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Commentary: trends in interests of new public health students concerning environmental health

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Introduction: This paper was based on data from the core course in environmental health (EH) for master's in public health students at Rutgers School of Public Health (SPH), Rutgers Biomedical and Health Sciences at Rutgers, and The State University of New Jersey (NJ).

Methods: The multi-part poll or survey of students was in the first module (2 weeks) of the course's eight module organization on Rutgers Canvas Learning Management System. We collected data every time the first author led this course section during the three academic semesters of each calendar year 2015-2023 (excluding winter 2022-summer 2023 due to grants buyout during COVID-19 pandemic).

Results: Data suggested interesting trends and changes in geographic levels of interest over time for EH. When examining interests separately for urban EH and rural EH, the trend was toward approximately equal interests in local, county and state levels (lower than national level—U.S. or student's home country/nation—but higher than global level). This is where many EH job opportunities are located. Overall, 95% of students reported they believed climate change is real, and 95% of students agreed ("yes") human activities including combustion sources of pollution contribute to climate change. No one stated "no;" the rest were not sure at the time.

Discussion: These insights from new public health students across majors/concentrations in NJ could inform other accredited SPH across the U.S. and in other nations to help plan future versions of core courses in EH or SPH-wide integrated core courses in compliance with required competencies for accreditation.

KEYWORDS

environmental health, climate change, urban health, rural health, public health

Introduction

Many documents by federal agencies and researchers have noted substantial challenges facing the environmental health (EH) profession. These include recruitment and retention due to high turnover and movement between agencies or from public agencies to the private sector for higher salaries, and as older, experienced practitioners retire or approach traditional retirement age. (U.S. Centers for Disease Control and Prevention [USCDC], 2003; Resnick et al., 2009; Heidari et al., 2019; U.S. Centers for Disease Control and Prevention [USCDC], n.d.).

At the same time, however, jobs available in EH for specialists, sanitarians, and scientists, including various types of field sampling and laboratory-based technicians, have been predicted to grow faster than the national average across industries and sectors (U.S. Department of Labor [USDOL], and Bureau of Labor Statistics [BLS], 2018). There are employment opportunities in EH starting after graduation with an undergraduate (UG) or bachelor's degree, and further certifications, in food safety/food sciences, industrial hygiene/worker safety, local EH and emergency preparedness and response at local agencies, etc. (Marion et al., 2017). U.S. federal agencies, national laboratories and research institutes provide funded opportunities for individuals with recently completed UG, graduate and doctoral-level degrees in EH and public health (PH) sciences as well as environmental engineering and related policy studies (U.S. Centers for Disease Control and Prevention [USCDC], 2019; U.S. Environmental Protection Agency [USEPA], 2019; U.S. Food and Drug Administration [USFDA], 2019; U.S. Geological Survey [USGS], 2019a,b; USAJobs, 2019). U.S. federal agencies, some national-level non-profit organizations, and research institutes also provide information on EH careers and various scholarship opportunities for varying amounts of annual or one-time funding for both UG and graduate programs involving EH and PH sciences, engineering, technology, statistics and/or policy (National Environmental Health Association [NEHA], 2019a,b; National Environmental Health Science and Protection Accreditation Council [NEHSPAC], 2019; U.S. Department of Energy [USDOE], and Oak Ridge Institute for Science and Education [ORISE], 2019a,b; U.S. National Science Foundation [NSF], 2019; Association of Environmental Health Academic Programs [AEHAP], 2024).

In summary, given opportunities for employment and careers in EH exist and could and should attract a broader range of UG majors, there is a need to both constantly improve and update formal training in EH for students at universities/colleges, and to address the 21st century EH workforce realities noted above. Combined, these have brought attention to several needs: engage young people in PH in general and EH through their few required sciences and/or math/statistics courses (Ahonen and Lacey, 2017; Shendell et al., 2017, 2020); encourage representation from racial/ethnic minorities, who have both perceived barriers to EH and been discouraged by relatively lower EH job salaries (Quimby et al., 2010; Haynes and Jacobson, 2015); develop and practice interpersonal or employment "soft skills" with newer EH employees (Thomas and Nicita, 2003; Knechtges and Kelley, 2015); and, use more smaller-to-larger group discussion activities in both in-person and online or virtual training course formats (Shendell et al., 2020; Shendell, 2023).

Furthermore, recently, the COVID-19 pandemic, due to exposure to the SARS-Co-V-2 virus, brought attention to EH topics, especially indoor air and environmental quality (IAQ/IEQ) and emergency preparedness and response. Society increased the use of cleaning, disinfection, and sanitation consumer products, and reiterated the importance of proper personal hygiene practices—especially handwashing with clean water and soap—to properly control biological and chemical hazards including particulate matter and aerosols either suspended in the ambient (outdoor) air and/or collecting on various indoor surfaces as dust (Shendell, 2023).

Therefore, this commentary shares changes in EH interests among new PH students (master's and doctoral level if MPH obtained before PhD or MD) during 2015-2023, which includes years before, during and after the COVID-19 pandemic. The EH interests are compared to general PH, urban and rural EH/PH, and initial knowledge, attitudes and awareness about global climate change including global warming and extreme weather events, which have always been covered by author in EH core course at a U.S. accredited school of PH (SPH).

Methods

Data collection

An online, eight (8)-question survey with single answer responses selected was developed and conducted each of the three semesters the author led teaching the EH core course section for Piscataway/New Brunswick campus of Rutgers SPH during 2015-2023. This project was exempt from Institutional Review Board/Human Subjects approval because the survey was conducted as part of normal educational classroom-type assessment activities/practices. Participation was voluntary and, since online, was with consent without written documentation. Students were invited at their Rutgers student e-mail to complete the survey as part of this small credit opportunity—eight points in a 1,000 point course—for the EH required core course toward the MPH at Rutgers SPH. The goal was survey completion in <3–5 min; this goal was realized. The view of the final screen for each survey question on Rutgers Canvas Learning Management System proved completion.

Data management and analysis

Since no individual student data were collected, our team created a spread sheet with dummy variables for statistical analysis. This is justified because at no point did the team look at data across questions. Data analyses were conducted using Excel and SAS 9.4 (Carey, NC). Any p-value below 0.05 was considered statistically significant. After determining the distribution of answers to any of the questions were not normal using the Shapiro-Wilk test, we conducted Chi-square tests to see if there were differences between groups. We also stratified the students by semester, the season that the survey was answered (spring, summer, fall), and pre vs. during COVID-19 pandemic. Season was the time of year–Fall, Summer, or Spring–no matter the years 2015-2023, and semester (year and season the course was taken in) was also used to examine

TABLE 1 Summary of survey answers by responding students (number, percentage), 2015–2023.

Number of enrolled students	Question: At what geographic level are your…?	Local	County/Intra-state regional	State	National	Global	Total	No response (number students)
549	Current public health interests in general?	89.5 16%	52 9%	51 9%	150.5 27%	189 34%	532 97%	17
549	Current environmental health interests?	95 17%	70 13%	36 7%	135.5 25%	194.5 35%	531 97%	18
520	General urban public health interests?	141 27%	82 16%	66 13%	124 24%	93 18%	506 97%	14
306	General rural public health interests?	62 20%	50 16%	54 18%	72 24%	63 21%	301 98%	5
235	Current interest in climate change greatest?	11 5%	5 2%	4 2%	44 19%	169 72%	233 99%	2

If value "0.5" appears in table then a student accidentally chose two (not one) answer option.

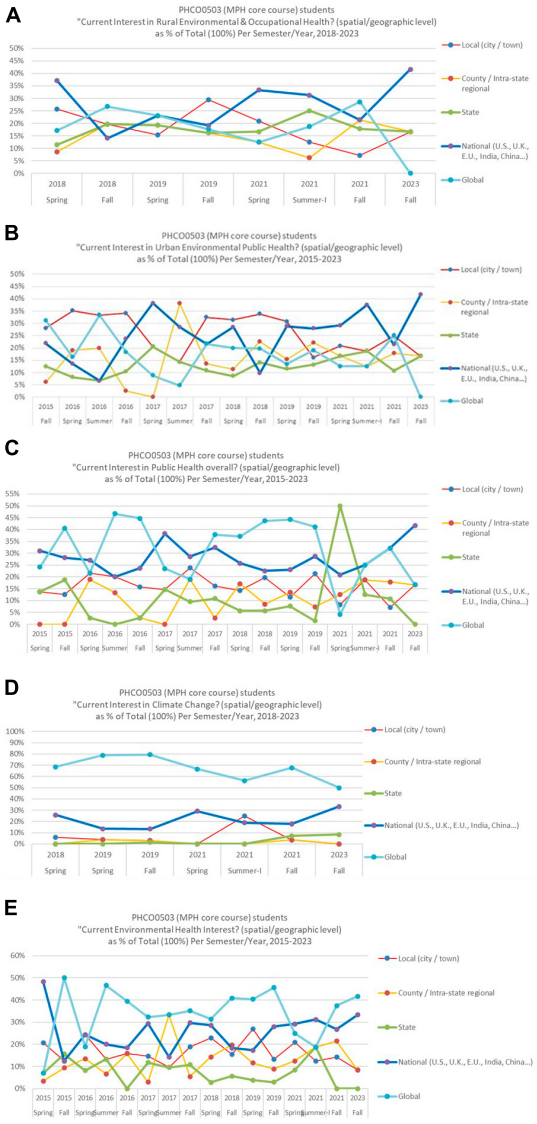

FIGURE 1
(A–E) Time trends in the spatial / geographical level of interest among responding students regarding aspects of environmental health (EH) and public health, 2015–2023. Note for data on climate change and rural EH, only 2018–2023 presented as these questions were worded differently 2015–2017.

if there was a difference between at least one semester and the other semesters. We looked at each option (local, county, state, national, global) individually to see if there was a difference between groups in what level was most important to students.

Results and discussion

Table 1 summarizes the overall survey completion descriptive statistics in 2015-2023, by semester. The number of enrolled students each semester ranged from 24–52 in the Spring semesters, 15–21 in the Summer semesters, and 28–71 in the Fall semesters (then 12 in fall 2023 given Rutgers SPH increased number of MPH core course sections throughout the week both in-person

and online to accommodate students globally post-COVID-19). It can also be reported how, across the entire study period, 95% of students reported they believed climate change in real, and 95% of students agreed (answered "yes") with the statement: "Do you believe human (anthropogenic) activities including combustion sources of pollution contribute to climate change? No one stated "no." The rest were not sure at the time, i.e., the start of this MPH core course, which covers climate change and natural disasters/extreme weather events.

Figure 1 presents the answers to selected questions relevant to EH and PH as time series trends using the percentage (%) of respondents to account for varying class sizes each semester in these years. In this paper, results about occupational safety and worker health were excluded.

In summary, trends depicted above by **Figures 1A–E**, respectively, suggest the following for new MPH students:

1. For question on EH interests, national and global ranked highest and state ranked lowest but there was variability among local and county, where many jobs are.
2. For question on climate change interests, students consistently were more interested in larger than smaller geographic scales (except fall 2021-local level).
3. For question on general PH interests, national consistently ranked first and state consistently ranked lowest, and global was second until recently where there is now an equal interest in local and county and global.
4. For question on urban EH/PH interests, over time, national and county trended higher whereas global and local trended lower; state level interest was consistent.
5. For question on rural EH/PH interests, over time, national trended higher and global lower; local, county and state level interests fluctuated but are now equal.

With regards to EH interests, when stratified by semester or pre/during COVID-19, showed no differences by geographic level. When stratified by season, however, there was a difference in two of five geographic levels: local level (Spring 23.6% vs. Summer 11.5% vs. Fall 15.0%, $p = 0.02$), and global level (Spring 29.2% vs. Summer 32.6% vs. Fall 42.8%, $p = 0.007$).

In terms of current public health (PH) interests, we found no differences when looking at the local or national levels; however, there were differences when looking at county, state, and global levels ($p = 0.02$, 0.001, and 0.02, respectively). Interestingly, for general PH, which by nature includes EH in terms of handwashing and IAQ/IEQ given ventilation with filtration, after the start of the COVID pandemic in 2020, the percentage of people who chose county as the most important region increased from 8.6 to 16.7% ($p = 0.03$). A similar trend also occurred in the state level (pre 7.5% vs. during 21.8%, $p = < 0.001$), but an inverse trend was present for global (pre 38.1% vs. during 20.5%, $p = 0.003$). For these three levels (county, state, and global) there were also differences by season. For the county level, students who took the course in the summer had a higher proportion of participants who chose this level (17.3%) when compared to the fall (7.1%) and spring (11.6%) ($p = 0.04$). For the state level, students who took the course in the spring had a higher proportion of participants who chose this level (14.1%) when compared to the fall (6.7%) and summer (7.8%) ($p = 0.02$). For the global level, students who took the course in the fall had a higher proportion of participants who chose this level (40.6%) when compared to the spring (30.2%) and summer (28.9%) ($p = 0.04$).

We examined and compared urban versus rural PH/EH interests. For rural interests, the analysis found no difference in any stratification or level. For urban interests, there were also no differences found when stratified by season or pre/during COVID-19; however, when stratified by semester, there were differences in the county level ($p = 0.03$) and national level ($p = 0.04$).

In conclusion, these data provide insights from new public health (PH) students in New Jersey, USA (NJ). These insights from NJ students across majors/concentrations in a master's in public health or MPH program could inform other accredited PH programs and schools across the U.S. and in other nations to help plan future versions of MPH core courses in EH or school-wide integrated core courses in compliance with required competencies for accreditation.

Data availability statement

The datasets presented in this article are not readily available because data were collected anonymously in aggregate for each class/section, each semester/season, 2015-2023, during normal educational activities on Rutgers Canvas Learning Management System. Thus, "exempt" research per U.S./State. Requests to access the datasets should be directed to DS, shendedg@sph.rutgers.edu.

Ethics statement

The studies involving humans were approved by the Rutgers Biomedical and Health Sciences Institutional Review Board. The studies were conducted in accordance with the local legislation and institutional requirements. The ethics committee/institutional review board waived the requirement of written informed consent for participation from the participants or the participants' legal guardians/next of kin because data collected anonymously and analyzed in aggregate by class/section during normal educational activities are approved as "exempt" human subjects research by U.S./State.

Author contributions

DS: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Supervision, Visualization, Writing – original draft, Writing – review & editing. JA: Formal analysis, Investigation, Methodology, Software, Validation, Visualization, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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