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**ABSTRACT:** Future environmental health problems will require a new generation of educated and trained professionals. Efforts to enhance the environmental public health workforce have been promoted by several organizations. While progress has been measured by these organizations, many environmental health academic programs are experiencing budget reductions and lower enrollments. One of the reasons for this trend is the so-called *higher education crisis*. We argue that *training* is not equivalent to *education* in the environmental health sciences, albeit the two terms are often used interchangeably. Organizations involved with the education, training, and credentialing of environmental health professionals must work together to ensure the viability and effectiveness of environmental health academic programs.

**KEYWORDS:** environmental health, environmental public health, education, training, competency, professional

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## Environmental Health Education vs. Training

As environmental health professionals, we are dedicated to controlling and protecting our environment to minimize the factors that contribute to human disease, as well as enhancing human health and well-being. While the historical gains in public health are in large part due to environmental health efforts, many challenges lay ahead us in the twenty-first century. Environmental health threats stemming from emerging diseases, climate change, population growth, and globalization (eg, food and chemical products), among others, will present major challenges to public health. Environmental health professionals will be a critical part of the future public health workforce because they have “far-reaching impacts” on “large segments of the population.”<sup>1</sup>

Efforts have been ongoing before and during the twenty-first century to enhance the environmental “public health” workforce.<sup>2</sup> In 2003, the Centers for Disease Control and Prevention, with contributions from many stakeholders, published *A National Strategy to Revitalize Environmental Public Health Services*.<sup>3</sup> Since then, progress toward the strategy’s goals has been laudable and discussed.<sup>4,5</sup> Yet, some issues appear insurmountable and have been highlighted elsewhere.<sup>6,7</sup>

More recently, important discussions have focused on the quantity and quality of environmental health professionals.<sup>1,8</sup> We agree wholeheartedly with these authors and would like to focus our discussion on the specific issue of educating future environmental health professionals. But first, we must distinguish between training and education, terms that are frequently used interchangeably.

According to the Business Dictionary, training is an “Organized activity aimed at imparting information and/or instructions to improve the recipient’s performance or to help him or her attain a required level of knowledge or skill,” whereas education is “The wealth of knowledge acquired by an individual after studying particular subject matters or experiencing life lessons that provide an understanding of something.”<sup>9</sup> Looking at these definitions in another way, in the words of Robert H. Essenhigh, training is the *Know How* and education is the *Know Why*.<sup>10</sup>

Obviously, in environmental health practice, the *Know How* is of utmost importance, but this is not enough. The *Know Why* is important for many reasons; foremost among them is to understand the underlying theories and basis for a procedure or standard. Without this depth of understanding and knowledge, a professional lacks the capability to solve unusual problems and to exercise independent judgment. Having *Know Why* distinguishes a professional from a technician. An educated professional is capable of developing solutions to problems that do not fall into the categories of the procedural or routine.

In most cases, an individual with a newly minted degree in environmental health is not ready to walk into a job without some level of training or internship. However, in the long run, the properly educated individual will be more likely to excel in his or her profession and to offer innovative solutions to unprecedented problems. As we discussed earlier, many unprecedented problems will be encountered in the future of environmental health.



### Higher Education: Institutions in Crisis

Most parents with college-age children have first-hand knowledge of issues such as rising tuition costs and increasing student debts. But there are many other issues associated with our institutions of higher education that will culminate in a crisis. These issues have been succinctly discussed and illustrated in the CNN documentary *Ivory Tower* and in a two-part series of articles by futurist Thomas Frey.<sup>11,12</sup> Table 1 lists some of the issues highlighted by the media and scholars with regard to the crisis in higher education. Environmental health science (EHS) academic programs are not immune from these issues. In fact, we contend that EHS academic programs – while essential to the quantity and quality of the future environmental health workforce – are at risk of becoming greatly scaled back or eliminated in the looming crisis.

If Thomas Frey’s predictions are correct, half of our colleges will collapse over the next 15 years.<sup>12</sup> Even if this dire prediction is overly pessimistic, there will certainly be a loss of degree programs at colleges and universities across the country, including EHS-degree programs. As academicians, we have experienced severe budget cuts in the past five years and participated in discussions aimed at eliminating courses and even entire programs that have enrollments below a certain threshold. Unfortunately, many of the EHS academic courses fall below this threshold, and EHS academic programs have been discontinued in several universities.

The reasons for low enrollments in EHS academic programs have not been systematically studied. Presumably, some of the reasons are student perceptions of lower wages, fewer training opportunities, and poorly defined career paths, as highlighted by Resnick et al.<sup>7</sup> On the other hand, students may not be aware of the career opportunities for EHS-degree candidates within the private sector. Yet another reason may be competition with degree programs that are specialized or complementary to EHS: students can earn degrees with majors in food science and safety, industrial hygiene, toxicology, epidemiology, general public health, and a number of other related majors. Many of these complementary academic programs are rivals to EHS academic programs. Research is urgently needed to systematically examine the reasons for low enrollments in EHS academic programs.

### Higher Education in EHSs

Arguably, we do not believe that EHS academic programs will become completely extinct. Nonetheless, we believe that EHS academic programs will close at several institutions, and among the surviving programs, course offerings in environmental health will be significantly curtailed, perhaps resulting in the loss of accreditation status. In any case, limited course offerings will not provide an individual student with a well-rounded background in environmental health and he or she will not be exposed to the many possible career paths in environmental health. Consequently, graduates will be less prepared to assume leadership positions that require

**Table 1.** The issues (real and/or perceived) and implications associated with institutions of higher learning.

REAL AND/OR PERCEIVED ISSUES	IMPLICATIONS
Sharply decreasing budgets, increasing tuition costs, and higher student debts	An unsustainable business model that will put education out-of-reach for most citizens. Crisis management of budget shortfalls without meaningful strategic planning
Competing institutional priorities: Research programs vs. sports enterprises vs. educational initiatives	Teaching may suffer from university enterprises that are prioritized on the basis of income generation and name recognition
Excessive overhead costs with research grant proposals	Less competitive research proposals because of overhead cost tax. Disproportionate taxing of smaller research efforts to cover infrastructure costs. Less opportunity for faculty and students to win smaller grants worthy of research. Fewer opportunities for student research experience
Poor return on investment with college degrees	Job opportunities with marginal wage earning potential of graduates compared with nongraduates
Disruptive innovation resulting from the rise of online educational programs (including MOOCs, SPOCs, OCW, OER, etc.) <sup>1</sup>	Online courses generated by simply grafting course materials from the existing classes. Greater competition for students from private institutions with lower overhead costs. Increasing enrollment and greater preference for online courses by students, reducing the need for brick and mortar facilities
Questionable credibility of online courses, degrees, and institutions	Perceptions that online courses and degrees are of lesser value, mail order, or handed out like candy. Competence levels of online graduates perceived as less compared with those attending face-to-face classes. Lower completion rates cited for online courses
Tenured vs. nontenured vs. adjunct (part time) faculty	Incentives to attract qualified educators; lower salaries and fewer benefits for part time faculty; limited ability to hire and fire as programs evolve. Ivory Tower vs. real-world experiences and perspectives of instructors
Grade inflation, declining academic rigor, and consumerism in higher education	Favorable student reviews of educators are rewarded by higher grades, resulting in fewer expectations and less competent graduates
Poor STEM <sup>2</sup> preparation of students	Students do not major in science-based curricula, or they require extensive remedial training in STEM

**Abbreviations:** <sup>1</sup>MOOCs, massive open online courses; SPOCs, small private online courses; OCW, OpenCourseWare; OER, open educational resources; <sup>2</sup>STEM, science, technology, engineering, and mathematics.

coordination and integration of multidisciplinary approaches to environmental health problems.

The academic programs in EHS that flourish will likely be affiliated with academic programs having a larger infrastructure. Case in point, accredited schools of public health are



required to have an environmental health component. Unfortunately, schools of public health are not accessible to all students, and course catalogs may not be sufficient to offer undergraduate and/or graduate majors in environmental health.

Another possibility is that EHS academic programs will splinter into several specialties or complementary majors, again likely affiliated with academic programs having a larger infrastructure. Since the passage of the Food Safety Modernization Act of 2011, for example, many food science departments and schools of agriculture have developed curricula to educate and train experts in food safety. Similarly, schools of engineering have specialty courses to educate engineering students in certain aspects of environmental health such as water and wastewater. Biology and chemistry departments sometimes offer environmental courses, albeit many of these courses are peripherally relevant to environmental public health.

Those of us who have practical experience in environmental health understand that problems do not confine themselves to a single specialty. As an example, food safety problems are frequently interwoven with issues related to pest control, water quality, infectious diseases, and chemical safety and toxicology. Similarly, occupational health problems may involve exposures that require knowledge of infection control and biological safety. The challenge of developing effective environmental precautions and isolation procedures for Ebola patients is a recently publicized example.

While the issues listed in Table 1 potentially impact all academic programs, several of them have special significance for EHS academic programs. Foremost, large student debts will place a disproportionate burden on government employees such as environmental health professionals. Another significant issue affecting EHS academic programs is the poor science preparation of students; degree majors in EHS require a solid foundation in the basic sciences. If EHS academic programs are curtailed, then it will be also more difficult to attract and retain instructors with environmental health experience. The rise of online courses and degree programs poses special challenges for EHS academic programs; many environmental health courses require hands-on laboratories and learning experiences to develop competency.

### The Way Forward

The foremost goal of any EHS academic program is to offer excellent curricula with highly qualified faculty and motivated students. It is also important to realistically examine the opportunities and threats to EHS academic programs – particularly in an era of unprecedented changes in our institutions of higher learning.

Following a sabbatical exchange, Dr. Charles Hart shared his experiences from visiting several EHS academic programs in Canada.<sup>13</sup> It was especially interesting to note that the Canadian Institute of Public Health Inspectors has direct control over both professional certification and accreditation of EHS academic programs. Unlike Canada, there is

no single entity or system in the US that is responsible for both professional certification and EHS academic accreditation. However, as pointed out by Dr. Hart, the Canadian EHS academic programs are more narrowly focused on educating public health inspectors; the EHS academic programs in the US have a broader focus that include other employment opportunities, such as positions in the private sector and environmental resource agencies.

In the absence of a single structure, cooperative agreements between the National Environmental Health Association (NEHA), the Association of Environmental Health Academic Programs (AEHAP), the National Environmental Health Science and Protection Accreditation Council, and federal and state agencies are paramount to producing environmental health professionals. In this context, the statement attributed to Professor Larry Gordon at the 2000 meeting of the Environmental Health Competency Project is worthy of repeating:

“... environmental health leaders [need] to take an active role not just in defining competencies but also in strengthening the organizations, funding, and standards that produce environmental health practitioners.”<sup>2</sup>

Whatever happens in the near- and far-term future, a few predictions can be made with some degree of certainty. First, environmental health issues will become more complex in the future, which will necessitate a well-educated and well-trained environmental health workforce. This means that EHS academic programs need to be strengthened and promoted. Public health authorities need to develop policies that will help educate and train the next generation of environmental health professionals.

Second, without revolutionary innovation, rising tuition costs and student debts will discourage many qualified candidates from pursuing an education in environmental health. In turn, this will likely result in the reduction and/or loss of EHS programs at universities. Strong consideration should be given to student debt forgiveness and/or scholarships for students majoring in environmental health, perhaps with a contractual obligation to work in government service after graduation.

Third, interconnected technologies will continue to increase online enrollments, but the format and structure of online courses will need to be rigorously reviewed using competency-based outcome metrics – especially for environmental health students. Organizations such as NEHA and AEHAP should develop criteria to evaluate, certify, and/or accredit online courses and degree programs. These criteria should be measurable and competency based; procedures to ensure academic integrity should also be included in the criteria.

Finally, it is the responsibility of all public officials to develop and implement succession plans for workforce development and turnover. Senior and retiring environmental health professionals – especially those in influential positions – have a special obligation to develop comprehensive succession plans. Environmental health profoundly affects the health



and well-being of the entire public, and environmental health leadership is needed now more than ever.

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Conceived the concepts: PLK, TRK. Analyzed the data: PLK, TRK. Wrote the first draft of the manuscript: PLK, TRK. Contributed to the writing of the manuscript: PLK, TRK. Agree with manuscript results and conclusions: PLK, TRK. Jointly developed the structure and arguments for the paper: PLK, TRK. Made critical revisions and approved the final version: PLK, TRK. All authors reviewed and approved the final manuscript.

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