; helpful resources and activities; ongoing support; and integration approaches to ESH. This university-system-wide initiative provides a transferable model to institutions, schools, and departments seeking to develop eco-medical literate faculty who educate their students about the climate, ecosystem, and health crisis.

As the climate crisis takes its toll on the planet, health professionals (HPs) are increasingly called upon to care for patients who experience the health impacts of climate change. Likewise, the health care system where HPs work, which has a high eco-footprint, is starting to embrace a culture of sustainability. HPs are on the front lines of the climate crisis, making them uniquely positioned to drive the culture of health care toward ecological responsibility and, consequently, improve patient care, health equity, and public health.[1] To enable this change, HPs must first recognize the connections between the climate, ecosystems, sustainability, and health as well as their responsibility and capacity as HPs to change the status quo. However, institutions that train HPs have yet to educate their students about eco-medical literacy, which is "the ability to access, understand, integrate, and use information about the health-related ecological effects of climate change to deliver and improve medical services."[2] Moreover, HP faculty do not yet have the content knowledge and pedagogical expertise to educate students about climate–health connections.[3–5]

Education for sustainable health care (ESHC, or ESH as it is commonly known) is the first step in developing health care practitioners who can think critically about and act upon the health and societal impacts of the climate crisis.[6] ESH refers to pedagogical approaches that develop attitudes, knowledge, and skills about the interdependence of ecosystems and human health, including the effects of environmental change on health, the health sector's impact on the environment, and sustainable solutions to both.[3,7] In the United States, education about climate and ecosystems change (referred to as climate or environmental literacy) is not yet a core part of primary, secondary, or higher education.[8,9] As such, learners and faculty have different understandings of the climate crisis and its impacts, including on health.[10] Likewise, globally, most HP faculty lack ESH expertise[11,12] and need support to learn and teach ESH[13]; and ESH-centered faculty development is underdeveloped.[5] Recent needs assessments of HP educators[14]

and HPs[1] have demonstrated that respondents desired more knowledge, faculty development, and pedagogical tools to integrate and teach eco-medical literacy. Moreover, a vast majority of respondents felt ESH should be taught in all courses,[14] underscoring that ESH should be framed within multidisciplinary worldviews.[15]

The current literature on ESH faculty development recommends what faculty should learn and provides guidance for how to develop training.[12,16,17] What the literature lacks is a model for ESH faculty development that incorporates key elements of effective faculty development in the health sciences such as training faculty in education, preparing them to engage in new activities, and fostering a "new intellectual and social community of likeminded individuals who share a passion."[18] Such communities often help faculty overcome feelings of isolation in their work environments.[18]A concerted effort to educate HP faculty in collaborative communities who can in turn educate students about ESH is vital.[13]

Here, we describe the University of California ESH Faculty Development Initiative (UC-ESH), which was designed to educate and enable a broad cross-section of HP faculty to adapt their curricula to incorporate ESH, thereby creating a critical mass of courses that educated students about sustainable health care. We describe the initiative, its outcomes, and the elements that contributed to those outcomes. Our initiative has broad applicability to individual institutions, schools, and departments seeking to improve the eco-medical literacy of their faculty and prepare their students to confront what we believe is the largest health threat of the century.[19]

The UC-ESH Faculty Development Initiative

The University of California (UC) is a 10-campus public institution system that enrolls over 280,000 students annually, employs more than 220,000 faculty and staff, and offers 800+ degree programs. UC includes 6 academic health centers, 20 HP schools, and the Global Health Institute.[20] The health science campuses offer training in the health professions (dentistry,

medicine, nursing, pharmacy, public health, and veterinary medicine) as well as graduate education.[21] The UC San Francisco (UCSF) campus was the core site for designing, implementing, and overseeing the UC-ESH on UC's health science campuses at Davis, Irvine, Los Angeles, Riverside, San Diego, and San Francisco.

The overall goals of the UC-ESH were to educate faculty on eco-medical literacy, empower faculty to build community and lead ESH at their institutions, and expand coverage of ESH to reach students beyond those for whom sustainability is already a focus. We implemented UC-ESH first at UCSF in 2016 and expanded to other UC health sciences campuses between 2018 and 2020. We describe each element of the program and the educational evidence and/or framework underlying the design of that element.

Train-the-trainer education model

We selected the train-the-trainer model, based on evidence supporting its effectiveness is disseminating knowledge across multiprofessional audiences at disparate geographic locations.[22] We selected 1 or 2 trainers from each UC health science campus to attend a training at UCSF, the core site. We used 2 methods to select trainers: targeted recruitment of faculty with climate and health leadership experience and eco-medical literacy, and campus-based open calls for participation. Faculty trainers participated in a day-long training session at the core site and were provided a stipend of $2,000 and compendium of standardized training materials (described below). Trainers returned to their campuses to recruit and train faculty at their campus via a similar full-day training.

Faculty trainers recruited faculty at their individual campuses through open campus calls and targeted recruitment across disciplines. At each campus, we allocated up to 20 stipend-funded positions at $1,000 per faculty member, except for 1 smaller campus that recruited for 10 positions. Except for implementation logistics, the day-long campus-based training was similar

in content and format to the trainer training.

Training content

The training content, for both faculty trainer and trainee, focused on the following core areas recommended for faculty development in eco-medical literacy[23]:

Fundamental knowledge of the climate and ecological crisis. We addressed foundational climate literacy with a focus on basic climate and ecosystem science and skills for how to communicate climate change information in a meaningful way to encourage informed decisions about climate action.[24,25]

The impact of the climate crises on health and the environmental impact of health care delivery. Since most HP schools have no core ESH education,[26,27] our training content included an overview of climate–health pathways, environmental determinants of health, and impact on local communities[17]; discussion of the environmental impacts of health care delivery and sustainable practices[23]; and the role of HPs in climate action including conceptualizations of professional identity that incorporate environmental ethics, advocacy, and leadership.[17,28]

Educational and pedagogical methods for integrating eco-medical literacy into the curriculum. We emphasized 3 distinct pedagogical methods: integration, curriculum development, and practice.

Integrating eco-medical literacy objectives into medical and nursing education can happen without adding significant weight to curricular load.[5] Accordingly, we presented faculty with principles and examples of 2 types of eco-medical literacy content integration[29,30]:

- Nesting or infusion within a course, in which a teacher brings in topic-related content to enrich the topic presented (e.g., introduction of climate change and wildfires within a discussion of pulmonary health).
- Sharing or joint teaching, in which 2 disciplines jointly implement overlapping topics to

emphasize shared concepts and skills (e.g., design of a small group that discusses a case and related evidence about the impact of red meat consumption on both human cardiovascular and ecological health).

Although we focused on integrating content into existing instruction, some participants were interested in developing new courses and curricula, and all participants would benefit from a structured approach to guide their work. Hence, we provided participants with an overview of a systematic approach to curriculum development.[31] We also provided participants with existing ESH competencies, learning objectives, and evidence-based pedagogies that they could draw on as needed.[3,32]

Finally, faculty participants participated in 2 small group activities focused on incorporating what they learned into practice.[23] During the first activity, we provided participants with the titles and objectives for 6 courses and asked them to conceive how they would incorporate ESH into these courses based on what they had learned. In the second activity, we tasked participants to develop a blueprint for how they would incorporate ESH into their own curricula, and which ESH objectives and pedagogies they would use.[3,33]

Longitudinal guidance and the networking event

The UC-ESH encouraged collaboration and resource-sharing across campuses.[17] The core site provided an online repository of educational resources and faculty were encouraged to add new educational materials to this repository. Six to nine months post-training, trainers at each campus hosted a networking event in which faculty reconvened and shared the transformation of their courses or curricula. These events included brief presentations on ESH changes and lessons learned, followed by question-and-answer sessions.

The Impact of UC-ESH

To characterize the impact of the initiative, we drew on the Context, Input, Process, and Product (CIPP) evaluation model, focusing on 2 of the model's steps: describing the outcomes of the initiative (product) and characterizing how initiative elements contributed to those outcomes (process).[34] The UCSF Institutional Review Board deemed the evaluation exempt. We used a survey, an open-ended questionnaire, and semi-structured interviews to study initiative outcomes and the open-ended questionnaire and interviews to also characterize initiative elements.

Survey

Upon completion of the networking event, we sent a survey to all 106 faculty trainers and trained participants to document their demographic characteristics and the course changes they made, including course department, units, number, and title; whether they revised or created a new course; student level; and number of students enrolled.

Open-ended questionnaire

At the completion of the training, we administered an open-ended questionnaire that was completed by 64 (60.4%) of the 106 faculty participants. The questionnaire asked them to describe what they learned from the training, types of practice/performance changes made, and strengths of the training and suggestions for improvement. The questionnaire was designed by the research team, piloted with faculty trainers, and revised accordingly.

Interviews

Finally, we conducted semi-structured interviews post-training with 17 faculty participants purposefully selected to represent diverse disciplines, campuses, and genders. The interview guide was piloted with 2 faculty participants and subsequently adapted into the final interview guide. The interview questions asked if and how the training changed knowledge, confidence, and motivation to lead discussions on the topic; about the value of resources provided to

integrate ESH; about use of the materials; how the group exercises during the training influenced the faculty's course transformation; what participants liked best and least about the training and why; if and how the training and networking sessions fostered the building of a collaborative community of ESH educators at each campus; and whether and how participants intended to leverage the training community to implement their transformed course.

We used descriptive statistics to analyze survey data for participant demographics and courses changed. To analyze the open-ended questionnaire data, we created an initial codebook based on a review of a random sample of 10 responses by 4 investigators (A.T., T.N., A.N., S.C.). The final codebook was applied to all responses and double coded by 2 investigators (A.T., A.N.) using thematic analysis.[35] Investigators reviewed each other's coded excerpts and, through discussion, arrived at consensus in application of codes to the responses. Interviews were audio recorded, transcribed, and entered into Dedoose software (Los Angeles, CA: SocioCultural Research Consultants, LLC) for analysis. The initial codebook was created based on review of 4 transcripts by 4 investigators (A.T., T.N., A.I., S.W.). The codebook was then applied to all transcripts in which each transcript was double coded by 2 of 4 investigators (T.N., A.I., 2 research assistants) using thematic analysis. [35] Coders reviewed each other's coded excerpts to decide if codes were consistently used and, through discussion, arrived at consensus in the application of codes. Because of similarity in themes, we integrated themes from the thematic analysis of open-ended questionnaire and interviews to report our findings.

Initiative outcomes

One-hundred and six faculty members, most of whom were full professors, participated in the training either as leads or trainees (Table 1). All health professions were represented, with the largest participation from medicine, public health, and nursing.

The initiative led to 99 newly created and revised courses, which educated more than 7,000 learners about sustainable health care (Table 2). A vast majority of curriculum transformations were revisions to existing courses to integrate ESH content rather than the creation of new courses.

Sixty-five courses (65.8% of 99 total courses) that were transformed did not originally contain content about the climate or environment prior to the training and 82 (82.8%) were graduate-level courses. Examples of courses transformed to include ESH in each health profession included the following: dentistry (Biomaterials Science and Cast Restorations in Dentistry, Pediatric Dentistry); medicine (Medical Histology, Foundations of Medicine); nursing (Clinical Prevention and Population Health for Improving the Nation's Health, Community-Based Healthcare); pharmacy (Health Policy for Pharmacists); and veterinary medicine (Integrative Pathobiology).

Interview and open-ended survey results indicated the initiative empowered faculty and increased their awareness and knowledge, helping to build a faculty community of practice around ESH. Table 3 displays representative quotes from the open-ended questionnaire and interviews for each theme.

Increasing empowerment, awareness, and knowledge. Some participants were overwhelmed by the severity of the climate crisis and the inadequacy of previous efforts to counter its impact. Participants noted that the training empowered them to be advocates for climate action. It provided a relevant overview of ESH issues, insight into the impacts of climate change on campuses' local community, and description of relevant sustainability efforts. Consequently, participants felt confident and motivated to engage in conversations and share this knowledge as part of the discourse on health. Some participants wanted more extensive and in-depth training on how to implement and integrate the information into their teaching and suggested a series of

trainings rather than a singular one, to allow for in-depth learning.

Building a community of practice. Many participants appreciated the opportunity to meet and network with other faculty from different disciplines and were also interested in incorporating ESH into their teaching. They described sharing expertise, resources, input, and support that they were not previously aware of at their own campus. Some participants began collaborations to strengthen changes to their curriculum. At one campus, participants chose to continue ongoing networking to maintain the community. Others were keen to engage in wider efforts to encourage both faculty and students to incorporate ESH themes into their work. Participants recommended the training information be widely disseminated and part of broader campus or UC-wide initiatives promoting eco-medical literacy.

Initiative elements

According to participants, several aspects of the initiative were particularly effective at strengthening empowerment, knowledge, and community among faculty.

Training characteristics and group dynamics. Participants thought the training was engaging and rich, and particularly appreciated opportunities to discuss and share ideas. Participants described hearing presentations from a variety of well-prepared experts who provided important ESH knowledge. They enjoyed both the richness of the presentations and examples that connected content to their local context and the communities they served. Although some participants would have liked representation from more departments and disciplines, most appreciated the diversity of both speakers and attendees that enabled interdisciplinary interactions.

Resources and activities. Participants found the catalogue of resources particularly helpful. These included a guide, prepared teaching materials, and a list of online resources. Some requested more resources and opportunities for one-on-one discussions with trainers and

recommended that materials be shared early on to establish familiarity with the training content.

Continued guidance. Many participants needed continued input and support to bridge the gap between the training and incorporating ESH concepts into their teaching. Participants suggested ongoing follow-up to hear from their peers and students about their experiences with ESH. Participants would have liked additional guidance and mentorship to help them navigate resources and monitor progress during the implementation of updated courses. They suggested follow-up trainings and organizing small groups to meet to support each other.

Educational methods. Participants appreciated that the training provided them with ESH materials and lessons on how to integrate this content into their teaching. They planned to integrate what they had learned through case-based activities and assignments, small group and team-based learning, discussion, and inclusion of evidence. At one campus, some participants explained that, although they were encouraged to discuss ESH issues with students, they were, at times, not positioned to add ESH to the curriculum. They suggested targeting ESH training toward education committees with curriculum oversight responsibilities. Other participants recommended more instruction, examples, discussion, and practice opportunities for how to integrate ESH themes into curricula.

In Sum

We describe a university system-wide faculty development program designed to educate HP faculty about ESH. Figure 1 displays the integrated design, strategies, elements, and outcome of the UC-ESH program, which educated over 100 faculty members and ultimately reached 7,000+ learners. UC-ESH educated and empowered faculty by building awareness and knowledge about the climate crisis and creating faculty communities of practice around ESH. The elements contributing to these outcomes included engaging training characteristics and creation of supportive group dynamics; helpful resources and activities; ongoing support; and educational

approaches to integrating ESH.

Most faculty participants were able to infuse ESH into existing courses that did not focus on environment or sustainability fields. Earlier work has similarly identified that barriers and drivers faced by educators requires a coordinated curricular approach[14] where ESH is integrated as a cross cutting theme[12] and spiraled, meaning that topics are revisited where each successive encounter builds on the prior so students can, through repeated exposure and within multiple disciplines, learn and observe the connection of content throughout their education pathway.[36] Our study extends earlier work that suggests the integrated approach can create deliberate education opportunities.[7] Future research should examine the optimal spiraling approaches to build and deepen a learner's ESH knowledge.

We began our training by teaching faculty about the fundamental components of eco-literacy and eco-medical literacy. Knowledge is often seen as an incomplete driver of human action.[37] However, eco-literacy is the first step in instigating action: without knowing the underlying causes of the climate crisis, individuals are unable to consider possible solutions.[37,38] The second knowledge step in instigating action is gathering practical, locally contextualized information that translates knowledge and beliefs into action.[39] Early work in contextualized education, which teaches HPs about the impacts of climate and health on the local communities they care for and how to address those impacts, shows promise and should be an emphasis of future ESH.[40]

Our inquiry had some limitations. Some faculty would have like additional ongoing support during the program and some may have needed more time to integrate what they learned into teaching. Hence our data may underestimate the outcomes or challenges to implementation post-training. Moreover, some courses were offered multiple times per academic year and hence we have likely underestimated the impact of the training. Our participants self-selected to participate

and may have been more interested in ESH than other faculty. Hence our participants may not be representative of all faculty or of faculty teaching in settings where there is differing receptiveness to ESH. And finally, we did not follow up on future implementation nor evaluate the impact of the UC-ESH on students' eventual knowledge and skills.

Health sciences faculty are positioned to transform health care culture toward greater ecological responsibility and, consequently, improve health. Using a series of educational strategies, we educated and connected a broad base of faculty across health science disciplines and campuses across a university system to infuse existing courses with ESH. The UC-ESH led to integration of ESH into courses that did not necessarily focus on the environment, climate, or sustainability, subsequently enabling education about sustainable health care. The UC-ESH increased empowerment toward change, awareness, and knowledge about the climate crisis and built a community of practice focused on ESH. The educational strategies used by our university system-wide effort can inform efforts at other institutions, schools, and departments seeking to embark on similar changes to create eco-medical literate faculty who in turn educate their students about the climate, ecosystem, and health crisis.

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Figure Legend

Figure 1

Overview of the design, elements, and outcomes of the University of California Education for Sustainable Healthcare Faculty Development Initiative, 2016–2020.

Abbreviation: ESH, education for sustainable health care.

Table 1

Demographic Characteristics of 106 Health Professional Faculty Participants, University of California Education for Sustainable Healthcare Faculty Development Initiative, 2016–2020

Characteristic	No. (%)
Faculty	
Trainers	10[a] (9.4)
Trained	96 (90.6)
Faculty rank	
Assistant professor	24 (22.6)
Associate professor	25 (23.6)
Professor	50 (47.2)
Other (e.g., lecturer)	7 (6.6)
Campus	
Davis	20 (18.9)
Irvine	20 (18.9)
Los Angeles	15 (14.2)
Riverside	7 (6.6)
San Diego	21 (19.7)
San Francisco	23 (21.7)
Health professions school	
Dentistry	3 (2.8)
Medicine	43 (40.6)
Nursing	15 (14.2)
Pharmacy	3 (2.8)
Public health	31 (29.2)
Oceanography: Marine biotechnology and biomedicine	2 (1.9)
Veterinary sciences	9 (8.5)

[a]Four campuses had 2 leads each, and 2 campuses had 1 lead each.
[b]Riverside campus includes 1 health professions school (medicine).

Table 2

Courses or Curricula Transformed to Include Education for Sustainable Health Care Topics, by Health Professional Faculty Participants in the University of California Education for Sustainable Healthcare Faculty Development Initiative, 2016–2020

Health profession	No. (%) courses[a] or curricula transformed		Approximate no. (%) of learners enrolled[b]
	Newly created	Revised	
Dentistry	0 (0.0)	4 (4.5)	191 (2.6)
Medicine	6 (60.0)	27 (30.3)	2,430 (33.4)
Nursing	0 (0.0)	18 (20.2)	1,048 (14.4)
Pharmacy	0 (0.0)	3 (3.4)	500 (6.9)
Public health	2 (20.0)	26 (29.2)	2,367 (32.5)
Veterinary medicine	2 (20.0)	11 (12.4)	736 (10.2)
Total	10 (100.0)	89 (100)	7,272 (100.0)

[a]Some courses enroll learners from multiple health professions.
[b]Learners enrolled in each offering of the course.

Table 3

Themes and Quotes by Theme Describing Outcomes and Characterizing Initiative Elements Contributing to Outcomes of the University of California Education for Sustainable Healthcare Faculty Development Initiative, as Described by Health Professional Faculty Participants in Open-Ended Surveys (n = 64) and Semi-Structured Interviews (n = 17)

Theme	Quote (campus and participant ID)[a]
Initiative outcomes	
Increasing empowerment, awareness, and knowledge	• I understand more broadly the impacts of climate change on health, allowing me to better incorporate that into conversations on the topic and making it more pertinent to doctors' practices. I feel more empowered with this knowledge that this is immediately pertinent to our duty as health care practitioners. (D116) • Definitely increased my knowledge and my confidence and my motivation because I, as many others, are more and more concerned about our environment, and our impact, and our ability as a human race to sustain our living on this planet and to maintain it for future generations. I would like to communicate that to the next generation of nurses. (L108) • The most important piece was to create awareness and advocacy within the campus. I think, for me, that was the most exciting, interesting thing to bring a limelight to this, which people usually don't pay attention to. (Q101)
Building a community of practice	• Very helpful to meet faculty and staff interested and committed to integrating climate change into [our university] courses. (L250) • Great to know there are many people who engaging in promoting the understanding of climate change on health on the [our university] campus. (I270) • [I plan to] contribute to any efforts to extend this knowledge to other departments on campus so that we may reach a larger student audience. (R140)
Initiative elements	•
Training characteristics and group dynamics	• Good speaker presentations [and] mix of faculties who have already incorporated and who plan to include sustainability in their courses and faculties with expertise in natural science and social science. (I230) • Excellent talks from different perspectives and expertise (environmental justice, climate modeling, vector borne disease) and provided resources and data to allow us to present scientific data on the effects of climate change with impact on health. (R220)

	• The latter parts of the training [on education strategies] were very valuable as they provided opportunities for sharing experiences and exchanging ideas and strategies. (I210) • I think the best part was the group discussion, as that jump-started ideas on what to do and how. (I215)
Resources and activities	• The training that we just did today, they presented what they had done in their coursework or in their studies using the ESH funding or the knowledge exchanged, so I think that just seeing what other people have done was really helpful. (Q117) • A template for newbies like myself on what content to present regarding environmental impact on mental and physical health. (D210) • It would be great to have a list of resources that we could add to and take from and that we could share with others who are interested and need access to the resources for their classes. (S212)
Continued guidance	• Maybe next time or a follow-up "how-to clinic"? (S230) • Periodic emails to the group with updates and mention of newly posted teaching resources or opportunities to engage with colleagues and students in this intellectual space would help to keep the initiative high on faculty leader radars. (Q250) • My major suggestion would be to have a follow-up gathering if possible. Would also be good to remind us all how to access the materials presented so we have them readily to hand as we are developing new materials. (D240) • There was a long gap between the training occurring and then when I actually had students where I could incorporate some of this information. …The training for us started in spring and my courses didn't start up until the fall. So, with that gap there, I didn't feel comfortable right after the training. I do recall feeling good to go with presenting some of this information but again, there was this delay when I actually had course work or I could teach some of these concepts. (Q103) • It should have not just been one half day meeting but like several meetings and discussions and figuring it out. So, I just didn't think there was enough to it. (Q102)
Educational methods	• Training provided a nice high-level overview of sustainability, teaching strategies, particularly strategies for helping students to assess dominant narratives and identify reputable evidence bases. (I212) • I will be adding a climate change activity to at least one existing assignment in each course. I will also be assigning at least 2 readings on health effects of climate change that we will discuss in class during both courses. (L160)

- Discuss the impact on health in my seminars with students (not as formal presentations, per se, but to bring it up regularly as part of the overall discussion when we are discussing cases. (L120)

[a]Each participant has been labeled with a participant ID beginning with a letter (D, L, I, R, Q) that represents their campus followed a unique random participant ID number.

Figure 1