

Children's Environmental Health Experience and Interest Among Pediatric Care Providers in Vietnam

Nancy J. Beaudet^{1,2}, MS, CIH; Garry C. Alcedo¹; Quan C. Nguyen^{3,4}, MD; Dan Jacoby⁵, PhD; Quynh Kieu⁶, MD; Catherine J Karr^{1,7}, MD, MS, PhD

1 Pediatric Environmental Health Specialty Unit, University of Washington, Seattle, WA

2 Occupational and Environmental Medicine Program, University of Washington, Seattle, WA

3 Department of Pediatrics, Thomas Jefferson Medical School, Philadelphia, PA

4 Alfred I. duPont Hospital for Children, Wilmington, DE

5 University of Washington, Bothell, WA

6 Project Vietnam Foundation, Fountain Valley, CA

7 Department of Pediatrics, University of Washington, Seattle, WA

Corresponding Author:

Nancy Beaudet
Box 359739, 325 9th Avenue
Seattle, WA 98104 USA

T. (206) 744-9379

F. (206) 744-9935

beaudet@uw.edu

Background. In rapidly developing regions of the world such as Southeast Asia, marked industrialization with insufficient regulation places children at increased risk for significant environmental exposures. Health care providers have a key role in identifying, treating and preventing environmentally-related illnesses.

Objectives. The authors undertook a survey of pediatric health care providers in Vietnam in order to gain preliminary insight into environmental hazard knowledge, and attitudes and beliefs regarding the relative importance of environmental factors in child health that could guide future initiatives towards building up capacity for children's environmental health in the region.

Methods. A formal written and self-administered survey instrument was adapted from the World Health Organization's Children's Environmental Health Survey and translated into Vietnamese. The survey was administered via convenience sampling after formal introduction to children's environmental health (CEH) was made through lectures or meetings with pediatric care providers affiliated with the major children's hospitals and pediatric departments in Vietnam.

Results. One hundred forty-one pediatric care providers completed the survey. Most indicated environmental factors are considered to be very important in child health (84%); 98% felt the magnitude of the problem is increasing; and air pollution is seen as the top environmental health issue facing the country. The most commonly identified problems in their clinical experience included: food poisoning due to microbiological agents (85%); pesticide poisoning (77%); tobacco smoke exposure (75%); and inadequate sanitation (60%). Although most (80%) endorsed asking about children's environmental conditions in clinical practice, a little more than a third (39%) were confident taking an environmental exposure history. For most key topics, less than half had received specific training. A majority (63%) of survey respondents were very interested in more environmental health training.

Conclusions. Pediatric health care providers in Vietnam believe that environmental hazards in child health is an important topic that is routinely encountered in their care of patients, but training, experience and self-efficacy in these topics are limited.

Financial Disclosure. None reported

Keywords. Environmental pediatrics, children's environmental health, pediatrician attitudes, global health, Vietnam, working youth, Pediatric Environmental Health Specialty Unit
J Health Pollution 2:24-36 (2011)

Introduction

Clinical, toxicological, and epidemiological evidence of the influential role of environmental factors on health and development of children has accumulated greatly in the United States and Europe. In rapidly developing nations, economic pressures and ineffective regulatory systems place children at increased risk for significant environmental exposures. These risks have been raised for children in Southeast Asia and the Western

Pacific (a World Health Organization-designated region including island states such as Samoa, Papua New Guinea, and Tonga) which are among the most rapidly industrializing areas of the world, and where half of the world's children live.¹ Children in these settings face the "triple burden of disease": a high-level of communicable disease (traditional morbidities such as diarrheal disease); the increasingly

severe burden of non-communicable disease (so-called new morbidities such as asthma); and the emerging risks of new diseases and stressors related to the changing social and physical environment (e.g., obesity).² In these settings, local research, public health surveillance, and the capacity for understanding and reducing the burden of pediatric environmental illness is largely undeveloped.

Health care providers (HCP) have unique and critical roles in that they identify, treat, and prevent environmentally related health problems as well as advocate for healthy environmental conditions for children. However, the lack of adequate preparation in standard medical curricula and the need for specialized training is a clear theme emerging from two decades of the children's environmental health movement in the United States and within international health agencies such as the World Health Organization (WHO).³ The North American Pediatric Environmental Health Specialty Unit (PEHSU) network of centers has arisen as a model approach toward the building of needed capacity.⁴ In these academically based regional centers, on-going training of HCPs, the public health sector, and the public is developed and delivered in multiple and audience-specific formats. In addition, the units provide management expertise for children with suspected or known exposure to environmental hazards as well as diagnosis, management and treatment of pediatric illnesses related to environmental issues.

In recent years, the PEHSU network has initiated global health partnerships to support the capacity of pediatric health professionals in developing nations. In 2008, the PEHSU based at the University of Washington (UW), Seattle, began a partnership with the UW-based Fogarty International Collaborative Center for Healthy Work and Environment Program and Project Vietnam Foundation to investigate children's environmental health (CEH) capacity in Vietnam. The project sought to identify and engage regional leaders in pediatric medicine and environmental health. The goal was to identify priority issues and current practices as a foundational effort to promote development of a PEHSU-

Abbreviations			
CEH	children's environmental health	PEHSU	Pediatric Environmental Health Specialty Unit
HCP	health care providers	WHO	World Health Organization

type resource in the region. Focused introductory trainings on core CEH topics were provided at five children's hospitals/pediatric departments in Vietnam in March 2009. Here we describe the results of a formal survey conducted on-site at the training sessions. These provide preliminary insight into knowledge about environmental hazards, attitudes, and beliefs of pediatric HCPs in Vietnam.

Methods

A written questionnaire was developed to survey HCPs' training experience, clinical practice, and overall impressions and interest regarding CEH topics. The survey instrument was adapted from the WHO Children's Environmental Health Survey on Child Environmental Health Awareness of Health Care Professionals⁵ and included 54 closed-ended and 5 open-ended questions (Appendix A). The survey was translated into Vietnamese by a physician whose native language was Vietnamese and was reviewed by two other native Vietnamese speakers with pediatric medical training.

The survey was administered via convenience sampling by the study team at the end of an approximately 1.5-hour formal introduction to CEH by lectures with HCPs affiliated with the National Hospital of Pediatrics, Hanoi; Hai Phong Children's Hospital, Hai Phong; Nghe An Children's Hospital, Vinh; Children's Hospital 2, Ho Chi Minh City (as part of a pediatric conference); and Binh

Duong General Hospital. These hospitals are large, regional children's hospitals in Vietnam where Project Vietnam Foundation has had historic engagement in child health projects and physician training. Surveys were also conducted during informal meetings with officials at the Vietnam National Institute of Occupational and Environmental Health and Children's Hospital 1, Ho Chi Minh City. These sites were located in north, central and south Vietnam and the HCPs that attended the trainings included pediatric generalists and specialists, medical trainees, nurses, and other medical staff.

Pediatricians who attended the CEH training and who were professionally involved as pediatric HCPs were requested to complete the survey (a different survey tool was offered to non-physicians, but due to the small sample size, these surveys were not analyzed). The survey asked if respondents had received training on a list of 15 children's environmental health (CEH) topics and their experience in pediatric practice with 16 environmentally related illnesses, including work-injury or hazardous exposures. The survey also asked whether respondents routinely complete an environmental or occupational exposure history as part of the clinic visit, as well as the frequency of parental CEH and working youth concerns. Other questions explored attitudes and beliefs regarding the relative importance of environmental factors in child health

and the pediatrician's role in addressing them. Self-efficacy questions asked how confident respondents felt in taking an exposure history, discussing these issues with parents, and the availability of resources related to diagnosis and treatment of CEH. Open-ended questions asked the respondents to list the three most important CEH issues regionally and nationally, and their top three CEH training topics of interest. Participant demographic and practice setting data was also collected. The survey responses were de-identified and the study received a University of Washington Human Subjects Division Certificate of Exemption.

Descriptive statistics of survey responses were calculated using SPSS for MAC version 11. Open-ended questions were back-translated into English before data entry.

Results

Approximately 230 medical staff attended the training sessions. Surveys were collected from 141 attendees. The 61% response rate reflects non-response of eligible attendees as well as the number of ineligible attendees (not pediatricians, not involved in pediatric care). The survey took approximately 15 minutes to complete. Questions that arose during respondent self-administration were answered on the spot by the study team, which included a native speaker. The response rate varied for individual survey questions and the investigators have no knowledge of why some respondents didn't answer certain questions.

Table 1 summarizes the demographic and pediatric practice characteristics of the 141 survey respondents. The number of responses varied for specific questions and the proportion of specific (non-missing) responses is described. There were more female respondents (63%) than male. Most

Characteristic (Number of respondents)	Number	Percent
<i>Age (mean ± SD) (N=110)</i>	39.7 ± 10.3	—
<i>Years involved children's health (N = 112)</i>	12.7 ± 10	—
<i>Gender (n=115)</i>		
Female	73	63
Male	42	37
<i>Pediatric Subspecialty (N=114)</i>		
Yes	56	49
No	58	51
<i>Work Sector (n=120)</i>		
Public	110	92
Private	7	6
Both	3	2
<i>Work Setting (n=119)</i>		
Hospital	101	85
Non-hospital	10	8
Both	8	7
<i>Major area of practice (N=114)</i>		
Rural	10	9
Urban	104	91
<i>Patient SES (n=118)</i>		
Low	31	26
Middle	75	64
High	2	2
Multiple	10	9

Table 1 — Demographic and Professional Characteristics of Pediatric Health Care Providers Surveyed in Vietnam (n=141*)

*Not all questions were answered by all survey respondents.

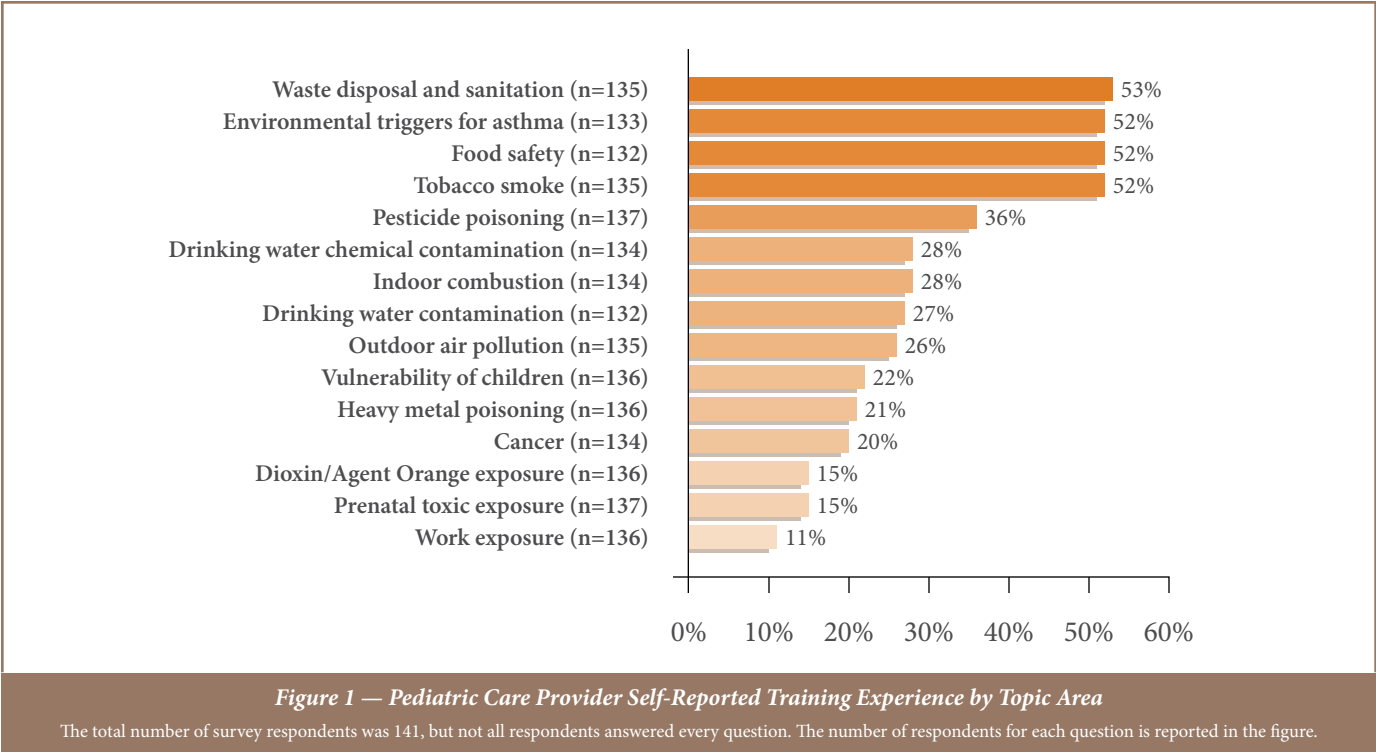
served low- to middle-income patients (combined 90%) and worked primarily in hospital settings (85%). Almost all identified the area where they practiced as urban (91%) and within the public sector (92%).

The reported training experience for key children's environmental health topics are portrayed in Figure 1. The response rate was high (94-97%) for the individual questions in this section.

Among the 15 topics, respondents most frequently endorsed having received: specific training for waste disposal and sanitation (53%); environmental asthma triggers (52%); food safety (52%); environmental

tobacco smoke (52%); and pesticide poisoning (36%). The topics for which respondents were least likely to report having received specific training were: vulnerability of children to environmental exposures (22%); heavy metal poisoning (21%); environmental contaminants and cancer (20%); dioxin/Agent Orange and child health (15%); prenatal toxic exposure (15%); and exposures of working youth (11%).

Despite the lack of a majority reporting to have received specific training on most of the environmental health topics listed, 84% of those that responded indicated the role of environmental factors in child health



Training Topic	Percent
Air Pollution	14%
Asthma and Respiratory Health	14%
Water Contamination	14%
Food Safety	13%
Non-Specific ^b	13%
Other ^c	12%
Tobacco Smoke	8%
Cancer	6%
Waste Disposal	3%
Weather	2%
Industrial Waste	1%
School	1%

Table 2 — Respondents Training Interests (Open-ended, Top 3 priorities^a, n=300)

^a To calculate percentages for each category, we summed all the individual rankings (from each of the 141 survey respondents) in all categories (regardless whether they were 1st, 2nd, or 3rd in importance) to generate our base (n=300). For the numerator, we used the frequency of all 1st, 2nd and 3rd responses within each category.

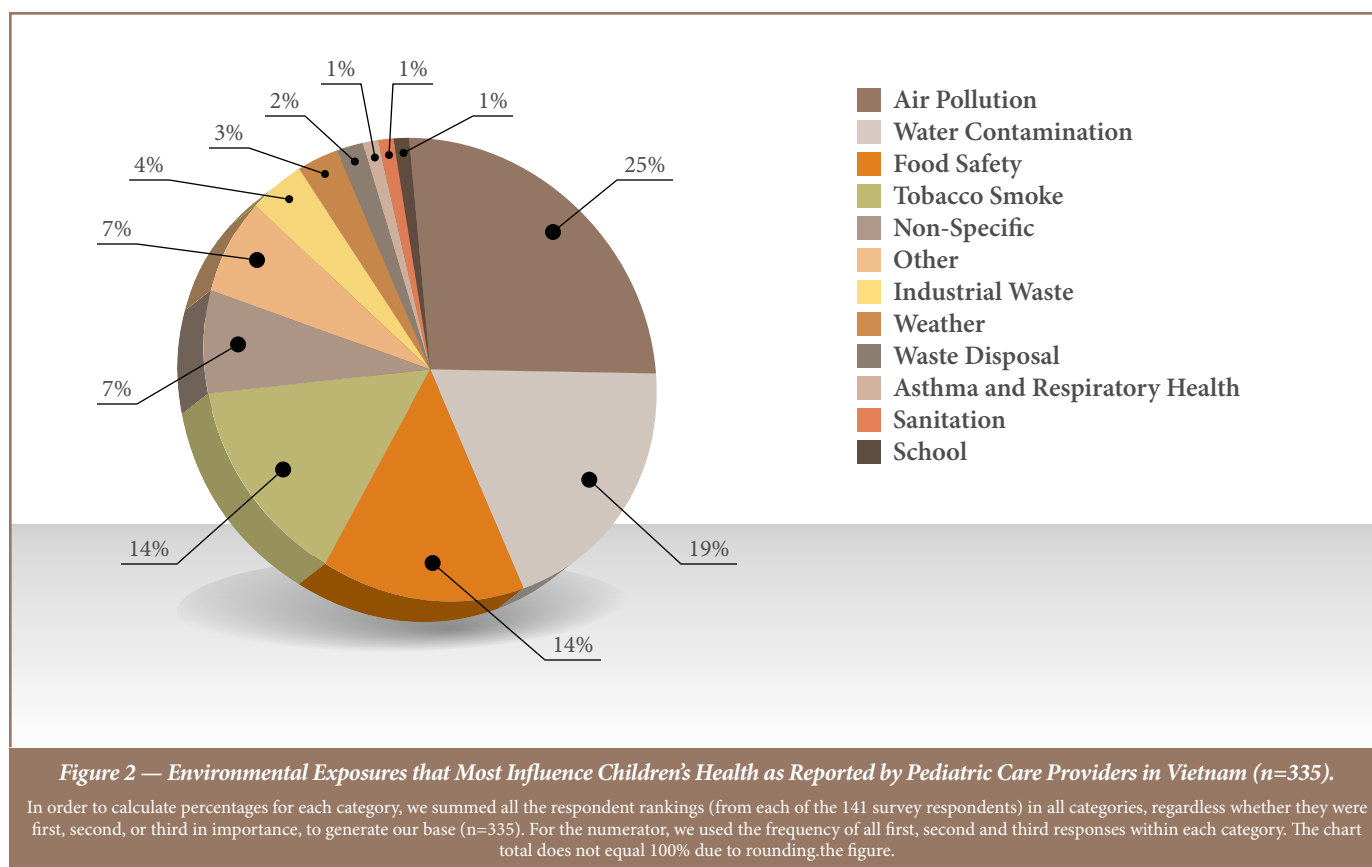
^b Non-specific responses included: specific vulnerability of children to environmental exposure, environment and child health, environmental knowledge, environmental contaminants, chemical poisoning, acute poisoning, toxic agents, how to limit and control the effect of environment to child health, general disease, poisoning, how to improve living environment.

^c Other responses included: medicine use, dangerous work, metabolism, digestion, government action on child health, pesticide poisoning, heavy metal poisoning, lead poisoning, prenatal toxic exposures, genetic diseases, pyodermititis, skin diseases, arsenic contamination, dioxin/Agent Orange exposure, infectious diseases, television, child and safety toys.

is very important. Nearly all (98%) indicated the magnitude of children’s environmentally related illness is increasing versus not changing (2%) or decreasing (0%). Furthermore, 63% of survey respondents were very interested in more training on environmental health topics.

Seventy-five percent of respondents to the question on future training opportunities reported conference attendance was the preferred method, with 18% preferring written materials and 7% preferring Internet-based training. Internet access and use were variable among sites visited.

Open-ended answers to topics of greatest interest for additional training varied widely. The most common themes were topics related to air pollution (14%), asthma and respiratory health (14%), water contamination (14%), and food safety (13%) (Table 2).



The respondents were also asked to provide open-ended responses listing the three most important CEH problems in Vietnam (Figure 2) and their local community. Eighty-four percent of the survey takers provided their top national topic, with 82% and 71% providing their second and third national topics, respectively. The most popular responses for the top national environmental health problems were air pollution (25%), water contamination (19%), food safety (14%) and tobacco smoke (14%). Few noted waste disposal (2%), asthma and respiratory health (1%), sanitation (1%), and school exposures (1%). Top priorities for their local regions were comparable (*data not shown*).

Several of the questions related to environmental health experience, attitudes, or behavior in everyday

practice. Many (80%) endorsed asking about the environments where a child lives, plays, and goes to school during clinical history taking. A smaller majority (64%) reported it is very important to include environmental exposure questions in the clinical history, with 36% indicating it is somewhat important and none reporting it is not important. Seventy-four percent of those who responded reported parents sometimes pose pediatric environmental health questions. When asked for their opinion on how much control pediatricians have over environmental health hazards, 51% indicated minimal control, 41% identified some control and only 8% reported much control.

Figure 3 shows the most commonly reported environmentally related health problem or hazards that

respondents' address in their patients. Food poisoning due to microbiological agents was identified most often (85%), followed by pesticide poisoning (77%), tobacco smoke exposure (75%), inadequate sanitation (60%), food poisoning due to chemical contamination (56%), drinking water (microbiological contamination) (56%), outdoor air pollution (56%), and indoor air quality symptoms (53%). The response rate (95-99%) was high for this section of the questionnaire.

In response to self-efficacy questions about taking an environmental history, less than half (39%) were confident, half (51%) somewhat confident, and 9% were not confident. More than a third (40%) were confident, more (47%) were somewhat confident and 13% were not confident discussing the

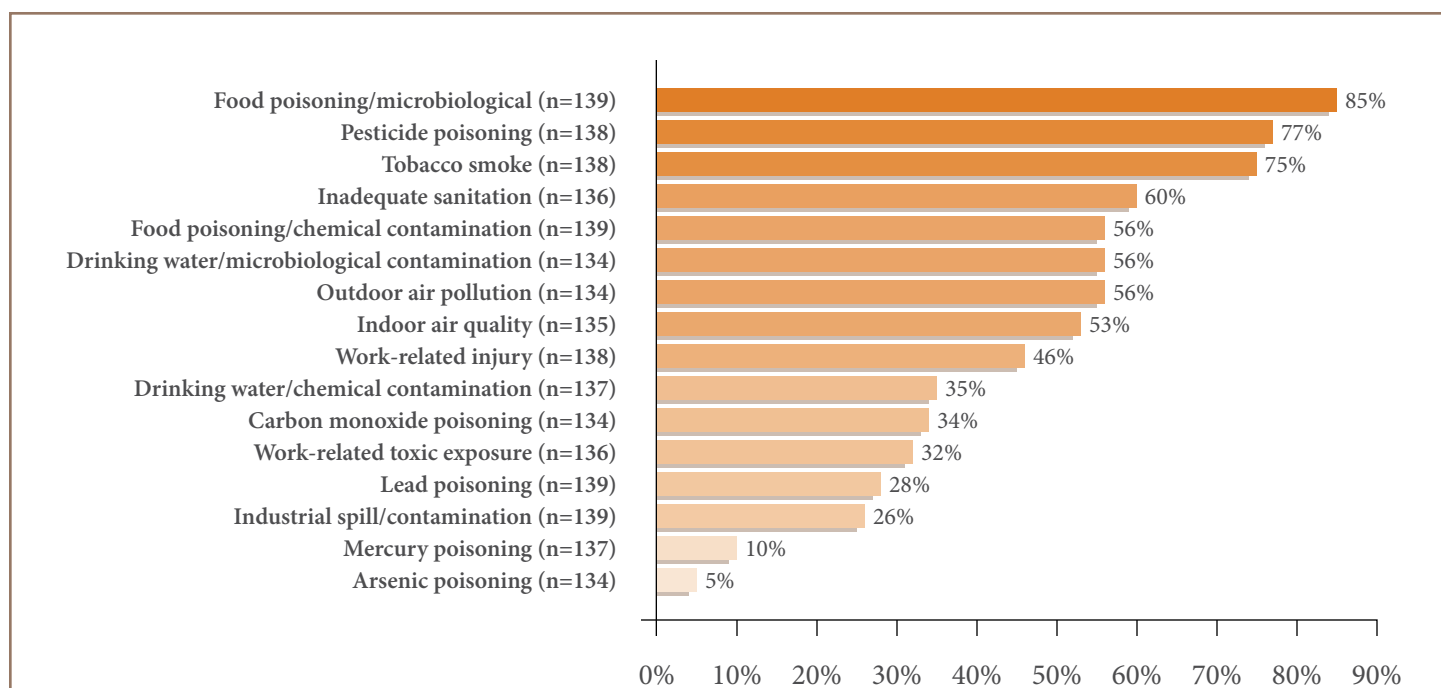


Figure 3 — Pediatric Care Provider Self-Reported Experience With Patients Affected by Environmental Exposures

The total number of survey respondents was 141, but not all respondents answered every question. The number of respondents for each question is reported in the chart.

impact of environmental exposures on health with patient families. Only 26% were confident in their ability to find diagnosis and treatment resources related to environmental exposures, with 44% somewhat confident and 30% not confident.

Providers were also asked about care of their pediatric patients who work. Forty-six percent of those who responded had experience with a work-related pediatric injury and 32% had experience with a work-related toxic exposure (Figure 3). Two-thirds (67%) of the providers reported inquiring about toxic work exposures during the clinical history. When providers identify youth exposed to dangerous working conditions, nearly all (90%) considered it their responsibility to take action. Many would act by informing parents (68%) and some would also contact the employer (19%), the government (10%), an NGO (2%)

and/or other venue of support (1%). Their confidence that the dangerous situation would be addressed was low, with 60% not confident, 30% somewhat confident and 10% confident.

Discussion

We surveyed 141 pediatric HCPs in Vietnam to inform future efforts toward development of pediatric environmental health expertise and capacity in the region. We found pediatric HCPs endorse environmental hazards in child health as an important topic that is routinely encountered in their care of patients, but training, experience, and perceived self-efficacy on these topics are limited.

Similar surveys of pediatric providers in developing countries are not in the published literature for comparison. However, surveys conducted among pediatric care providers in the United

States and Canada in the last decade demonstrate similar themes. These studies find that pediatric HCPs in these developed-nation settings also recognize the importance of environmental factors in child health and commonly receive questions from patients and families on these issues.⁶⁻¹⁰ However, as in our survey in Vietnam, providers in the United States and Canada report training and resources for these topics is limited yet desired.^{7,8,11} Similar to our findings, self-efficacy is generally low but varies by topic. For example, respondents are relatively comfortable addressing tobacco-smoke exposure and lead poisoning, but are not for other topics, such as pesticides and mold.⁸⁻¹¹

These other surveys did not include data on provider perspectives regarding working youth. In Vietnam, we found working youth health hazards are commonly encountered

in clinical practice (work-related injury 46%, toxic exposure 32%). Yet respondents reported receiving the least amount of training in work exposure training (11%) out of 15 key training topics. Overwhelmingly (90%), the survey respondents felt a responsibility to take action if such problems are discerned. However, the list of potential sectors to contact in response was varied with most seeing it as a family issue (selecting to contact the affected child's parents, 68%) versus a workplace issue (only 19% choosing to contact the employer) or a public health sector issue (selecting contact government officials, 10%).

The published literature on children's environmental health conditions and problems in Vietnam is scant. For example, lead poisoning is one of the most prevalent children's environmental health problems worldwide. Cases of widespread community contamination from lead battery recycling, other cottage industries involving lead such as gold recovery, or the use of leaded gasoline have been noted in multiple settings.¹²⁻¹⁴ In Vietnam, lead was phased out of gasoline in 2001.¹⁵ Reports of contamination due to lead battery recycling in villages have been investigated by the government but published data on this problem or any data on blood lead levels in Vietnamese children are not currently available. In our survey, we found just under one-third of respondents having encountered lead poisoning in clinical practice (28%). Nonetheless, only 21% reported any specific training on lead or heavy metal poisoning, and it was not noted among the top issues for future training nor as a top environmental health issue for children in the region or country.

Second to lead poisoning, asthma is among the most well-established environmentally linked diseases and

is one of the major 'new pediatric morbidities' in developed high-income countries.¹⁶⁻¹⁸ Data is available from many countries using the validated and well-established International Study of Asthma and Allergies in Children (ISAAC) prevalence survey tools.¹⁹ This data demonstrates that in general, more developed and wealthier nations have higher rates of pediatric atopy, including asthma. This suggests etiologic aspects related to changing economies and industrialization. An ISAAC survey of school-children in urbanized Hanoi, Vietnam, observed an asthma prevalence rate that is comparable to the prevalence in U.S. children.²⁰ Air pollutants linked to asthma are problematic in Vietnam. Traffic, industrial emissions, and burning for domestic cooking produce high particulate matter concentrations in Vietnam's cities, often exceeding U.S. EPA standards and Vietnam air quality management targets.²¹⁻²⁴ The survey respondents listed air pollution as the top children's environmental health concern for their regions and the country as a whole, although air pollution was seventh among problems identified in children these providers care for. Prevalence of smoking among males in Vietnam is among the highest in the world²⁵ but came up as fourth among top issues of concern for the nation and their local regions. Tobacco-smoke exposure and asthma triggers were among the topics that these providers were more likely to report in having had some specific training experience.

Conclusion

Based on WHO estimates, 25% of the global burden of disease is due to preventable environmental exposures with the greatest burden to children in low-income and developing countries.²⁶ Pediatric care providers in Vietnam are at the forefront of observing adverse environmental impacts on

children. However, there are no formal organizations nor agencies focused on children's environmental health among environmental health activities in Vietnam and there has been no integration of these topics into routine training or practice for pediatric providers. Training and specialty expertise on environmental health for the pediatric community in Vietnam is largely undeveloped but desired. Lessons learned from other settings would suggest that development of local expertise and regional resources for ongoing training and information in the pediatric health sector should be initiated as a key component of a children's environmental health agenda. Building capacity in pediatric environmental health should link to and augment efforts in all of the sectors that influence the environments of children (public health, economic development, environmental protection).^{3,27} Previously successful models include the development of pediatric environmental health faculty champions within academic medical centers, offering of specialty training opportunities such as specialized pediatric environmental health fellowships for medical and public health professionals, and the development of children's environmental health units such as exist in North America.^{2,4,28,29}

In addition, there is clearly a need to obtain better data on environmental exposures among children in Vietnam and how these exposures relate to health status. Nonetheless, many of the hazards, risk factors, and exposure scenarios are not unique and strategies have been developed to serve as models for policy and program development which need not be delayed.^{30,31} Overall, pediatric environmental health capacity building is an emerging and underserved area that needs more emphasis in Vietnam as well as in many global child health settings.

Acknowledgements.

This project was supported by funding, collaboration and mentorship from the United States Environmental Protection Agency Office of Children's Health Protection and Environmental Education (Ms. Martha Berger), the University of Washington Collaborative Center for Healthy Work and Environment (Dr. Matthew Keifer, Dr. Bill Daniell), the Project Vietnam Foundation, and the University of Washington Harry Bridges Center for Labor Studies. The authors acknowledge the important role of the Project Vietnam Foundation for lending help with organizing the trainings through their longstanding work with the pediatric professional community in Vietnam. Special thanks also to Virginia Ellingson for her assistance with this project.

References

1. Suk WA, Ruchirawat KM, Balakrishnan K, Berger, et al. Environmental threats to children's health in Southeast Asia and the Western Pacific. *Environ Health Perspect.* 2003 Aug;111(10):1340–7.
2. World Health Organization. *Children's Environmental Health Units*. WHO Press, Geneva, Switzerland. 2010. Available at: <http://www.who.int/ceh/publications/units/en/index.html> (accessed November 12, 2009).
3. Etzel RA. Developmental milestones in children's environmental health. *Environ Health Perspect.* 2010 Oct;118(10):A420–1.
4. Paulson JA, Karr CJ, Seltzer JM, et al. Development of the pediatric environmental health specialty unit network in North America. *Am J Public Health.* 2009 Nov;99 Suppl 3:S511–6.
5. World Health Organization. *Children's environmental health survey: assessing CEH issues as perceived by health care professionals*. 2008. Available at: http://www.who.int/ceh/capacity/training_modules/en/index.html (accessed June 29, 2011).
6. Sanborn MD, Scott EA. Environmental health concerns in urban and rural family practice. *Can Fam Physician.* 1998 Jul;44:1466–72.
7. Kilpatrick N, Frumkin H, Trowbridge J, et al. The environmental history in pediatric practice: a study of pediatricians' attitudes, beliefs, and practices. *Environ Health Perspect.* 2002 Aug;110(8):823–7.
8. Trasande L, Newman N, Long L, et al. Translating knowledge about environmental health to practitioners: are we doing enough? *Mt Sinai J Med.* 2010 Jan-Feb;77(1):114–23.
9. Trasande L, Schapiro ML, Falk R, et al. Pediatrician attitudes, clinical activities, and knowledge of environmental health in Wisconsin. *WJM.* 2006 Mar;105(2):45–9.
10. Trasande L, Boscarino J, Graber N, et al. The environment in pediatric practice: a study of New York pediatricians' attitudes, beliefs, and practices towards children's environmental health. *J Urban Health.* 2006 Jul;83(4):760–72.
11. Buka I, Rogers WT, Osornio-Vargas AR, et al. An urban survey of paediatric environmental health concerns: Perceptions of parents, guardians and health care professionals. *Paediatr Child Health.* 2006 Apr;11(4):235–8.
12. Haeffliger P, Mathieu-Nolf M, Locicero S, et al. Mass lead intoxication from informal used lead-acid battery recycling in Dakar, Senegal. *Environ Health Perspect.* 2009 Oct;117(10):1535–40.
13. Moszynski P. Lead poisoning in Nigeria causes "unprecedented" emergency. *BMJ.* 2010 Jul 26;341:c4031. DOI: 10.1136/bmj.c4031.
14. Washam C. Lead challenges China's children. *Environ Health Perspect.* 2002 Oct;110(10):A567.
15. Asian Development Bank. *Cleaner fuels: Policy guidelines for reducing vehicle emissions in Asia, No. 110502*; Asian Development Bank: Manila, 2003. Available at: http://www.adb.org/Documents/Guidelines/Vehicle_Emissions/cleaner_fuels.pdf (accessed September 15, 2011).
16. Institute of Medicine. *Clearing the air: asthma and indoor air exposures*. National Academies Press. 2000.
17. Landrigan PJ, Schechter CB, Lipton JM, et al. Environmental pollutants and disease in American children: estimates of morbidity, mortality, and costs for lead poisoning, asthma, cancer, and developmental disabilities. *Environ Health Perspect.* 2002 Jul;110(7):721–8.
18. Pearce N, Douwes J. The global epidemiology of asthma in children. *Int J Tuberc Lung Dis.* 2006 Feb;10(2):125–32.
19. Pearce N, Ait-Khaled N, Beasley R, et al. Worldwide trends in the prevalence of asthma symptoms: phase III of the International Study of Asthma and Allergies in Childhood (ISAAC). *Thorax.* 2007;62:758–766.
20. Nga NN, Chai SK, Bihn TT, et al. ISAAC-based asthma and atopic symptoms among Ha Noi school children. *Pediatr Allergy Immunol.* 2003 Aug;14(4):272–9.
21. Oanh NTK, Upadhyaya N, Zhuang YH, et al. Particulate air pollution in six Asian cities: spatial and temporal distributions, and associated sources, *Atmos Environ.* 2006;40:3367–3380.
22. Tuan, N. Current situation of air pollution in Ho Chi Minh City, Vietnam. Proceedings of the Asia-Pacific Conference on Sustainable Energy and Environmental Technology; 1996 Jun 19–21; Singapore. 242–248 p.
23. Hung, NT. Urban air quality modeling and management in Hanoi, Vietnam [PhD thesis]. [Aarhus, Denmark]: National Environmental Research Institute, Aarhus University, Denmark. 2010. Available at: http://www2.dmu.dk/pub/PhD_Hung.pdf (accessed September 15th, 2010).
24. Tung HD, Tong HY, Hung WT, Anh NT. Development of emission factors and emission inventories for motorcycles and light duty vehicles in the urban region in Vietnam. *Sci Total Environ.* 2011 Jun 15;409(14):2761–7. Epub 2011 May 5.
25. Edwards R. The problem of tobacco smoking. *BMJ.* 2004 Jan 24;328(7433):217–9.
26. World Health Organization. *Almost a quarter of all disease caused by environmental exposure*. World Health Organization [Internet]. 2006 Jun 16. Available from: <http://www.who.int/mediacentre/news/releases/2006/pr32/en/index.html> (accessed September 15th, 2010).
27. Powis B, Nga NH, Ireland J. National environmental health planning in Vietnam: flying some kites. *Health Promot Int.* 2002 Dec;17(4):373–81.
28. Rogers B, McCurdy LE, Slavin K, et al. Children's Environmental Health Faculty Champions Initiative: a successful model for integrating environmental health into pediatric health care. *Environ Health Perspect.* 2009 May;117(5):850–5.
29. Landrigan PJ, Woolf AD, Gitterman B, et al. The ambulatory pediatric association fellowship in pediatric environmental health: a 5-year assessment. *Environ Health Perspect.* 2007 Oct;115(10):1383–7.
30. Carpenter DO, Chew FT, Damstra T, et al. Environmental threats to the health of children: the Asian perspective. *Environ Health Perspect.* 2000 Oct;108(10):989–92.
31. Gavidia T, Brune MN, McCarty KM, et al. Children's environmental health—from knowledge to action. *Lancet.* 2011 Apr 2;377(9772):1134–6.

Appendix A

Provider Knowledge, Attitudes and Beliefs Survey



Children's health can be affected by exposure to hazardous substances in water, soil, air, and the food supply. Vulnerability to toxic exposures may differ in children compared to adults. While the scientific evidence for understanding this is improving, it takes time to integrate this knowledge into medical training and medical practice.

We are trying to understand the current experience and interest in children's environmental health among health professionals in Vietnam. This will be used to assess the needs and content for future training opportunities.

The survey takes approximately 15 minutes to complete. Your responses are confidential.

Knowledge and Training Experience

Have you had any specific training regarding:

- | | |
|---|--|
| 1. Specific vulnerability of children to environmental exposures? | ☐ Yes ☐ No |
| 2. Heavy metal poisoning (e.g. lead, mercury, arsenic)? | ☐ Yes ☐ No |
| 3. Pesticide poisoning? | ☐ Yes ☐ No |
| 4. Outdoor air pollution and child health? | ☐ Yes ☐ No |
| 5. Indoor combustion (cooking/heating) and child health? | ☐ Yes ☐ No |
| 6. Tobacco smoke and child health? | ☐ Yes ☐ No |
| 7. Chemical contamination of drinking water? | ☐ Yes ☐ No |
| 8. Microbiological contamination of drinking water? | ☐ Yes ☐ No |
| 9. Waste disposal and sanitation? | ☐ Yes ☐ No |
| 10. Food safety? | ☐ Yes ☐ No |
| 11. Exposures of working youth? | ☐ Yes ☐ No |
| 12. Environmental contaminants and cancer? | ☐ Yes ☐ No |



13. Environmental triggers for asthma? ☐ Yes ☐ No

14. Prenatal toxic exposures and child health? ☐ Yes ☐ No

15. Dioxin/Agent orange exposure and child health? ☐ Yes ☐ No

Have you had experience with a child patient affected by:

16. Lead poisoning ☐ Yes ☐ No

17. Mercury poisoning ☐ Yes ☐ No

18. Arsenic poisoning ☐ Yes ☐ No

19. Carbon monoxide poisoning ☐ Yes ☐ No

20. Pesticide poisoning ☐ Yes ☐ No

21. Tobacco smoke exposure ☐ Yes ☐ No

22. Indoor air quality related symptoms ☐ Yes ☐ No

23. Outdoor air pollution related symptoms ☐ Yes ☐ No

24. Lack of adequate sanitation ☐ Yes ☐ No

25. Chemical contamination of drinking water ☐ Yes ☐ No

26. Microbiological contamination of drinking water ☐ Yes ☐ No

27. Food poisoning - microbiological contaminant ☐ Yes ☐ No

28. Food poisoning - chemical contaminant ☐ Yes ☐ No

29. Industrial related spill or contamination? ☐ Yes ☐ No

30. Work-related toxic exposure? ☐ Yes ☐ No

31. Work-related injury? ☐ Yes ☐ No

32. How often do you receive questions from parents about their children's health and environmental issues?

☐ Often ☐ Sometimes ☐ Never

When conducting a clinical history:

33. Do you gather information about the environment where the child lives, plays and studies (e.g. school)? ☐ Yes ☐ No

34. Do you gather information about any toxic exposures a youth might have from doing work within or outside of the home? ☐ Yes ☐ No

Attitudes & Beliefs

35. The role of environmental factors in child health is:

☐ Not very important ☐ Somewhat important ☐ Very important

36. In care of pediatric patients, including environmental exposure questions in the clinical history is:

☐ Not very important ☐ Somewhat important ☐ Very important

37. The magnitude of children's environmental related-illnesses is

☐ Decreasing ☐ Not changing ☐ Increasing

38. The amount of control pediatricians have over environmental health hazards is

☐ Minimal control ☐ Some control ☐ Much control

39. If my care of pediatric patients, if I identify a youth exposed to a dangerous work situation, it is my responsibility to take action.

☐ Yes ☐ No

40. If yes, who would you contact?

☐ Parent

☐ Government agency (list)

☐ Employer _____

☐ NGO

☐ Other _____

41. If yes, do you have confidence the dangerous situation would be addressed?

☐ Not confident ☐ Somewhat Confident ☐ Confident

42. My interest in additional training on environmental health and children is:

☐ Minimal interest ☐ Somewhat interested ☐ Very interested

43. My preferred format for additional training would be: (rank as 1st, 2nd, 3rd)

_____ Web-based modules

_____ Attend a conference or workshop

_____ Written material



44. My top 3 environmental health topics to learn more about would be:

45. What are the top 3 environmental exposures that you feel most influence children's health in your country?

46. What are the top 3 environmental exposures that you feel most influence children's health in your local community?

Self efficacy

Indicate your confidence level with the following tasks:

47. Taking a patient history that includes questions on environmental exposures

☐ Not confident ☐ Somewhat Confident ☐ Confident

48. Discussing with parents or guardians the impact of environmental exposures on health

☐ Not confident ☐ Somewhat Confident ☐ Confident

49. Finding treatment and diagnosis resources related to environmental exposures

☐ Not confident ☐ Somewhat Confident ☐ Confident

Professional Profile

50. Age: _____ years

51. Sex: ☐ Yes ☐ No

52. How many years have you been involved with children's health: _____ years

53. Do you have a pediatric subspecialty: ☐ Yes ☐ No

Subspecialty _____

54. Major Area of Practice: ☐ Urban ☐ Rural

55. District/city where you live: _____

56. Where do you work the majority of the time?

- ☐ Public (government hospitals, centers of primary attention, etc.)
- ☐ Private (offices, clinics, house calls, etc.)

57. Where do you treat the majority of your patients?

- ☐ Outside of the hospital (ambulatory)
- ☐ Private (offices, clinics, house calls, etc.)

58. Within which age group do the majority of you patients fall:

- ☐ <1 year
- ☐ 1-5 years
- ☐ 6-12 years
- ☐ 13-18 years
- ☐ All ages
- ☐ I don't know

59. How would you describe the majority of your patients in terms of socioeconomic background?

- ☐ Low
- ☐ Middle
- ☐ High