Evaluation of the National Environmental Education Foundation Children's Environmental Health Faculty Champions Train-the-Trainer Workshop

Katie Elaine Slavin

A thesis submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Master of Science in Public Health Nursing in the Public Health Leadership Program.

Chapel Hill
2007

Approved by:

Dr. Bonnie Rogers
Advisor

Judith Ostendorf
Reader

Susan Randolph
Reader

ABSTRACT

KATIE ELAINE SLAVIN: Evaluation of the National Environmental Education Foundation Children's Environmental Health Faculty Champions Train-the-Trainer Workshop

(Under the direction of Dr. Bonnie Rogers)

This is an evaluation of an educational intervention project conducted by the National Environmental Educational Foundation (NEEF) designed to build health professional capacity to address children's environmental health (and general environmental health) issues. This was accomplished through the integration of identified pediatric/environmental health (P/EH) competencies via a network of children's environmental health Faculty Champions from medical and nursing schools throughout the country. Data were collected by NEEF using a pre-experimental mixed methods approach. Twenty-eight faculty members of schools of medicine and/or nursing at a university academic health centers participated in the Faculty Champion training project.

The NEEF Faculty Champions train-the-trainer workshop was highly effective in incorporating P/EH information into the education and practice of medical and nursing professionals with a significant ($p = < .0001$) improvement in participants' knowledge of P/EH. In addition the Faculty Champions far exceeded the initial goal of training an additional 280 health professionals, reaching a total of 1,517 faculty, practitioners, residents, and nursing and medical students about P/EH topics.

This program may serve as a model for integration of P/EH into medical and nursing school curricula.

ACKNOWLEDGEMENTS

I would like to thank my family, especially Thomas, Carol, and Amy Slavin, for their relentless love and support. Special thanks to Dr. Bonnie Rogers for her patience and guidance throughout my academic career at UNC, and particularly during thesis creation. Sincere gratitude goes out to Dr. Rogers, Judy Ostendorf, Susan Randolph, and Kathleen Buckheit for their academic counseling and, more importantly, their camaraderie. Special thanks to Carol Harris, Karen Mastrioanni, Dr. David Machles, Vicki Smith, Connie Rowley, Julie Maness, Teresa Riley, Dr. Gary Greenburg, Dr. Nelson Couch, and Sheila Higgins for their support, assistance, and encouragement. Appreciation and best wishes to Jason Tate and Kathy Dayvault. Additional thanks to Dr. Bonnie Rogers, Judy Ostendorf, Susan Randolph, and Kathleen Buckheit for generous recommendations and assistance with career development. For the opportunities that will follow the completion of Dr. Bonnie Rogers' program, I am extremely grateful.

TABLE OF CONTENTS

ABSTRACT……...ii

ACKNOWLEDGEMENTS……iii

LIST OF TABLES……...viii

LIST OF FIGURES……..….ix

ABBREVIATIONS……...…….….x

CHAPTER

I. INTRODUCTION……...1

II. LITERATURE REVIEW……..……..7

Introduction……..7

Pediatric Environmental Health……...9

Unique Vulnerabilities of Children……10

Asthma.....12

Environmental Tobacco Smoke……19

Exposure to Ultraviolet Light……....21

Pesticide Exposure…….22

Lead and Mercury……..25

Pediatric Environmental Health in Curricula…….28

Effectiveness of Teaching Strategies…….33

National Environmental Education Foundation…….37

Competency Development…….39

Summary……44

III. METHODS……46

Purpose……..…….46

Research Design…….47

Research Questions……47

Faculty Champions Train-the-Trainer Workshop Planning……..48

Setting……51

Participants…….51

Instruments…….52

Pretest/Posttest……...52

Workshop Evaluation Form……...52

Competency Data Assessments…….....53

Action Plan…….…54

Telephone Interviews...……...…54

Data Collection……..54

Pretest/Posttest……...54

Workshop Educational Intervention …….……55

Workshop Evaluation…….58

Action Plan…….58

Competency Data Assessments…….58

Telephone Interviews...……..59

Protection of Human Subjects……...60

IV. RESULTS……..61

Demographic Characteristics…….…61

Workshop Evaluation…….61

Action Plan…….……61

Pretest/Posttest Data……...66

Examination 1 (Pretest) vs. Examination 2 (First Posttest)……..66

Examination 2 Subsample vs. Examination 3……68

Examination 1 Subsample vs. Examination 3……69

Competency Data Assessment……..70

Rating Score……..71

Compliant Subsample……81

Additional Assessment Data……..82

Telephone Interviews…….92

Overall Impact……..…...113

V. DISCUSSION……..114

Increase in Pediatric/Environmental Health Knowledge…….114

Integration of Pediatric/Environmental Health in Practice and Curricula..……..116

Effective Strategies……..119

Barriers…….123

Competency Evaluation……...123

Reasons for Success and Non-Success……127

Limitations……...…130

Future Research……...130

Policy Implications……..131

Implications for Occupational and Environmental Health Nursing……133

Conclusion……...133

APPENDICES……135

APPENDIX A: National Environmental Education Foundation (NEEF) Planning Committee……135

APPENDIX B: Organizations Endorsing the National Environmental Education Foundation's Health Professionals and Environmental Health Education Position Statement……136

APPENDIX C: National Environmental Education Foundation Pretest/Posttest Instrument……137

APPENDIX D: Workshop Evaluation Form……...142

APPENDIX E: Competency Data Assessment Form B1……143

APPENDIX F: Competency Data Assessment Form B2……145

APPENDIX G: Competency Data Assessment Form B4……149

APPENDIX H: Children's Environmental Health Faculty Champion Action Plan Guide for Integrating Environmental Health into Education and Practice July 2006-July 2007……..153

APPENDIX I: National Environmental Education Foundation Faculty Champions Telephone Interview 1……..155

APPENDIX J: National Environmental Education Foundation Faculty Champions Telephone Interview 2……..157

APPENDIX K: National Environmental Education Foundation Children's Environmental Health Faculty Champions Train-the-Trainer Workshop Agenda……....160

REFERENCES……162

LIST OF TABLES

Table		Page
2.1	Health Consequences of Passive Smoking	20
2.2	Ambulatory Pediatric Association's Competencies for Pediatric Environmental Health Specialists	42
4.1	Workshop Evaluation Summary	62
4.2	Evaluation of Pediatric Environmental Health Train-the-Trainer Workshop Participant Score Evaluation	67
4.3	Competency Data Assessments: Mean Scores	72
4.4	Faculty Champions Competency Data Baseline Assessment Scores—B1 (1 month post workshop) for Practice and Curriculum Assessment	74
4.5	Faculty Champions Competency Data Ongoing Assessment Scores—B2 (4 months post workshop) for Practice and Curriculum Assessment	76
4.6	Faculty Champions Competency Data Ongoing Assessment Scores—B4 (8 months post workshop) for Practice and Curriculum Assessment	78
4.7	Faculty Champions Composite Scores--Competency Data Assessments	80
4.8	Reported Number Trained and Referrals Made	83
4.9	Faculty Champions Competency Data Assessment Summary at 4 Months Post Workshop (B2)	84
4.10	Faculty Champions Competency Data Assessment Summary at 8 Months Post Workshop (B4)	89
4.11	NEEF Faculty Champion Telephone Interview Responses at 6 Months	93
4.12	NEEF Faculty Champions Telephone Interview Responses at 12 Months	104

LIST OF FIGURES

Figure		Page
1.1	Consumer Product Safety Commission's Recalls for Lead Violations October, 2007	4
2.1	Categories of Indoor Air Pollutants	15
2.2	Health Effects of Common Indoor Air Pollutants	16
3.1	Faculty Champions Workshop Curricula and Training Materials	56
4.1	Action Plan Responses, Common Themes: Training Faculty Members	64
4.2	Action Plan Responses, Common Themes: Integrating Pediatric/Environmental Health into Education and Practice	65

ABBREVIATIONS

AAP	American Academy of Pediatrics
AMA	American Medical Association
ANA	American Nurses Association
APA	Ambulatory Pediatric Association
ATSDR	Agency for Toxic Substances and Disease Registry
BLL	Blood Lead Level
CAA	U.S. Clean Air Act
CBCL	Child Behavior Checklist
CDC	Centers for Disease Control and Prevention
CI	Confidence Interval
CNS	Central Nervous System
DAP	Dialkylphosphate
DHHS	U.S. Department of Health and Human Services
EPA	U.S. Environmental Protection Agency
ETS	Environmental Tobacco Smoke
EBM	Evidence-based Medicine
GAO	U.S. General Accounting Office
IOM	Institute of Medicine
MDA	Malathion
MDI	Mental Development Indices
MMWR	Morbidity and Mortality Weekly Report
MP	Methyl Parathion

NEEF	National Environmental Education Foundation
NIOSH	National Institute for Occupational Safety and Health
OPs	Organophosphate Pesticides
PBCs	Polychlorinated Biphenyls
PDI	Psychomotor Development Indices
P/EH	Pediatric/Environmental Health
PEH	Pediatric Environmental Health
PENTB	Pediatric Environmental Neurobehavioral Test Battery
PSR	Physicians for Social Responsibility
SHS	Secondhand Smoke
SIDS	Sudden Infant Death Syndrome
TCPy	Chlorpyrifos
VOC's	Volatile Organic Compounds

CHAPTER I

Introduction

All individuals confront a wide range of potential hazards in the environment in their homes, communities, and workplaces. Children, as a result of environmental exposures or exposures to toxins brought home on clothing or other material from their parents who work, are especially susceptible to toxic effects because of their developing organ systems, immature biologic defenses, and increased exposure due to small size, diet, behaviors, and other factors (American Academy of Pediatrics [AAP], 2003; National Research Council, 1993; Physicians for Social Responsibility [PSR], 2006). Public concern for these exposures is high, and patients frequently ask their health care providers about the health effects of environmental exposures (Pew Charitable Trusts, 1999; Szneke, Nielsen, & Tolentino, 1994). A survey conducted by Princeton Survey Research Associates for Health-Track (2000) found that 92 percent of Americans believe that environmental factors are an important cause of disease.

Clinical practice plays an important role in advancing and protecting children's environmental health (Kilpatrick et al., 2002). The field of pediatric environmental health has been defined as "the diagnosis, treatment, and prevention of illness due to perinatal and pediatric exposures to environmental hazards" (Children's Environmental Health Network/Public Health Institute, 1999, page 1). Despite the importance of the need for health care provider proficiency in evaluating environmental exposures of pediatric

patients, pediatric medical and nursing education currently lacks the environmental health content necessary to appropriately prepare pediatric health care professionals to prevent, recognize, manage, and treat environmental-exposure-related disease (McCurdy et al., 2004).

Children are the most vulnerable in terms of declining environmental health conditions (Anderko, 2003). For example, diseases such as birth defects (Pew Environmental Health Commission, 1999) and childhood cancer (Daniels, Olshan, & Savitz, 1997; Devesa, Blot, Stone, Miller, Tarove, & Fraumeni, 1995) are on the rise, asthma mortality has doubled (Centers for Disease Control and Prevention [CDC], 1996), and autism is increasing both nationwide and worldwide (Jacobsen & Jacobsen, 1996; Landrigan et al., 1998; Pew Environmental Health Commission, 1999). Many environmental health hazards for children are present in everyday settings such as homes, day care centers, playgrounds, and schools (Anderko, 2003; U.S. Environmental Protection Agency [EPA], 2002). Due to time spent in the home, materials used for home construction, ventilation/heating systems common in homes, home water sources, and potential take-home pathway for parental work exposures, the home environment is a particularly important source of potential fetal and early childhood exposures to biologic, chemical, and physical agents, as well as a strategic opportunity for intervention (Krieger & Higgins, 2002).

Increasing this concern is the fact that the U.S. continues to rapidly increase global outsourcing of production and importing of goods (Lotke, Rasmussen, Carter, & Borosage, 2007). World imports have increased by 338 percent since 1974, with imports from China alone increasing nearly 3,900 percent just since 1985 (Lotke et al., 2007).

Compounding this concern, the budget of the Consumer Product Safety Commission, the government agency responsible for monitoring consumer goods in the U.S., is less than half the amount the budget was when it originated in 1974 (Lotke et al., 2007). As a result, American consumers are exposed to increasing numbers of products that were neither produced in America nor subject to American Safety Standards, putting more individuals at risk (Lotke et al., 2007). For example, although lead in paint has been banned in the U.S. for toys since 1987 and federal law sets the maximum acceptable level of lead at 600 parts per million, Figure 1.1 displays the recalls of a record number (n=29) of imported children's toys for either violation of lead paint standards (n=24) or for excessive levels of lead (n=5) in October 2007 (U.S. Consumer Product Safety Commission [CPSC, 2007a; Lotke et al., 2007). Please note that none of these products were manufactured in the U.S., whereas 27 products were manufactured in China.

Prevention of environmental disease among children has important social and economic benefits (Breysse et al., 2004). Landrigan, Schechter, Lipton, Fahs, & Schwartz (2002) estimates that the total annual costs for environmentally attributable childhood diseases in the United States—lead poisoning, asthma, cancer, and developmental disabilities—is $54.9 billion. A concerted effort to prioritize pediatric environmental health by governmental organizations and foundations is essential in providing the resources and expertise to set policy and provide the tools for teaching pediatric environmental health to health care providers (McCurdy et al., 2004).

The need for improvements in health professionals' environmental health knowledge has been expressed by leading health institutions (NEEF, 2004). The Institute

Figure 1.1 **Consumer Product Safety Commission's Recalls for Lead Violations** **October, 2007** **(U.S. CPSC, 2007a)**		
Amount (approximate)	**Item**	**Manufactured in:**
380,000	"Galaxy Warriors" Toy Figures	China
43,000	"Ugly Teeth" Party Favors	China
16,000	Elite Operations Toys	China
1,500	Ribbit Board Games (excessive lead)	China
142,000	Purple Halloween Pails with Witch Decorations	China
80,000	Football Bobble Head Cake Decorations	China
97,000	Children's Toy Gardening Tools	China
38,000	Go Diego Go Animal Rescue Boats	China
198,000	Beary Cute, Expressions, and Sassy & Chic Children's Metal Jewelry (excessive lead)	China
110,000	WeGlow Children's Metal Jewelry (excessive lead)	China
55,000	Skull Pails Filled With Halloween Candy Mix	China
200,000	Cool Clip™ and Mini Cool Clip™ Bookmarks	China
5,400	Tabletop Puppet Theaters	China
2,400	Breyer 2006 Stirrup Ornaments	China
19,000	Deluxe Wood Art Sets	Taiwan and Vietnam
49,000	Disney™ Deluxe Winnie-the-Pooh 23-Piece Play Sets	China
7,800	Princess Magnetic Travel Art Set Lap Desks	China
10,000	Bendable Dinosaur Toys (excessive lead)	China
2,500	Collectible "Jeff Gordon" Mini Helmets	China
2,400	Kidnastics Balance Beams	Taiwan
1.6 million	Cub Scouts Totem Badges	China
11,200	Alpine Design Aluminum Water Bottles	China
150,000	Bookmarks and Journals	China
192,000	Key Chains (excessive lead)	China
15,000	Children's Toy Decorating Sets	China
63,000	Frankenstein Tumblers	China
79,000	"Pirates of the Caribbean" Medallion Squeeze Lights	China
35,000	Baby Einstein Discover & Play Color Blocks	China
10,000	Wooden Pull-Along Alphabet & Math Blocks Wagons, Wooden Pull-Along Learning Blocks Wagons, 10-in-1 Activity Learning Carts, and Flip-Flop Alphabet Blocks	China

of Medicine recommends the integration of environmental health concepts into all levels of medical and nursing education (Pope & Rall, 1995; Pope, Snyder, & Mood, 1995).

The American Medical Association encourages physician educators in medical schools, residency programs, and continuing medical education sessions to devote more attention to environmental health issues and suggests physicians educate themselves about pesticide-related illnesses (NEEF, 2004). The American Academy of Pediatrics (AAP) advocates for pediatricians to become informed about air pollution problems in the community and on the identification, prevention, and treatment of childhood environmental health problems (AAP Committee on Environmental Health, 2003; Committee on Environmental Health, 1993). The American College of Preventive Medicine has urged funding and support for the Agency for Toxic Substances and Disease Registry (ATSDR) in their efforts to educate health care providers on toxic substances and how to prevent exposure to these substances (American College of Preventive Medicine, 2003). The Ambulatory Pediatric Association has established the National Fellowship Program in Pediatric Environmental Health and developed competencies for pediatric environmental health specialists (Etzel et al., 2003). The U.S. Department of Health and Human Services (DHHS) Division of Nursing has included the ability to recognize environmental health problems affecting patients and providing health protection interventions as one of the essential primary care nurse practitioner competencies (U.S. DHHS, 2002). Finally, the American Nurses Association (ANA) has resolved to broaden its work in occupational and environmental health and apply the precautionary approach when an activity raises threats of harm to human health or the environment (ANA, 2003).

While several studies have identified a lack of pediatric and environmental health content (P/EH) in curricula and/or the lack of knowledge in P/EH by health care professionals, few have evaluated the effectiveness of programs incorporating P/EH into curricula and practice. The purpose of this study is to evaluate the National Environmental Educational Foundations Children's Environmental Health Faculty Champions Train-the-Trainer program designed to build health professional capacity to address children's environmental health (and general environmental health) issues. The identification of programs and strategies that are effective in producing health care providers competent in preventing, recognizing, managing, and treating environmental-exposure-related-disease is the first step in improving current deficiencies in this field.

CHAPTER II

Literature Review

Introduction

Environmental health hazards are widespread in our communities, placing adults and children alike at risk for developing diseases from hazardous exposures (Rogers, 2004). Many of the escalating chronic diseases of the 21st century can be attributed to declining environmental conditions world-wide. Children have special vulnerabilities in regard to their exposures and responses to the environment (Anderko, 2003). It is estimated that environmental toxins may account for 25 to 40 percent of the global burden of disease. Moreover, although children under five years old make up only 12 percent of the world's population, it is estimated that approximately 43 percent of the total burden of disease attributable to environmental factors falls on them (Crain, 2000).

Because children spend as much as 80-90 percent of their time indoors (AAP, Committee on Environmental Health, 2003; Children's Environmental Health Network [CEHN], 1999; U.S. EPA, 2002), the possible origins of many of the health risks they face can be traced to homes, schools, workplaces, and other indoor environments (U.S. EPA, 2002). For example, pollutants from industry, pesticide exposures, or other toxins may be brought home on work clothing from parents who work. Specifically, lead and pesticide dust, if not contained in the workplace through appropriate industrial hygiene

techniques, can be transferred to the employee's house via clothing and shoes worn at work, posing a serious health threat to children residing in the home environment (Erickson & Thompson, 2005). Due to the fact that children can be exposed to pesticides after coming into contact with residues on parents' clothing, a report by the U.S. General Accounting Office (GAO) (2000) found that improvements were needed to ensure the safety of farmworkers' children. Industry is also responsible for the release of toxins into the environment, placing surrounding communities at risk. Mercury is emitted into the atmosphere by coal-fired power plants, some manufacturing processes, waste incineration, and volcanic activity (Graff, Murphy, Ekvall, & Gagnon, 2006). Emissions from power plants alone are estimated to contribute to 70 percent of the world's methylmercury supply (Trasande, Landrigan, & Schecter, 2005).

Prevention of environmental disease among children has important social and economic benefits (Breysse et al., 2004). It is estimated that the total annual costs for environmentally attributable childhood diseases in the United States—lead poisoning, asthma, cancer, and developmental disabilities—is $54.9 billion (Landrigan et al., 2002). In the 1970s, government efforts to reduce childhood lead poisoning and to monitor birth defects and cancer began (Goldman et al., 2004) as concern for the relationship between children and the environment heightened among health professionals and researchers. In the 1990s, federal efforts to protect children from detrimental health effects of environmental toxins accelerated with the Food Quality Protection Act, the Agency for Toxic Substances and Disease Registry/Environmental Protection Agency Pediatric Environmental Health Specialty Units, and National Institute of Environmental Health Sciences/Environmental Protection Agency Centers of Excellence in Research in

Children's Environmental Health (Goldman et al., 2004). The discipline of pediatric environmental health is still young, but it will become increasingly more important as new chemicals are generated and as more is learned about the health effects of chemicals already in commerce (Reddy, Reddy, & Reddy, 2004). Numerous studies have demonstrated the need to improve practitioner and nurse knowledge and practice of pediatric environmental health (Balbus, Harvey, & McCurdy, 2006; Hays, Davis, & Miranda, 2006; Kilpatrick et al., 2002; NEEF, 2004; Roberts & Reigart, 2001; Woolf & Cimino, 2001).

Pediatric Environmental Health

According to Israel et al. (2005), over the past several decades there has been growing evidence of the increase in incidence rates, morbidity, and mortality for a number of health problems experienced by children such as asthma and other respiratory diseases (Landrigan et al., 2002; Mannino et al., 2002), developmental disabilities (Barone, Das, Lassiter, & White, 2000; Canfield et al., 2003), neuropsychological disorders (Baldi et al., 2001; Schantz, Widholm, & Rice, 2003), and childhood cancers (Daniels et al., 1997). The causation and aggravation of these problems are complex and multifactoral, including genetic predisposition, demographic factors, psychosocial stressors, and environmental exposures (Israel et al., 2005). Israel et al. (2005) asserts that numerous environmental exposures have been identified as contributing factors, including ambient levels of respirable particulate matter (Delfino, Zeiger, Seltzer, Street, & McLaren, 2002; Eggleston, 2000; Samet, Dominici, Curriero, Ciyrsac, & Zeger, 2000), ozone (Buchdahl, Willems, Vander, & Babiker, 2000; Perera et al., 2003), house dust mite and cockroach allergens (Litonjua, Carey, Burge, Weiss, & Gold, 2001; Sproik et

al., 1999), and environmental tobacco smoke (Gergen, Fowler, Maurer, Davis, & Overpeck, 1998; Gold, 2002). Additionally, research shows that children in lower socioeconomic status families, as well as children of color, reside in less environmental friendly housing and are exposed to more environmental health risks (Evans & Kantrowitz, 2002; Evans & Marcynyszyn, 2004; Israel et al., 2005).

Unique Vulnerabilities of Children

Due to higher metabolic rates, children consume more oxygen, food, and water per pound of body weight than do adults (AAP, 2003). In the first six months of life children drink seven times as much water, and from one to five years of age consume three to four times more food than do adults (Physicians for Social Responsibility [PSR], 2006). Normal children's diet, play, and hand-to-mouth behavior (the latter two of which increase a child's exposure to dust and dirt) can also increase toxicant exposure (PSR, 2006). A young child's higher surface area to body mass ratio increases exposure to toxicants that are absorbed through the skin (PSR, 2006).

Children's exposures and their ability to metabolize and excrete chemicals will vary greatly depending on where they are in terms of growth and development (PSR, 2006). Rapid growth and development, potential for high levels of exposures due to their environment, and immature detoxification systems are universal to all children (National Academy of Sciences, 1993). The American Academy of Pediatrics (2003) identifies six stages of development from fetus to 18 years. From conception to adulthood, children move through windows of vulnerability unique to each stage of development (Pike-Paris, 2004). For example, the exceptionally rapid growth of fetal tissue provides opportunities for toxins to significantly affect development (Dunn, Burns, & Sattler, 2003).

Environmental toxins may alter the maternal or paternal reproductive organs, causing mutagenesis of sperm or ova and increasing the risk of cancer or congenital defects of offspring (Dunn et al., 2003). Likewise, toxins stored in maternal tissues (e.g., lead or polychlorinated biphenyls [PCBs] in bone and fat) may be released during pregnancy, disrupting organ system development of the fetus (Dunn et al., 2003). Additionally, toxins to which the mother is exposed may cross the placenta and result in deficits (Dunn et al., 2003). Tragedies resulting from fetal exposures during critical periods of development have been known for years: maternal consumption of alcohol, thalidomide, diethylstilbestrol, and mercury (Pike-Paris, 2004).

Due to highly permeable skin and gastrointestinal systems, newborn infants are at higher risk for toxin update with minimal exposure (Dunn et al., 2003). Infants' and toddlers' hand-mouth behaviors, close proximity to the floor, and diet place them at risk for exposure to vapors (radon, smoke, and formaldehyde from carpets), dust (lead, pesticides, insect parts), and pesticides and PCBs (from diets high in fruit, vegetables, and milk) (Dunn et al., 2003). School-aged children are exposed to toxins in their school and home environments—asbestos, PCBs, paints and chemicals in art and science projects, air pollutants, pesticides, and wood preservatives in playground equipment, play areas, lawns, and school yards (Fields, 2001; Spann, Blondell, & Hunting, 2000). In addition, schools are sometimes built on land that has been previously contaminated by chemical toxins or near know environmental hazards or, because of construction or maintenance, have become "poisoned schools" (Sattler, Atzal, Condon, Belka, & McKee, 2001). Adolescents increase their exposure to toxins as they enter the workforce and engage in experimental or risky behaviors (e.g., smoking or drug use) (Dunn et al., 2003).

The rapid adolescent growth spurts related to sexual maturation, and growth of body mass create a set of target tissues highly susceptible to toxic effects (Dunn et al., 2003).

Little research has been conducted regarding vulnerable childhood periods, which leaves practitioners with less certainty about when critical developmental periods occur (Pike-Paris, 2004). A growing body of evidence proves the consequences to children's health from exposure to lead, mercury, environmental tobacco smoke (ETS), and pesticides (Pike-Paris, 2004). Since children have a longer life span and since many toxicants have long latency periods before adverse effects may manifest, early life exposures are particularly concerning especially for exposures to carcinogens like arsenic and asbestos and substances like radon (PSR, 2006). This is also true for some neurotoxicants where early exposures may lead to behavioral and developmental problems not appreciated until problems arise in school or later in life (PSR, 2006). Early exposure to carcinogens may increase risk of adulthood cancer and also may cause certain cancers to appear sooner in life (PSR, 2006).

Asthma

Asthma is the most common chronic disease in childhood (Goveia et al., 2005). During 1995-1996, the prevalence of asthma in children aged 0-4 years in the United States was 5 percent, representing a 71 percent increase from 1980 (Akinbami & Schoendorf, 2002). Between 60 to 70 percent of children with asthma have disease onset before age 5 years, and evidence exists for a causal relationship between exposures to particular indoor environmental allergens and the development and/or exacerbation of asthma in susceptible individuals (Almqvist et al., 1999; Epstein, 2001). For this reason, it is important to assess the environments where young children are exposed to items that

may potentially trigger asthma (Goveia et al., 2005). Asthma control requires disease recognition and therapy management (Goveia et al., 2005). There are a number of studies that have demonstrated the need to improve physician asthma knowledge and practice (Goveia et al., 2005). Additional studies of staff of child care centers and schools found knowledge about asthma symptoms, potential asthma triggers and appropriate treatment particularly inadequate in these personnel (Bell, McElnay, Hughes, & Gleadhill, 2000; Brook & Shiloh, 1994; Brooks & Jones, 1992; French & Carroll, 1997; Goveia et al., 2005; Juhn, St. Sauver, Shapiro, & McCarthy, 2002).

Indoor air quality (IAQ) has become an acknowledged health concern for the past 30 years (Pike-Paris, 2005). The U.S. EPA and its Science Advisory Board have ranked indoor air pollution as one of the top five risks to public health (Wigle, 2003). Multiple factors impact indoor air including building age, building materials, ventilation, activities conducted, humidity, and outdoor air (Pike-Paris, 2005). According to the U.S. EPA (2003), poor IAQ in schools can result in decreased academic performance and days lost due to illness in the school age population. Multiple scientific and governmental groups have identified a vast number of indoor air pollutants, which Wigle (2003) groups into three broad categories: (a) gases and vapors, (b) particulate matter—large and small, and (c) dust. Examples of gases and vapors include carbon monoxide (CO), nitrogen dioxide (NO_2), formaldehyde, radon, volatile organic compounds (VOC's), and pesticides. Particulate matter include such toxicants as environmental tobacco smoke (ETS), particulate matter from other combustion processes, asbestos, and biologics, animal dander, fugal spores, bacteria, viruses, pollens, and arthropod antigens. Examples of dust include pesticides and heavy metals (Wigle, 2003). Particles of lead (particularly from

lead paint) and pesticide residue (consisting of the dried liquid form of the pesticide solution) can enter children's respiratory and digestive systems as powdery dust as illustrated in Figures 2.1 and 2.2.

Ambient (outdoor) air pollution also poses a threat to children's health, and children are more vulnerable to adverse effects of air pollution than adults (AAP, 2004). Eighty percent of alveoli are formed postnatally, and changes in the lung tissue continue through adolescence (Dietert et al., 2000). During the early postneonatal period, the developing lung is highly susceptible to damage after exposure to environmental toxicants (Dietret et al., 2000; Pinkerton & Joad, 2000; Plopper & Fanucchi, 2000). Children have increased exposure to many air pollutants compared with adults because of higher minute ventilation and higher levels of physical activity (Plunkett, Turnbull, & Rodricks, 1992). Lead is neurotoxic, carbon monoxide interferes with oxygen transport though the formation of carboxyhemoglobin, and other criteria pollutants (ozone, sulfer dioxide, particulate matter, nitrogen dioxide) pose respiratory effects in children and adults, including increased respiratory tract illness, asthma exacerbations, and decreased lung function (AAP, 2004). In addition to associations between air pollution and respiratory symptoms, asthma exacerbations, and asthma hospitalizations, recent studies have found links between air pollution and preterm birth, infant mortality, deficits in lung growth, and possibly, development of asthma (AAP, 2004).

Numerous studies have shown that outdoor air pollution exacerbates asthma (AAP, 2004). One study by McConnell et al. (2002) demonstrated that time spent outside was associated with new cases of asthma in high-ozone communities but not in low-ozone communities. Likewise, children in communities with higher levels of urban air

pollution (acid vapor, nitrogen dioxide, particulate matter with a median aerodynamic

Figure 2.1: Categories of Indoor Air Pollutants (Wigle, 2003)	
Category	**Examples**
Gases and Vapors	Carbon monoxide, nitrogen dioxide, formaldehyde, radon, volatile organic compounds (VOCs), and pesticides.
Particulate Matter	Toxicants—ETS, particulate matter from other combustion processes, asbestos. Biological-animal dander, fungal spores, bacteria, virus, pollens, arthropod antigens.
Dust	Pesticides, heavy metals.

Figure 2.2 Health Effects of Common Indoor Air Pollutants (Pike-Paris, 2005)	
Combustion Pollutants: Carbon monoxide, nitrogen dioxide, sulfur dioxide, particles. These are products of the following fuel sources: natural gas or liquid propane, fuel oil, kerosene, wood, and coal.	
Common Sources	Appliances (vented and unvented) such as ranges, ovens, furnaces; gas hot water heaters or fireplaces; charcoal being burned indoors; ice re-surfacing equipment and indoor recreational activities such as truck and tractor events; outdoor air; exhaust from cars, lawn mowers, or any machinery with internal combustion engines; hobbies such as wood burning, welding, or soldering; school laboratories, vocational arts areas.
Routes of Exposure	Inhalation.
Clinical Effects	Mucous membranes of the eyes, nose, throat, respiratory tract, and, in the case of carbon monoxide, in the central nervous system (CNS) and cardiovascular system. Amount and length of time exposed may have an effect on symptoms.
Carbon Monoxide	Symptoms will vary greatly and appear to have a poor correlation with level of exposure. The range of symptoms include: fatigue, headache, cognitive impairment, flu-like symptoms (i.e., dizziness, weakness, nausea, vomiting), skin pallor, palpitations, confusion, coma or death, potential of delayed neuropsychological sequelea up to 240 days post exposure.
Nitrogen Dioxide	Low level exposure—irritation of respiratory tract, particularly the lower portion; increased risk of respiratory infections in young children; asthmatics exposed to low levels while exercising show narrowing of airways. High level exposure—irritation of the respiratory tract, decreased pulmonary function, shortness of breath, and death.
Sulfur Dioxide	Highly water soluble and irritating to eyes and upper respiratory tract. Low level exposure—irritation of eye, nose, and respiratory tract. High levels—decreased lung function with a narrowing of airways, resulting in wheezing and difficulty breathing; asthmatics are particularly affected.
Particle Matter	Increase in respiratory symptoms; overall health effects will depend upon size of particle and chemical make-up; small particles are easily inhaled and will deposit deeper into the lung.

Figure 2.2 Health Effects of Common Indoor Air Pollutants (Pike-Paris, 2005)	
Continued	
Volatile Organic Chemicals (VOCs)	
Identified Pollutant	Formaldehyde. Nearly colorless, water-soluble gas with a distinct pungent odor, classified by the EPA as a probable human carcinogen.
Common Sources	Plywood, paneling, fiberboard, particleboard, sub-flooring, furniture, cabinets; permanent press fabrics, draperies, carpets, and flooring as a water repellent; mobile homes; urea-formaldehyde insulation (used in home construction until the early 1980's); tobacco smoke; gas heaters and ovens, paints, temporary classrooms, science labs.
Route of Exposure	Inhalation and dermal.
Clinical Effects	Route and amount impact symptoms. Airborne formaldehyde acts as an upper respiratory tract irritant causing burning or tingling in the throat and nose as well as eyes (may occur in school setting with exposure to formalin). Symptoms resolve with removal of the irritant and are temporary. Asthmatic infants and children may be more likely to react to exposure. Even low level exposure, such as that experienced in science labs, may result in sensitization and subsequent allergic response to future exposures.

diameter less than 2.5 μm [PM 2.5], and elemental carbon [a component of diesel exhaust]) had decreased lung function growth, and children who spent more time outdoors had larger deficits in the growth rate of lung function (Gauderman et al., 2000; Gauderman et al., 2002). Levels of ozone and particulate matter are high enough in many parts of the United States to present health hazards to children (U.S. EPA, 2001).

Wong, Gohlke, Giffith, Farrow, & Faustman (2004) performed a cost-benefit analysis of U.S. Clean Air Act (CAA), utilizing a meta-analysis approach. In their research, Wong et al. (2004) examined the impacts of the criteria air pollutants, except lead, on children's health and quantified the health benefits associated with reductions in criteria air pollutants for the period 1990-2010, utilizing future estimates. Reductions in criteria air pollutants predicted to occur by 2010 due to CAA regulations were estimated to produce the following impacts: 200 fewer expected cases of postneonatal mortality; 10,000 fewer asthma hospitalizations in children 1-16 years old, with estimated benefits ranging from $20 million to $46 million (1990 U.S.$); 40,000 fewer emergency department visits in children 1-16 years old, with estimated benefits ranging from $1.3 million to $5.8 million; 20 million school absences avoided by children 6-11 years old, with estimated benefits of $0.7-1.8 billion; and 10,000 fewer infants of low birth weight, with estimated benefits of $230 million (Wong et al., 2004). Additionally, inclusion of limited child-specific data on hospitalizations, emergency department visits, school absences, and low birth weight could be expected to add $1-2 billion (1990 U.S.$) to the $8 billion in health benefits currently estimated to result from decreased morbidity, and $600 million to the $100 billion estimated to result from decreased mortality (Wong et al., 2004).

Environmental Tobacco Smoke

Secondhand smoke (SHS), also called environmental tobacco smoke (ETS), is a mixture of the smoke resulting from a lit cigarette, cigar, or pipe and the smoke an individual exhales while smoking (California EPA, 2005). Anyone in the vicinity of a smoker may inhale the exhaled smoke, which can linger for hours (Maher, 2007). SHS consists of chemicals known to be carcinogenic or toxic, including formaldehyde, benzene, vinyl chloride, arsenic, ammonia, and hydrogen cyanide (U.S. DHHS, 2006). The U.S. EPA, National Toxicology Program, and International Agency for Research on Cancer have designated SHS as a carcinogen (U.S. DHHS, 2006). The National Institute for Occupational Safety and Health (NIOSH) also lists ETS as a potential occupational carcinogen (U.S. DHHS, 2006). Smoking causes premature death and disease in children and adults who do not smoke but are exposed to secondhand smoke (SHS) (U.S. DHHS, 2006). Children exposed to SHS are at increased risk for Sudden Infant Death Syndrome (SIDS), acute respiratory infections, ear problems, and more severe asthma (U.S. DHHS, 2006). The home is where children are most exposed to SHS, and children remain more heavily exposed to SHS than do adults (U.S. DHHS, 2006). The Surgeon General's Report, *The Health Consequences of Involuntary Exposure to Tobacco Smoke,* concludes that no risk-free level of SHS exposure exists. The Surgeon General's Report also stated that eliminating indoor smoking fully protects nonsmokers, whereas separating smokers from nonsmokers, cleaning the air, and ventilating buildings cannot fully eliminate this exposure (U.S. DHHS, 2006). For this reason, everyone is encouraged to make their homes smoke-free to protect themselves and their families from exposure to SHS (CDC, 2006). Table 2.1 summarizes the report findings.

Table 2.1 **Health Consequences of Passive Smoking** **(U.S. DHHS, 2006)**
1. Americans continue to be exposed to secondhand smoke at home and in the workplace.
2. Exposure to SHS causes disease and premature death in children and adults who do not smoke.
3. Children exposed to SHS are at increased risk for SIDS, acute respiratory infections, ear problems, and severe asthma. Smoking by parents causes respiratory symptoms in children and slows lung growth.
4. Among adults, exposure to SHS has immediate adverse effects on the cardiovascular system and causes coronary heart disease and cancer.
5. No risk-free level of exposure to SHS exists.
6. Eliminating smoking indoors fully protects nonsmokers from exposure to SHS. Separating smokers from nonsmokers and cleaning and ventilating the air in buildings cannot eliminate exposure of nonsmokers to SHS. Conventional air cleaning systems can remove some of the large particles but not the smaller particles and gases found in SHS. Heating, ventilating, and air conditioning units can distribute SHS throughout buildings.

The effect of parental smoking on wheezing illness and diagnosed asthma in children is well established (Cook & Strachan, 1999; U.S. EPA, 1993). A cross-sectional study of asthma in young children aged 4-6 years (n=11,562), conducted by Lewis et al. (2005), investigated the independent effects of exposure to secondhand smoke, road vehicle traffic, and dietary fruit intake. A parental questionnaire collected data on respiratory symptoms, diagnoses and treatment, smoking in the home, and dietary fruit intake. Researchers also used a geographic information system to map postcodes and determine the distance of participants' homes from the nearest main road to estimate road traffic exposure. Wheezing in the past year was reported by 14.1 percent of participants and physician-diagnosed asthma was reported by 18.2 percent of participants. Both of these outcomes were more common in children who lived with a smoker. The prevalence of asthma increased with the number of smokers in the home. In this study, asthma prevalence was not associated with proximity of the home to a main road or with dietary fruit intake.

Exposure to Ultraviolet Light

Skin cancer is the most prevalent cancer in our society with over one million new cases annually (Maguire-Eisen, Rothman, & Demierre, 2005). Skin cancer is becoming more common in children and accounts for approximately four percent of pediatric malignancies. It is estimated that 90 percent of all skin cancers are preventable (Schmid-Wendtner et al., 2002). An individual's childhood sun-exposure history appears to significantly influence the risk of developing skin cancer (Kennedy, Bajdik, Willemze, & Gruijl, 2003; Rhodes, 1995; Silverberg, 2001; Tsao, Atkins, & Sober, 2004). Skin

cancers are associated with both intense, sporadic sun exposure (sunburn) and with chronic sun exposure (tanning) (Koh, Geller, Miller, Grossbart, & Lew, 1996).

Overexposure to ultraviolet radiation is a growing health concern for children in our society due to environmental changes and cultural trends (Maguire-Eisen et al., 2005). Sunburn incidence among American children is extremely high, ranging from 29 to 83 percent for the previous summer season and between 7 and 13 percent for the previous summer weekend (Geller et al., 2002; Robinson, Rigel, & Amonette, 2000). Repeated and severe sunburns affect 12 percent of adolescents with reports of 5 or more sunburns during 1 summer season (Davis, Cokkinides, Weinstock, O'Connell, & Wingo, 2002). Sunburn incidence is associated with increasing age, fair skin, time spent outdoors, sporadic sunscreen use, and inadequate protective clothing (Geller et al., 2002). These factors are important because one sunburn may double a child's risk for developing melanoma (Maguire-Eisen et al., 2005). Parental attitudes that a child looks "healthier with a tan" may be a contributing factor influencing sun damage and skin cancer risk (Robinson, Rigel, & Amonette, 1997).

Pesticide Exposure

Insecticides, herbicides, fungicides, rodenticides, fumigants, wood preservatives, and insect repellants are all considered pesticides (Dunn et al., 2003). More than 600 chemicals are registered with the EPA as pesticides in the United States (Dunn et al., 2003). Pesticide exposures are common to all children because these products are found in foods, homes, schools, parks, and the workplace (Dunn et al., 2003). Clinical signs of exposure can be acute or chronic (Reigart & Roberts, 1999, 2001), and some research suggests a relationship to cognitive or developmental delay in children (Giullette, Meza,

Aquilar, Soto, & Garcia, 1998). An early survey conducted for the U.S. EPA found that nearly half of U.S. households with a child younger than five years old had a pesticide stored within reach of children (Whitmore, Kelly, & Reading, 1992). Organophosphate pesticides (OPs) account for about half of all insecticides used the United States by amount sold (Wessels, Barr, & Mendola, 2003). OPs are used primarily on agricultural crops, but are also used in residential settings for pest control and for public health protection against vector-borne diseases (Wessels et al., 2003). When used indoors or as part of structural treatments, OPs can remain for extended periods of time (months to years) making them potentially available for repeated exposure to both adults and children (Fenske, Bradman, Whyatt, Wolff, & Barr, 2005; Wessels et al., 2003).

Acute effects of OP exposures are well documented and well understood (Kwong, 2002). Individuals exposed to high levels of OPs can develop acute cholinergic syndrome, which is characterized by a variety of symptoms including rhinorrhea, salivation, lachrymation, tachycardia, headache, convulsions, and death (Karalliedde, Feldman, Henry, & Marrs, 2001). Individuals exposed to OPs can also develop a proximal and reversible paralysis called intermediate syndrome, organophosphate-induced delayed polyneuropathy, or long-term neurologic sequelae (Wessels et al., 2003). While adverse effects of chronic low-level OP exposure are suspected, they have not been conclusively determined (Eskinazi, Bradmen, & Castorina, 1999; Ray & Richards, 2001). Although accurate characterization of children's exposure to pesticides has proven to be a particularly challenging aspect of exposure assessment (Fenske et al., 2005), many are being phased out due to increasing concern regarding the safety of OPs to children (Wessels et al., 2003).

Ruckart, Kalolewski, Bove, & Kaye (2004) evaluated the association between methyl parathion (MP) exposure and neurobehavioral development of children. The study participants included children aged six years or younger residing in Mississippi and Ohio who had been exposed to MP. MP, which is an OP licensed only for agricultural uses, had been illegally sprayed for pest control in these participants communities. Researchers used the Pediatric Environmental Neurobehavioral Test Battery (PENTB) to evaluate participants. The PENTB utilizes performance-based procedures (neurobehavioral tests for children four and older) and information based procedures (parent interview and questionnaire) that evaluate cognitive, motor, sensory, and affect domains essential to neurobehavioral development. Findings suggested that MP might be associated with subtle changes to short-term memory and attention and contribute to problems with motor skills and some behaviors (Ruckart et al., 2004).

A study by Eskenazi et al. (2007) of children participating in a longitudinal birth cohort of primarily Latino farmworker families in California, investigated the relationship of prenatal and child OP urinary metabolite levels with children's neurodevelopment. Researchers measured six nonspecific dialkylphosphate (DAP) metabolites in maternal and child urine, as well as metabolites specific to malathion (MDA) and chlorpyrifos (TCPy) in maternal urine (Eskenazi et al., 2007). Researchers examined the association between maternal and child urine metabolites of DAP and MDA with children's performance at 6 (n=396), 12 (n=395), and 24 (n=372) months of age on the Bayley Scales of Infant Development (Mental Development [MDI] and Psychomotor Development [PDI] Indices) and mother's report on the Child Behavior Checklist (CBCL) (n=356) (Eskenazi et al., 2007). Pregnancy DAP levels were

negatively associated with MDI, but child measures (urine metabolites, MDI, PDI, and CBCL) were positively associated (Eskenazi et al., 2007). At 24 months of age, associations between maternal and child urine metabolites of DAPs reached statistical significance [per 10-fold increase in prenatal DAPs: $\beta = -3.5$ points; 95% confidence interval (CI), –6.6 to –0.5; child DAPs: $\beta = 2.4$ points; 95% CI, 0.5 to 4.2] (Eskenazi et al., 2007). Neither prenatal nor child DAPs were associated with PDI or CBCL attention problems, but both prenatal and postnatal DAPs were associated with risk of pervasive developmental disorder [per 10-fold increase in prenatal DAPs: odds ratio (OR) = 2.3, $p = 0.05$; child DAPs OR = 1.7, $p = 0.04$]. MDA and TCPy were not associated with any changes in neurodevelopment (Eskenazi et al., 2007). In conclusion, researchers reported adverse associations of prenatal DAPs with mental development and pervasive developmental problems at 24 months of age (Eskenazi et al., 2007).

Lead and Mercury

Children are exposed to lead-based materials mostly through lead-based paint in older homes (Erikson & Thompson, 2005). Other sources of lead exposure for children include water from old homes with lead pipes that can contaminate drinking water (Erikson & Thompson, 2005). Lead solder on canned food is common if imported from outside the United States (Jones, Moore, Craig, Reasons, & Schaffner,1999). Additionally, adults who work in industries that involve lead can bring lead dust home on their clothing and expose their children (Erikson & Thompson, 2005). Other items such as lead ammunition, battery casings, fishing sinkers, curtain weights, pool cue chalk, clothing accessories, collectible toys, and some jewelry can be ingested and broken down inside the digestive system of a child, causing lead intoxication (Jones et al., 1999).

Lead has long been known to be a toxic agent, and the history of lead exposure in children has been a tragic one (Markowitz, 2000; Markowitz & Rosner, 2000). Beginning in the late 1970s, studies began to show that asymptomatic children with elevated blood lead levels (BLL) had lower IQ scores, increased behavioral problems, and language and learning problems (Needleman et al., 1979; Needleman, Riess, Tobin, Biesecker, & Greenhouse, 1996; Needleman, Schell, Bellinger, Leviton, & Allred, 1990). Lead exposure also has been associated with decreased growth, decreased hearing acuity, elevated blood pressure, attention dysfunction, aggression, and delinquency (AAP, 1999). Lead crosses the placenta, enters the fetal brain, and interferes with normal brain development (Schettler, Stein, Reich, & Valenti, 2000). Consequences of pre-natal, post-natal, and childhood lead exposure include lower intelligence, hyperactivity, learning disabilities, and attention disorders (Lin-Fu, 1973; Needleman, Davidson, Sewell, & Shapiro, 1974; Pihl & Parkes, 1977).

Efforts to decrease the lead burden in the environment and to protect children from lead exposure have lowered lead levels significantly, yet many children still face high risks (Dunn et al., 2003). Particularly susceptible are children living in low-income or poverty-level families, black children, immigrants, and all children living in urban areas or housing build before 1950, when voluntary paint industry standards called for limiting lead content to one percent were initiated (CDC, 1997, 2002; Lanphear, Byrd, Auinger, & Schaffer, 1999). According to the U.S. Consumer Product Safety Commission (2007b), of the 22 U.S. consumer products recalled September 2007, 10 (45 percent of products recalled in September 2007) child toy products were recalled due to violation of the federal lead paint standard (n=8) or from detected high levels of lead in

metal jewelry intended for children (n=2). In October 2007, 29 children toys were recalled for either violation of lead paint standards (n=24) or for excessive levels of lead (n=5) (U.S. CPSC, 2007a). The CDC (2004) reported in the Morbidity and Mortality Weekly Report (MMWR) that a 4-year-old boy in Oregon ingested a toy necklace with a medallion that caused a BLL of 123 µg/dL.

Haley & Talbot (2004) examined the geographical distribution of the BLLs of 677,112 children born between 1994 and 1997 in New York State and screened before 2 years of age. Five percent of children screened had BLLs higher than the current CDC action level of 10 µg/dL (Haley & Talbot, 2004). Rates were higher in upstate cities than the New York City area (Haley & Talbot, 2004). Older housing, a lower proportion of high school graduates, and higher percentage of births to African-American mothers were the community characteristics most associated with elevated BLLs (Haley & Talbot, 2004). Researchers concluded that lead remains an environmental health problem in inner-city neighborhoods, particularly in upstate New York (Haley & Talbot, 2004).

Mercury is another known substance toxic to children. It is emitted into the atmosphere in substantial amounts by coalfired power plants, and in lesser amounts by some manufacturing processes, waste incineration, and volcanic activity (Graff et al., 2006). Emissions from power plants are estimated to contribute to 70 percent of the world's methylmercury supply (Trasande et al., 2005).

Elemental mercury is easily volatilized and inhaled at room temperature (Dunn et al., 2003). It is concentrated in red blood cells and the central nervous system (CNS) (Dunn et al., 2003). Inorganic mercury salts can be absorbed through the skin, but are poorly absorbed through ingestion (Dunn et al., 2003). Organic mercury compounds are

lipid soluble and absorbed in the gastrointestinal tract (Dunn et al., 2003). Methyl mercury passes through the placenta; pregnant women who ate fish containing methyl mercury taken from Minamata Bay in Japan or contaminated grain in Iraq became ill, and their offspring had psychomotor retardation, seizures, blindness, and deafness (Greenwood, 1985; Harada, 1995; Takeucki & Eto, 1999). Methyl mercury is also transmitted in breast milk and absorbed by inhalation (Dunn et al., 2003). Exposure to high levels of mercury can permanently damage the developing brain of the fetus and children's brain and kidneys (ATSDR, 1999). In addition to developmental disorders, mercury is associated with irritability, shyness, tremors, and memory problems (ATSDR, 1999).

Pediatric Environmental Health in Curricula

Although assessing the impact of children's exposures to environmental toxins is a subspecialty in clinical pediatrics, pediatric health professionals in practice may not be familiar with critical information necessary to diagnose and manage environmental toxic exposures in children (Woolf & Cimino, 2001). Pediatric medical and nursing education currently lack the environmental health content necessary to appropriately prepare pediatric health care professionals to prevent, recognize, manage, and treat environmental-exposure-related-disease (McCurdy et al., 2004). Primary care providers must have resources available to competently provide initial management to children, families, and community groups who have had potential exposure to toxins (Dunn et al., 2003).

Kilpatrick et al. (2002) conducted a mail survey of practicing pediatricians (n=266) in Georgia to assess their knowledge, attitudes, and behaviors regarding patients'

environmental histories. Fewer than one in five pediatricians reported having received training in environmental history-taking (Kilpatrick et al., 2002). Pediatricians reported that they strongly believe in the importance of environmental exposures in children's health, and 53.5 percent of respondents reported experience with a patient who was seriously affected by an environmental exposure (Kilpatrick et al., 2002). Pediatricians agreed moderately strongly that environmental history-taking is useful in identifying potentially hazardous exposures and in helping prevent these exposures (Kilpatrick et al., 2002).

Despite the importance of environmental exposures on pediatric health, respondents reported low self-efficacy regarding environmental history-taking, discussing environmental exposures with parents, and finding diagnosis and treatment resources related to environmental exposures (Kilpatrick et al., 2002). The probability of self-reported history-taking varied with the specific exposure, with environmental tobacco smoke and pets most frequently queried and asbestos, mercury, formaldehyde, and radon rarely queried (Kilpatrick et al., 2002). The pediatricians' preferred information resources include the American Academy of Pediatrics, newsletters, and patient education materials (Kilpatrick et al., 2002). Pediatricians are highly interested in pediatric environmental health but report low self-efficacy in taking and following up on environmental histories (Kilpatrick et al., 2002). Researchers concluded there is considerable opportunity for training in environmental history-taking and for increasing the frequency with which such histories are taken (Kilpatrick et al., 2002).

A study by Balbus et al. (2006) assessed the attitudes, beliefs, and practices of pediatricians, nurse practitioners, physician assistants, and nurses in the metropolitan

Washington, D.C. area and the surrounding rural counties regarding health effects of pesticide toxicity and continuing education on pesticide toxicity in the years 2001-2002. The pilot project was carried out under the *National Strategies for Health Care Providers: Pesticides Initiative*. Data were collected using questionnaires completed by practitioners (n=160) and nurses (n=43) and also from six focus groups (n=29) (Balbus et al., 2006). Results showed that most respondents in both groups did not frequently diagnose or ask questions about pesticide toxicity on patient histories (Balbus et al., 2006). Most focus group participants were more comfortable answering questions about acute pesticide toxicity, and many relied on poison control centers for assistance with management of acute cases (Balbus et al., 2006). Participants of the focus group expressed less understanding and more uncertainties about chronic toxicity (Balbus et al., 2006).

When asked questions by patients, 64 percent of practitioners and 69 percent of nurses felt poorly prepared to answer them (Balbus et al., 2006). Forty percent of practitioners but only 26 percent of nurses felt it was important to obtain more information on pesticides (Balbus et al., 2006). There were divergent preferences on ways to obtain continuing medical education (CME) in general, but a recurrent theme was the need to make CME on pesticide toxicity clinically relevant and one topic among several in a CME conference (Balbus et al., 2006). Lectures and short courses were the most commonly preferred modes of education among both practitioners and nurses (Balbus et al., 2006). Researchers concluded that educational materials to reach pediatric clinicians on environmental health topics should discuss the importance of these topics,

provide information of clinical relevance, and use a variety of forms of education (i.e., short courses and lectures, online and in-person) (Balbus et al., 2006).

Woolf and Cimino (2001) investigated the perceptions of pediatricians, nurses, and nurse practitioners regarding their own practices and educational needs concerning pediatric environmental toxic exposures using a 22-item questionnaire. The cross-sectional survey was completed by a convenience sample of pediatricians (n=121), nurses (n=41), and pediatric nurse practitioners (n=36). Results showed that within the previous 6 months, over 90 percent of pediatricians and nurse practitioners had diagnosed a child's illness as food poisoning; 50 percent had diagnosed lead poisoning; 50 percent had diagnosed a child's illness as due to exposure to a toxic chemical; and 24 percent had diagnosed building-related illness. Although 90 percent of pediatricians and 82 percent of nurses and nurse practitioners stated that they routinely asked about parental occupations, only 35 percent of both groups asked about parental hobbies (Woolf & Cimino, 2001). Only 58 percent of the groups asked about smoke detectors in the home, and only 18 percent of nurses and 9 percent of pediatricians queried families about their use of radon detectors (Woolf & Cimino, 2001). Over 70 percent of all three groups indicated a high interest in the following educational topics: taking in environmental history, breast milk contaminants, food allergies, food contamination, and illness related to tobacco smoke (Woolf & Cimino, 2001).

NEEF (2004) included a review of literature in their Health Professionals and Environmental Health Education Position Statement. According to NEEF (2004), a survey about environmental medicine content in U.S. medical schools found that 75 percent of medical schools require only about seven hours of study in environmental

medicine over the four years of medical school, and a survey of Migrant Clinicians Network (n=164) found that approximately half of whom had not had any training or courses related to environmental and/or occupational health (Liebman & Harper, 2001; Schenk, Popp, Neale, & Demers, 1996). A survey of chief residents of U.S. pediatric residency programs (n=109) found that fewer than half of pediatric programs routinely include pediatric environmental health issues in their curriculum, other than lead poisoning and environmental exacerbation of asthma (Roberts & Gitterman, 2003). A majority of nurse practitioner program directors stated there should be greater emphasis on environmental health in their programs; and a majority of medical school deans and family practice residency directors believed moderate emphasis on environmental health in their programs would be ideal (Bellack, Musham, Hainer, Graber, & Holmes, 1997; Graber, Musham, Bellack, & Holmes 1995; Mushham, Bellack, Graber, & Holmes, 1996). NEEF (2004) also acknowledges that the need for improvements in health professionals' environmental health knowledge has been expressed by leading health institutions including the Institute of Medicine, American Medical Association, American Academy of Pediatrics, American College of Preventive Medicine, Agency for Toxic Substances and Disease Registry, Ambulatory Pediatric Association, U.S. Department of Health and Human Services Division of Nursing, and the American Nurses Association. Finally, the American Nurses Association resolved to broaden its work in occupational and environmental health and apply the precautionary approach when an activity raises threats of harm to human health or the environment (American Nurses Association, 2003).

Effectiveness of Teaching Strategies

In order to identify and advance the necessary actions for incorporating environmental health into medical and nursing education and practice, NEEF conducted and published the study, *"Incorporating Environmental Health into Pediatric Medical and Nursing Education"* (McCurdy et al., 2004). For the study, two expert groups of physicians and nurses assessed pediatric medical and nursing education structures and identified key leverage points for curricular change. The medical education working group recommended increasing education about children's environmental health in the medical school curricula, residency training, fellowship training, and in continuing medical education (McCurdy et al., 2004). Likewise, the nursing working group recommended increasing children's environmental health content at the undergraduate, graduate, and continuing education levels (McCurdy et al., 2004).

Roberts and Reigart (2001) examined the effects of a lecture on environment on third-year medical student's history-taking skills. Baseline data of environmental history-taking and clinical toxicology knowledge were collected using an anonymous survey that was distributed prior to an asthma lecture that strongly emphasized environmental triggers (Roberts & Reigart, 2001). The survey consisted of 14 questions regarding students' practices and attitudes toward environmental history-taking and six multiple-choice questions assessing clinical toxicology knowledge (Roberts & Reigart, 2001). To confirm reported history-taking practices of students, histories written by students before and after the lecture on environmental health were audited (Roberts & Reigart, 2001).

Results from the Roberts & Reigart study (2001) found that, although the third-year medical students reported that an environmental history was important, few asked

about environmental history topics other than smoking and pets (Roberts & Reigart, 2001). Occupational histories were included for adult patients, but few students asked about parental occupations for pediatric patients (Roberts & Reigart, 2001). Students recognized the correct antidotal therapy for iron and acetaminophen toxicity but were less proficient at identifying clinical features of lead and organophosphate poisoning (Roberts & Reigart, 2001). Student history performance, when students were considered as a group, was similar to reported performance, with the presence of pets being the only significant post-lecture change in history-taking behavior (Roberts & Reigart, 2001). Researchers concluded that data were insufficient to conclude that one lecture changed history-taking practices (Roberts & Reigart, 2001).

The School of Nursing at Duke University collaborated with the Duke University Nicholas School of the Environment and Earth Sciences to integrate environmental health content into the curricula of their Accelerated Bachelor of Science in Nursing program for second-degree students (Hays et al., 2006). An environmental nursing module for the final-semester community health nursing course was developed. The module focused on the role of the built environment in community health and featured a mix of teaching strategies, including five components: (1) classroom lecture (75 minutes in length) with associated readings, (2) two rounds of online small-group discussions, (3) assessment of the built environment in local neighborhoods by student teams, (4) team presentation of the neighborhood assessments, and (5) individual student papers synthesizing the conclusions from team presentations (Hays et al., 2006). The goal of the module was to provide nursing students with an organizing framework for integrating environmental

health into clinical practice and an innovative tool for understanding community-level components of public health (Hays et al., 2006).

Studies have shown that primary-care residency faculty trained in environmental/occupational health increase the environmental/occupational health education offered at their schools, and after physicians attended an interactive asthma seminar, the children they saw experienced fewer hospitalizations and fewer subsequent emergency department visits (Clark et al., 2000; Frazier et al., 1999). Additional studies show that faculty leadership is key to integrating prevention-related topics (Lindberg, 1998; Sachdeva, 2000; Skochelak, Barley, & Fogarty, 2001; Susman & Pascoe, 2001). Past studies show that faculty champions help implement curricula, influence the career choices of students, introduce topics that serve as an impetus for change, advocate for research funding, and ensure the material is taught in their classes (Goldman, Rosenwasser, & Armstrong, 1999; Schwartz, Pransky, & Lashley, 1995).

Burr, Storm, and Gross (2006) conducted a project that trained health care providers from 2000 to 2002 using a faculty trainer (or train-the-trainer) model. The goals of the projects were to increase knowledge and change practice, increase HIV counseling and testing in prenatal care, and improve management of HIV in pregnant women (Burr et al., 2006). In four jurisdictions of the southeastern United States, 193 health care providers attended faculty trainer workshops using a standardized curriculum (Burr et al., 2006). Eighteen providers used the curriculum to train an additional 545 health care providers over 2 years (Burr et al., 2006). Participants in both faculty trainer workshops and trainer-led seminars reported significant increases in perceived knowledge in all content areas and the intention to change clinical practice (Burr et al., 2006). The number

of providers who became faculty trainers and then led seminars varied widely among the jurisdictions (Burr et al., 2006). Six-month follow-up of faculty trainers, although limited by a 63 percent response rate, found that over 90 percent of respondents reported the workshop had a positive impact on their care of women with and at risk for HIV (Burr et al., 2006). Their findings indicate that the faculty trainer model is an effective way to educate practicing clinicians (Burr et al., 2006). Key elements to successful implementation were: ongoing support of faculty trainers by acquired immune deficiency syndrome (AIDS) educators, involvement of local HIV experts as trainers and resource persons, and use of a standardized curriculum based on national guidelines (Burr et al., 2006).

Scherrer, Dorsch, and Weller (2006) studied the effectiveness of a train-the-trainer collaboration model between librarians and medical faculty to instruct librarians and health professionals in teaching evidence-based medicine (EBM) principles. A telephone survey was administered to graduates of an EBM course who agreed to participate in the study (Scherrer et al., 2006). They were asked if and how they taught EBM on returning to their institutions, if they felt competent to critically appraise an article, if their skill in searching PubMed improved, and if they collaborated with others in teaching EBM (Scherrer et al., 2006). Most respondents were librarians (Scherrer et al., 2006). The class was successful in that most taught EBM on return to their home institutions (Scherrer et al., 2006). Most respondents initiated collaboration with health professionals (Scherrer et al., 2006). The goals of improving PubMed searching and achieving statistical competency had less success (Scherrer et al., 2006). The authors concluded that the train-the-trainer model is effective in preparing librarians to teach

EBM (Scherrer et al., 2006). Modeling and encouraging collaboration between librarians and health professionals were successful techniques (Scherrer et al., 2006). Conclusions could not be made for health professionals because of the low response rate from this group (Scherrer et al., 2006).

National Environmental Education Foundation

The National Environmental Education Foundation (NEEF) is a private not-for-profit 501(c)(3) organization dedicated to bringing objective and scientifically sound environmental education to America. The Foundation was authorized in 1990 by the U.S. Congress and is governed by a volunteer board of environmental, health, education, and business leaders.

The focus of NEEF's Health & Environment Programs is to provide environmental education and training for health professionals to improve health care and public health, with a special emphasis on protecting children and other populations disproportionately affected by environmental pollutants. To accomplish this goal, NEEF has established the Health Care Provider Initiative, which takes a strategic approach for incorporating environmental health information into the education and practice of health professionals, with specific activities in education, practice, and resources/tools. This overall initiative includes the National Strategies for Health Care Providers: Pesticides Initiative (NEEF, 2002b), Pediatric Asthma Initiative, and Environmental Exposure History-Taking Initiative. Building health professionals' capacity to address children's environmental health is a vital component of these on-going initiatives. NEEF developed, published, and has been promoting the "National Pesticide Competency Guidelines for Medical & Nursing Education" (2003) and "National Pesticide Practice Skills for

Medical & Nursing Practice", referenced in the funding announcement, and is currently developing competencies for environmental management of asthma. The competencies build on the recommendations for medical and nursing environmental health education in the Institute of Medicine's Environmental Medicine report as well as the Nursing Health & the Environment report, both which were referenced in the original study funding announcement. NEEF has an established record of bringing together health professionals across disciplines, including pediatricians, pediatric nurse practitioners, and nurses, which leads to cross fertilization among health professionals and synergistic program outcomes.

The Pesticides Initiative, a partnership between NEEF and the U.S. Environmental Protection Agency, in collaboration with other federal agencies, was launched in 1999 as a long-term effort involving a broad range of stakeholders. The Initiative's National Forum in 2003 brought together more than 100 leaders in medicine, nursing, and environmental health. The forum created a national partnership to institutionalize the integration of environmental health into health professional education and practice. The forum participants identified and helped NEEF create a position statement about the necessity of environmental health education for health professionals, which has been endorsed by 27 medical, nursing, and public health organizations to date (NEEF, 2004).

NEEF's Pediatric Asthma Initiative: Incorporating Environmental Management of Asthma into Pediatric Health Care, replicates the pesticides model for environmental triggers of asthma. The overall goal of the initiative is to integrate environmental management of asthma into pediatric health care. A steering committee of experts

developed competencies, an environmental history form, and intervention guidelines for environmental triggers of asthma. The committee is also creating an action agenda for adoption of these tools by medical and nursing educational institutions and pediatric practice settings. The tools were completed in May 2005, after which NEEF implemented the action agenda.

Under the Environmental Exposure History-Taking Initiative, NEEF developed a generic environmental history form to be used by pediatric health professionals. This history form serves as the center piece for a multi-year campaign to make environmental history-taking a routine undertaking in pediatric practice.

Competency Development

The need for improvements in health professionals' environmental health knowledge has been expressed by leading health institutions (NEEF, 2004). To accomplish this, some institutions have supported or initiated the development of competencies for health care providers regarding pediatric environmental health. For example, the U.S. Department of Health and Human Services (DHHS) Division of Nursing has included the ability to recognize environmental health problems affecting patients and to provide health protection interventions as one of the essential primary care nurse practitioner competencies (U.S. DHHS, 2002).

Because environmental health problems are complex and require specialty training, the Ambulatory Pediatric Association initiated a three-year postgraduate fellowship in pediatric environmental health with in order to develop competencies for the specialty of pediatric environmental health and appropriate measures (i.e., performance indicators) for the achievement of these competencies (Etzel et al., 2003).

The President of the Ambulatory Pediatric Association appointed a six-member Fellowship Oversight Committee to guide the development of the fellowship program and to draft competencies for Fellows in Pediatric Environmental Health (Etzel et al., 2003). The committee developed a list of competencies for graduates of Pediatric Environmental Health fellowships (Etzel et al., 2003). These skills were identified as very important for a specialist to have for minimal competency in the practice of pediatric environmental health (Etzel et al., 2003). As a result, 27 Pediatric Environmental Health competencies were developed. The competencies are presented below from 3 separate perspectives: academic, individual patient care, and community advocacy, and each competency has a list of suggested performance indicators (Etzel et al., 2003). These competencies are intended to assist in structuring the training experience, achieving consensus with respect to expectations of fellows and faculty, providing opportunities for fellows to assess their own needs or gaps in training, and identifying the expertise of fellowship graduates to potential employers (Etzel et al., 2003). Competencies are listed in Table 2.2.

The NEEF *Health Care Provider Initiative Strategic Plan* (2005) discloses strategies for achieving the goals and objectives of NEEF's Health Care Provider Initiative. The strategic plan is based on the National Strategies for Health Care Providers: Pesticides Initiative Implementation Plan (NEEF, 2002a), which was developed by experts as a model that can be applied to other environmental health issues and was built upon the Institute of Medicine reports recommending the integration of environmental health issues throughout training and clinical practice for health care providers (NEEF, 2005). A component of integrating pediatric/environmental health into

educational settings involved producing national guidelines that recommend competencies specific to the recognition, management, and prevention of environmental exposures for all basic and advanced training in medicine and nursing; define accompanying content areas; suggest methods of integration into curricula; and provide access to relevant resource materials (NEEF, 2005). Several competencies recommended by the Ambulatory Pediatric Association (Table 2.2) are integral to the national guideline competencies. By utilizing the expertise of such stakeholders as academic institutions, national professional associations for academic institutions, and faculty members who had already developed curricula, national guidelines were developed, peer reviewed, and endorsed by key stakeholder organizations. These national environmental health competency guidelines for education recommend competencies, content, insertion points into curricula, and resources.

The NEEF competencies also served as competencies for the NEEF Faculty Champions program. Initially the NEEF Faculty Champions competencies were as follows:

1) understand the influence of environmental agents on children's health;
2) recognize signs, symptoms, diseases, and sources of exposure relating to common environmental agents and conditions;
3) complete a pediatric environmental health history and recognize potential environmental health hazards and sentinel illnesses;

Table 2.2 **Ambulatory Pediatric Association's** **Competencies for Pediatric Environmental Health Specialists** **(Etzel et al., 2003)**
Academic Perspective
Competency
1. Write a grant application.
2. Submit a study proposal to an Institutional Review Board (IRB).
3. Use the major national data sources to access information about exposures and health outcomes.
4. Collect primary data, analyze the results and summarize the findings.
5. Publish a study in a peer-reviewed journal.
6. Appreciate the policy implications and formulate recommendations based on clinical and epidemiologic research findings.
7. Present results of a study at a professional meeting.
8. Develop curricula to teach residents and medical students the fundamentals of pediatric environmental health.
9. Understand the impact of the natural environment on children's development and behavior and translate that understanding into practice, teaching and research.
Individual Patient Care Perspective
1. Take an environmental history from a patient/parent.
2. Utilize a specialized environmental health laboratory and interpret results appropriately.
3. Report appropriate health conditions to the state or local Public Health Department.
4. Develop a plan to reduce a patient's or a child's exposure to environmental contaminant(s).
5. Evaluate the effectiveness of therapies and methods of reducing environmental exposures.
6. Identify and coordinate available community resources to improve a patient's well-being.

Table 2.2 Ambulatory Pediatric Association's Competencies for Pediatric Environmental Health Specialists (Etzel et al., 2003)
Continued
7. Respond to questions about acute exposures from parents and health care providers who call a Poison Control Center.
8. Write a case report about an individual patient and critically review the literature on that patient's environmental health problem.
Community Advocacy Perspective
1. Assess a health problem in a community.
2. Assess an environmental exposure in a community.
3. Communicate about environmental risks to community members, school board, political groups, and other stakeholders.
4. Develop and implement a community-based intervention.
5. Evaluate the effectiveness of a community intervention.
6. Work effectively as a member of a multidisciplinary team
7. Develop media literacy in order to use media education as an advocacy tool in promoting environmental health.
8. Interpret legal and regulatory authority as well as non regulatory approaches as they relate to children's health and the environment.
9. Prepare and present testimony before local, state, and national legislators.

4) recommend a course of preventable action or make appropriate referrals for conditions with probable environmental etiologies as appropriate for their professional disciplines;
5) demonstrate a knowledge of risk communication in patient care and community intervention with respect to the potential adverse effects of the environment on health;
6) recognize the full range of resources available to support their work in the field of pediatric environmental health; and
7) understand reporting requirements and regulations.

After peer review, it was decided that competencies 1 and 2 were addressed by the remaining competencies and would also be evaluated through the pretest and posttests. The final NEEF Faculty Champions competencies to be achieved were:

1) performing pediatric environmental history-taking;
2) making referrals for preventative/curative interventions for possible environmental health hazards;
3) involvement with community groups/organizations (e.g., PTA, daycare) for environmental health hazards, risk communication;
4) utilization of resources for pediatric environmental hazards; and
5) reporting incidents for regulatory requirements.

Summary

In response to the lack of pediatric environmental health (PEH) in nursing and medical school curricula, the National Environmental Education Foundation (NEEF) planned an educational intervention project. The overall project goal was to build health

professional capacity to address pediatric/environmental health issues, through the integration of identified pediatric/environmental health competencies via a network of children's environmental health faculty champions from medical and nursing schools throughout the country. The purpose of this study was to evaluate the effectiveness of the program in increasing participants' knowledge about children's environmental health, as well as incorporation of children's environmental health into pediatric practice, and medical and nursing curricula following the workshop. If this program is successful, it may serve as a model for integration of PEH into medical and nursing school curricula, and then be replicated in additional settings for similar effects. Since this field experiment occurred in a real-world setting with limitations to funding, a pre-experimental research design was utilized.

CHAPTER III

Methods

Purpose

In response to the lack of pediatric environmental health (PEH) in nursing and medical school curricula, the National Environmental Education Foundation (NEEF) planned an educational intervention project with the overall project goal to build health professional capacity to address children's environmental health (and general environmental health) issues. This would be accomplished through the integration of identified pediatric/environmental health competencies via a network of children's environmental health faculty champions from medical and nursing schools throughout the country.

The specific aims were to:

1) determine the effectiveness of the project intervention to increase the PEH knowledge of faculty members about children's environmental health;
2) increase the integration of children's environmental health into professional pediatric practice, and medical and nursing institutional curricula; and
3) provide information to encourage institutional practice changes which could impact the knowledge and practice of nurses and physicians at institutions and provide this knowledge to future nurses and physicians.

This program may serve as a model for integration of P/EH into medical and nursing school curricula, and then be replicated in additional settings for similar effects. Since this field experiment occurred in a real-world setting with limitations to funding, a pre-experimental research design was utilized.

Research Design

This is an evaluation research study of existing data collected by NEEF using a pre-experimental mixed methods approach. The study had several components including:

1) completion of pretest-posttests for sustained knowledge acquisition,
2) delivery of a Children's Environmental Health Faculty Champions Train-the-Trainer Workshop, and
3) participation in baseline and ongoing assessments of integration of pediatric/environmental health content and competencies into medical and nursing school curricula and practice, and into institutional changes.

Research Questions

1) Did participation in the Faculty Champions workshop significantly increase participants' knowledge of pediatric/environmental health?
2) Did participation in the Faculty Champions workshop result in changes in participants' integration of P/EH into pediatric practice?
3) Did participation in the Faculty Champion's workshop result in incorporation of P/EH into medical and nursing curricula?
4) What strategies were used to increase P/EH integration into curriculum and practice, and which approaches were most effective in making institutional changes?

5) What were barrier factors to integration and institutional change?
6) What improvements were made in achieving the identified competencies and which ones were most successfully achieved?
7) What were reasons for success and non-success of integration of P/EH content into curricula, practice, and institutional changes?

Faculty Champions Train-the-Trainer Workshop Planning

As part of NEEF's Health and Environment Programs, NEEF received grant funding from the U.S. Environmental Protection Agency (EPA) for the Children's Environmental Health Faculty Champions Initiative. This initiative created a network of children's environmental health Faculty Champions at medical and nursing schools throughout the country, who took a leadership role in integrating children's environmental health into their academic institutions in a sustainable fashion, train their colleagues and students, teach courses, provide expertise and support in their institutions and surrounding communities, and serve as a model for how to integrate environmental health into health professional education (NEEF, 2007). The initiative involved developing a Faculty Champions Train-the-Trainer project.

NEEF established a planning committee (Appendix A) which included medical and nursing organization leaders, and medical and nursing faculty to guide the project. The overall goals for the project were to increase the number of health professionals who could incorporate children's environmental health issues into their practice and to integrate children's environmental health into medical and nursing curricula.

The planning committee's objectives were:

1) identify faculty from medical and nursing schools interested in becoming children's environmental health Faculty Champions at their academic institutions;
2) create twenty Faculty Champions at select academic health centers who would take a leadership role in integrating children's environmental health into their institution in a sustainable fashion, lend expertise and support to their institutions and surrounding communities, teach courses, integrate competencies into curriculum, and serve as a model for how to integrate pediatric/environmental health into health professional education;
3) create 200 health professionals at academic institutions, trained by faculty champions, who would incorporate children's environmental health into their teachings and clinical practices;
4) provide children's and environmental health resources through health professional organizations; and
5) measure the impact of the Faculty Champions and the outreach campaign on achieving the overall goals.

The general approach and format for this project was based on the Faculty Champion model outlined in the National Strategies for Health Care Providers: Pesticides Initiative's Implementation Plan (NEEF, 2002a). NEEF, under the guidance of the project's planning committee, recruited faculty to participate in the one-day train-the-trainer workshop; acquired continuing education credits; conducted the train-the-trainer workshop; and supported Faculty Champions' post- train-the-trainer efforts to develop and implement strategies to integrate P/EH content into practice and curricula of medical and nursing students schools.

As part of the grant application process, NEEF secured commitments from several health professional organizations including the Association of Academic Health Centers, American Association of Colleges of Nursing, and the National Association of Pediatric Nurse Practitioners to serve on the planning committee, and disseminated information to their members. As of May 2007, 27 organizations have endorsed this project (Appendix B).

The planning committee met via teleconference to discuss competencies to be achieved, workshop topics and agenda, program evaluation, data collection methods, and workshop presenters. The planning committee anticipated that Faculty Champions' awareness and knowledge of environmental health hazards and risk would increase as a result of the workshop and use of NEEF materials and resources provided. Overall, the target audience for this training and outreach campaign were health professionals who address children's health in their clinical practice or education settings.

Dr. Bonnie Rogers served as lead coordinator and instructor, and James Roberts, MD, MPH, served as an instructor for the workshop proceeding. Both were co-authors of the National Pesticide Competency and Practice Skills Guidelines (NEEF, 2003) which provided the model for this project initiative. Additional instructors were identified by the panel of experts to assist with the training. The five competencies determined by the planning committee were that, upon completion of the project, participants would be proficient in:

1) performing pediatric environmental history-taking;
2) making referrals for preventative/curative interventions for possible environmental health hazards;

3) involvement with community groups/organizations (e.g., PTA, daycare) for environmental health hazards, risk communication;
4) utilization of resources for pediatric environmental hazards; and
5) reporting incidents for regulatory requirements.

Setting

The NEEF workshop itself took place at the Hamilton Hotel Grand Plaza in Washington, D.C. Following the workshop, participants returned home to their respective institutions for implementation of the remainder of the project.

Participants

Using a purposive sample technique, faculty members for the train-the-trainer workshop were selected nationally from academic health centers with a medical and nursing school, in order to foster cross-fertilization between these professionals. Faculty were drawn from a cross-section of disciplines, such as pediatric nurse practitioners, pediatricians, midwives, occupational health, and school nurse programs. The planning committee identified and assisted NEEF staff in recruiting the faculty selected to participate in the train-the-trainer workshop.

The inclusion criterion was that participants must be a faculty member in the school of medicine or nursing at a university with an academic health center. NEEF already had a database of faculty members interested in teaching environmental health, based in part on recommendations from National Forum participants. The Faculty Champions' planning committee sought to have participants who were affiliated with academic health centers that served underserved communities. Additionally, the planning

committee also contacted universities that historically have a large minority student population to ensure a diverse group of students would benefit.

Instruments

Pretest/Posttest

Prior to the workshop, a pretest/posttest tool was developed (Appendix C). The pretest was developed by Dr. Rogers based on questions and answers submitted by workshop faculty instructors. Each agenda topical area had 4-6 questions for a total of 20 questions. The pretest was pilot tested on five health professionals for readability, consistency, and content, and was revised. The pretest tool was distributed from NEEF via email.

Workshop Evaluation Form

The workshop evaluation form (Appendix D) was designed to evaluate how effective the workshop was in helping Faculty Champions initiate training at their institutions. It consisted of an evaluation of the five topic power point presentations: "Taking an Environmental History", "Environmental Management of Pediatric Asthma", "Environmental Tobacco Smoke", "Exposure to Ultraviolet Light", and "Lead and Mercury" that the Faculty Champions received during the workshop and would, in turn, present to their respective trainees. Each of the five topics was evaluated on a 4-point scale where 1= Highly Effective, 2= Moderately Effective, 3= Somewhat Effective, and 4= Not Effective. A section for comments asking about the effectiveness in providing the tools necessary to act as a pediatric/environmental health champion was included.

Competency Data Assessments

Competency Assessment Rating Scale Forms (B1, B2, B4) were developed by Dr. Rogers in consultation with NEEF staff. Competency Data Baseline Assessment Rating Scale (B1) (Appendix E) included the five competency areas each of which was to be measured in terms of self-assessment and curricula assessment (by each Faculty Champion member). PEH competencies assessed were 1) completion of PEH history-taking; 2) making referrals for preventative/curative interventions for possible environmental health hazards; 3) involvement with community groups/organizations for environmental health hazards/risk communication; 4) utilization of resources for pediatric environmental hazards; and 5) reporting incidents for regulatory requirements. The scale for measurement was 0 = N/A, 1 = Not Done, 2 = To Little Extent, 3 = To Moderate Extent, and 4 = To Great Extent.

Two additional Competency Assessment Rating Scale Forms (B2 and B4) (Appendices F and G) were ongoing measurement tools and included the rating of the five competency areas described for the baseline tool (B1) and several additional questions including 1) number of faculty members trained on pediatric/environmental health topics; 2) number of pediatric/environmental health referrals made; and 3) were NEEF power points used by faculty member to train others. A section to provide two to three examples of how Faculty Champions incorporated pediatric/environmental health into curricula and practice was also included.

Action Plan

The Action Plan (Appendix H) had sections to ask participants to identity opportunities, barriers, strategies, and planned activities for: 1) Training Faculty Members and 2) Integrating Environmental Health into Education and Practice.

Telephone Interviews

The initial telephone interview form (Appendix I) was developed by Dr. Rogers and a graduate masters student based on the program competencies. The telephone interview assessment included methods of incorporation of pediatric/environmental health into curricula and practice, including the development of any institutional intervention and materials (i.e. protocols, procedures, or policies). Similar to the B2 and B4 assessments, the form included a section asking for two to three examples of how Faculty Champions incorporated pediatric/environmental health into curricula and practice and to describe overall impact. The 12 month telephone interview form (Appendix J) included areas for feedback and suggestions for program improvement.

Data Collection

Pretest/Posttest

To measure knowledge of pediatric/environmental health resulting from the workshop, a pretest and two posttests (Appendix C) were performed. One to two weeks prior to the workshop, participants completed a pretest to evaluate knowledge of subject matter on five competency areas. The pretest was distributed from NEEF via email to all workshop invitees (n=28) one to two weeks prior to the workshop to assess immediate knowledge changes and participants had the option to return their completed examination to NEEF staff via fax or email. At the completion of the one-day workshop, participants

again completed the same test (Posttest 1). Three months following the workshop, participants received the test again (Posttest 2) via email, to measure knowledge sustainability. Participants completed the second posttest and had the option to submit it back to NEEF staff via email or fax.

Workshop Educational Intervention

The curricula presented to Faculty Champions was compiled from NEEF's peer-reviewed children's environmental health medical and nursing training materials, as well as other relevant materials, such as the Agency for Toxic Substances and Disease Registry (ATSDR) and Association of Occupational and Environmental Clinics' resources, with input from the planning committee (Figure 3.1).

The one-day train-the-trainer workshop agenda (Appendix K) consisted of an overview of the Faculty Champions' project focusing on the need for increasing pediatric/environmental health education for health professionals, followed by four consecutive sessions:

1) Instruction regarding the competencies that provided the background data, knowledge, and insight that go into making a differential diagnosis and managing environmental exposures, including environmental history-taking using NEEF's environmental history form;
2) Instruction on the competencies that address longer-term and wider concerns for managing environmental exposures, such as reporting cases of exposure to the proper authorities, supporting surveillance efforts, and providing guidance and education to patients. This session introduced the faculty champions to environmental health training tools, referral services, websites, and additional

Figure 3.1
Faculty Champions Workshop Curricula and Training Materials
National Pesticide Competency Guidelines for Medical & Nursing Education
National Pesticide Practice Skills Guidelines for Medical & Nursing Practice
On-line continuing education modules (2) based on the national pesticide competency and practice skills guidelines
Pediatric Asthma Initiative tools and resources for health care providers: • environmental management of asthma competencies • environmental intervention guidelines • environmental history-taking form • action plan for incorporating these tools into medical and nursing schools
Generic pediatric environmental history form

relevant information sources, pesticide and asthma competencies, as well as broader children's environmental health topics;

3) Identification and discussion of interdisciplinary strategies and opportunities to incorporate children's and other environmental health issues into the ongoing practice of health care and professional development, and how to overcome the barriers and challenges that clinicians face in keeping informed about current practices to address environmental concerns; and
4) Methods in training faculty colleagues and practicing health professionals in achieving five competencies referenced in the funding announcement, and how to incorporate these topics into education and practice.

The Faculty Champions were taught by instructors who are experts in environmental health. Power point presentations on each topic presented were later provided for use by the Faculty Champions when giving lectures, workshops, conference presentations, grand rounds, or faculty training about children's environmental health, and were also posted on the NEEF website (www.neefusa.org).

Each Faculty Champion was committed to train ten additional health professionals at academic institutions within twelve months after the train-the-trainer workshop. NEEF also encouraged the Faculty Champions to collaborate with other groups such as states, territories, tribes, and regional asthma coalitions conducting EPA-funded projects to address environmental triggers of childhood asthma and other environmental health hazards. NEEF provided transportation reimbursement, lodging, meals and, in conjunction with its academic partner, University of North Carolina – Chapel Hill, offered CEU credit for the train-the-trainer workshop. In addition, NEEF

staff provided ongoing support via phone communication and emails to the Faculty Champions following the workshop. Ongoing support was also provided to the additional faculty trained by the faculty champions, to assist them in incorporating pediatric/environmental health into curricula and practice, and train their colleagues as well.

Workshop Evaluation

The Workshop Evaluation form was completed by each Faculty Champion and submitted at the end of the workshop day.

Action Plan

At completion of the workshop or within one week post workshop each Faculty Champion (n=28) completed the Action Plan in which participants described opportunities, barriers, strategies, and planned activities for training faculty members and students, and integrating pediatric/environmental health content into curricula and practice. Each action plan was later evaluated against participant outcomes.

Competency Data Assessments

Faculty Champions were asked to complete baseline and ongoing data assessment forms (Appendices E, F, and G) regarding the extent to which pediatric/environmental health (PEH) competencies were taught as part of curricula and their own ability related to the five P/EH competencies. Faculty Champions completed this assessment at baseline (B1) within one month of the workshop and again at four (B2) and eight months (B4) post workshop. Forms were emailed to participants by NEEF staff. Faculty Champions could return completed forms to NEEF staff via email or fax.

Telephone Interviews

At 6 and 12 months, using the telephone interview survey forms, telephone interviews were conducted with each Faculty Champion regarding the impact of the train-the-trainer on curricula and practice, including the sustained use and degree of incorporation of pediatric/environmental health history-taking into curricula, individual practice, and institutional practice protocols, procedures, and policies. Faculty Champions were asked to provide 2-3 examples of strategies used in their practice that have resulted in specific behavioral changes in parents and children as well as institutional changes, such as in day care centers that have resulted in a decreased exposure to environmental pollutants.

Faculty Champions were emailed by NEEF staff to schedule an interview at 6 and 12 months. The telephone interviews were performed by NEEF staff, using the telephone interview questionnaire (Appendices I and J). When prompts were necessary, participants were given examples of responses. NEEF staff handwrote responses during the conversation, and later transcribed the information to a typed document.

During the 12 month telephone interview, participants' previous responses from the 6 month telephone interview were reviewed for each question. Participants were asked for updates on their progress, and were asked for future plans to sustain efforts regarding pediatric/environmental health inclusion in curricula and practice. Finally, participants were asked for feedback regarding the faculty champions program, including what elements were effective, and suggestions for improvement. Participants were encouraged to continue to use NEEF staff as a resource.

Protection of Human Subjects

The University of North Carolina at Chapel Hill's Institutional Review Board (IRB) of Human Subjects Research reviewed the IRB proposal for evaluation of this existing data and determined this research to be exempt.

CHAPTER IV

Results

Demographic Characteristics

Twenty-eight healthy volunteers who were faculty members from various universities participated in the train-the-trainer workshop. Faculty members included 14 physicians, 8 nurse practitioners (7 of which were pediatric nurse practitioners), 5 nurses with graduate degrees, and a physician assistant. Some of the participants also worked in the practice setting. There were 15 males and 13 females in the sample. Ethnicity, race, and age data were not collected/available.

Workshop Evaluation

Participants (n=25) who completed the workshop evaluation rated the content highly effective with a score range for all topic areas from 1.16 to 1.48 (scale: 1 = Highly Effective to 4 = Not Effective) (Table 4.1). Participants' comments were highly favorable as shown in Table 4.1.

Action Plan

Following the workshop 27 participants completed an Action Plan. The Action Plan asked participants to identity opportunities, barriers, strategies, and planned activities for: 1) training faculty members and 2) integrating environmental health into education and practice. The common themes for planned activities provided by the Faculty Champions are shown in Figures 4.1 and 4.2.

TABLE 4.1	
Workshop Evaluation Summary	
I. Power Point Presentations Scale: 1 = Highly Effective to 4 = Not Effective	
Topic: Average	**Comments**
Taking an Environmental History: 1.28	• Excellent presentation. • Well organized. • Excellent examples provided. • Nice summaries and transition. • Excellent "sell" for why to obtain history.
Environmental Management of Pediatric Asthma: 1.24	• Excellent overview. • Nice job explaining "why" we need to worry. • Great examples. • Nice transitions and use of slides, however, it was the cat, not the rabbit. • Excellent presentation.
Environmental Tobacco Smoke: 1.6	• Okay talk. • Provided overview but not too much editorializing. • This interfered with the talk. • Needs to be better organized.
Exposure to Ultraviolet Light: 1.16	• Great talk. • Awesome overview. • Organized. • To the point. • Excellent reference. • Excellent presentation.
Lead and Mercury: 1.48	• Nice overview. • Excellent to include cases. • Helped learning objectives. • Old information. • Need new updated information please.
II. Do you think this workshop was effective in providing you the tools needed to be a pediatric environmental health champion? Explain briefly.	
• Very good sharing of ideas – looking forward to list-serv and list of speakers. • Great job of organizing conference. • Yes, but it is important to get updated info and to think creatively about ways to disseminate. • Also, publications available are helpful. A stronger nursing presence would be beneficial. • Excellent start! Will need to follow-up and to refocus all of us. Well organized. Efficient. Great small group.	

TABLE 4.1 (continued)
• Yes, I learned a lot of information. • Increased knowledge. Became aware of helpful resources. Would have liked to hear more info on pesticides. • In order to "grab" providers' attention – we need hard data to emphasize the impact of disease (problem – I would strengthen the Epidemiology portion). • More time should have been spent on exploring actual tools to use. • The presentations given were excellent with the exception of the pesticide presentation. I would have prepared a presentation on pesticide hazards and exposures rather than guidelines. Will there be a power point available that is content based on pesticide? Would be a nice complement to the others. Thank you for the excellent program and speakers. • Yes, but would have benefited from an hour on each topic. It also would have been good to review websites so we know what is available to us as educators. • Would like more specific information on pesticides. • Great review of key concepts. I feel I could take the slides and give effective talks to colleagues. • Long time to sit – more small group interactive format/breaks would be helpful. • More on policy / advocacy work with governing agencies. • Expand the view of environmental health. • Thank you...a good start! • The material will need to sink in to see if they are effective. • Well done presentations. Excellent links to support links. • Yes, the shared material was helpful. The monitoring for progress will be motivating. • Absolutely! Great resource for training others. • Develop a DVD focusing on ALL of this content. • Partial – look forward to more links to tools and resources.

Figure 4.1
Action Plan Responses
Common Themes: Training Faculty Members

- Email information to faculty
- Add lecture content in nursing, medical, pediatric, physician assistant courses, both graduate and undergraduate levels
- Present content at local and national conferences
- Create template for environmental health assessment/screening
- Revise clinic/patient care forms to include environmental health questions
- Discuss with certification examination boards inclusion of environmental content questions
- Present at grand rounds
- Meet with course directors to include environmental health content
- Have noon/ brown bag discussions
- Create web-based or case modules
- Talk with community providers/policy makers
- Discuss at faculty meetings
- Discuss possibility for research opportunities in environmental health
- Provide CME/CE
- Present environmental health content in school-based programs
- Develop online courses
- Outreach to community

Figure 4.2
Action Plan Responses
Common Themes: Integrating Pediatric/Environmental Health into Education and Practice

- Use websites / web-lists
- Reinforce with faculty to include environmental health content
- Encourage environmental health clinical rotations
- Perform presentations at conferences
- Discuss the inclusion of environmental health with curriculum committee
- Contact certification boards for environmental health content addition
- Give environmental health resources (NEEF) to faculty
- Model behaviors
- Work with parents
- Encourage residents to be more proactive in asking questions
- Change records/forms to include environmental health
- Noon conferences for residents
- Meet with community advocacy groups
- Foster environmental health research
- Network with other Faculty Champions
- Teach PHNs

Pretest/Posttest Data

Statistical analysis of the pretest performed prior to the workshop, the first posttest performed at the end of the workshop, and the second posttest performed three months after the workshop, were examined. This analysis was performed to determine whether mean test scores significantly improved following the workshop. The 82 tests (28 pretest, 28 initial posttests, and 26 second posttests) were evaluated using a two-way ANOVA test in SAS. Table 4.2 displays number of questions answered correctly for each test from a total 20 questions, and presents data from all pretests/posttests with changes in scores over time.

Examination 1 (Pretest) vs. Examination 2 (First Posttest)

Significance for a difference in means between the examinations was established performing paired t-tests. Following participation of the Children's Environmental Health Faculty Champions Workshop, average examination scores (n=28) increased 13.5 percentage points between pretest and posttest 1, from 52 to 65.5 percent. This increase in mean scores was significant with a t-value of -6.92 and P-value < .0001. Ten participants answered 4-7 additional examination questions correctly following the workshop, and 14 participants answered 1-3 additional examination questions correctly. Two participants showed no change in scores following the examination and two participants scored one additional question incorrectly following the workshop. Out of 28 participants, 10 participants scored more than half of the examination questions incorrectly prior to the workshop, and following the workshop only one participant answered more than half of the examination questions incorrectly.

Concurrently, the average percent correct for individual questions (n=20)

Table 4.2						
Evaluation of Pediatric Environmental Health Train-the-Trainer Workshop						
Participant Score Evaluation Questions Answered Correctly (20 questions total)						
Participant	**Exam 1**	**Exam 2**	**Score Change (2-1)**	**Exam 3**	**Score Change (2-3)**	**Score Change (3-1)**
1	7	12	5	9	-3	2
2	12	14	2	17	3	5
3	12	11	-1	11	0	-1
4	10	15	5	11	-4	1
5	11	13	2	19	6	8
6	6	12	6	13	1	7
7	9	13	4	12	-1	3
8	11	14	3	15	1	4
9	10	10	0	20	10	10
10	6	12	6	20	8	14
11	10	12	2	10	-2	0
12	13	12	-1	N/A	N/A	N/A
13	9	11	2	15	4	6
14	9	13	4	13	0	3
15	9	14	5	12	-2	3
16	8	15	7	12	-3	4
17	14	17	3	15	-2	1
18	10	13	3	11	-2	1
19	14	15	1	15	0	1
20	8	9	1	N/A	N/A	N/A
21	10	12	2	13	1	3
22	15	16	1	15	-1	0
23	13	16	3	20	4	7
24	12	12	0	20	8	8
25	12	13	1	10	-3	-2
26	10	14	4	11	-3	1
27	8	12	4	18	6	10
28	12	15	3	14	-1	2
Sum	290	367	77	371	25	101
Average	10.4	13.1	2.75	14.3	0.96	3.88
Percentage	52	65.5		71.5		
Subsample Sum	269	346				
Subsample Average	10.3	13.3				
Subsample %	51.5	66.5				

increased 13.6 percentage points from 51.8 to 65.4 percent. Question numbers 4, 10, 11, and 18 were answered incorrectly by 2-3 more participants following the examination. Twelve questions were responded to correctly by 2-6 more participants following the workshop and 3 questions were responded to correctly by 9-10 additional participants. Question number 2 was answered correctly by an additional 17 participants. Four examination questions (6, 10, 11, and 19) were answered incorrectly by over half of the participants following the workshop. The mean average of correct responses for each individual question pre-test verses post-test improved significantly with a t-value of -3.50 and a P-value of 0.0024.

Examination 2 Subsample vs. Examination 3

In this section, data from the 26 examinations from the third examination were compared with the results of 26 corresponding second examinations, i.e., compliant subsample. The third examination average scores (n=26) increased 5 percentage points from the workshop posttest subsample (66.5 to 71.5 percent), indicating sustained knowledge improvement following the workshop, possibly via reinforcement through teaching the workshop content to trainees. While sustained knowledge increased, the change in means of the compliant subsample (n=26) from the first to second posttest (examinations 2 vs. 3) was not significant, with a t-value of -1.24 and P-value of 0.2266. Three participants did not improve scores between the first and second posttests indicating some loss of sustained knowledge, and 12 participants performed worse on the second posttest, leaving 42 percent of the 26 participants that performed a second post-test to improve scores from the first to second posttest.

Of the compliant subsample, the average percent correct for individual questions (n=20) increased 4.6 percentage points (61.6 to 66.25 percent) from examination 2 to examination 3. This increase in means, however, was not statistically significant, with a t-value of -1.87 and P-value of 0.0774. Six questions (1, 2, 3, 9, 12, and 17) were answered incorrectly by more participants on the third examination compared to the second examination. Questions 5 and 8 were answered correctly by five additional participants on the third examination compared with the second examination. The remaining 12 questions (4, 6, 7, 10, 11, 13-16, 18-20) were answered correctly by 1-3 more participants. Question 6 was answered incorrectly by 21 participants on the third examination and 24 participants on the second examination subsample. Six questions (6, 9, 10, 11, 12, and19) were answered incorrectly by at least half of the participants on the third examination.

Examination 1 Subsample vs. Examination 3

In this section, data from the 26 examinations from the third examination were compared with the results of 26 corresponding first examinations, i.e., compliant subsample. The third examination (i.e., second post examination) average scores (n=26) increased 20 percentage points from the pretest group (51.5 to 71.5 percent). The change in means of the compliant subsample (n=26) from the original pretest to the second posttest (examination 1 vs. 3) was significant, with a t-value of -5.16 and a P-value of <0.0001. Comparing the third examination with the pretest, two participants scored worse on the third examination than the pretest, and two participants did not improve scores between the pretest and second posttest. Seven participants (27 percent) answered 1 or 2 more question(s) correctly on the third examination compared to the first, and six

participants (25 percent) answered 3 to 4 more questions correctly on the third examination. Six participants answered 5-8 more questions correctly on the third examination and three participants answered 10-14 more questions correctly on the third examination compared with the second examination subsample.

The average percent correct for individual questions (n=20) increased 16.4 percentage points (48.01 to 66.25 percent) from examination 1 to examination 3 in this group. This increase in means was statistically significant, with a t-value of -6.80 and P-value of <0.0001. Question 18 was answered incorrectly by additional two participants on the third examination compared to the first posttest. Questions 2, 3, and 4 were answered correctly by 1-2 more participant(s) on the third examination. Ten questions (1, 6, 9, 10, 11, 12, 14, 15, 16, and 20) were answered correctly by an additional 3-5 participants. Six questions (5, 7, 8, 13, 17, and 19) were answered correctly by an additional 7-11 participants on the third examination compared with the first examination subsample.

Competency Data Assessment

Faculty Champions provided baseline (Form B1) data within one month of the workshop and ongoing data (Forms B2 and B4) at four and eight months following the workshop regarding the extent to which pediatric/environmental health (P/EH) competencies were taught as part of curricula as well as their personal utilization of these P/EH competencies (B1, B2, and B4 Forms). Faculty Champions provided examples of ways in which they incorporated pediatric/environmental health history-taking into curricula and practice, and the number of referrals they made for preventive and curative interventions (B2 and B4 Forms only). P/EH competencies assessed were:

1) completion of P/EH history-taking,

2) making referrals for preventative/curative interventions for possible environmental health hazards,
3) involvement with community groups/organizations for environmental health hazards/risk communication,
4) utilization of resources for pediatric environmental hazards, and
5) reporting incidents for regulatory requirements.

Rating scores of the five competencies were averaged (with a range of 1 to 4; 1 = Not Done, 2 = To Little Extent, 3 = To Moderate Extent, and 4 = To Great Extent) for each participant on both professional practice self-assessments and curricula assessment giving a composite rating for each participant and time interval (Table 4.3). Participants not working in practice settings did not complete self-assessments. In addition, a rating for each individual competency by participant for each interval time period at one month, four months, and eight months post training workshop (Tables 4.4, 4.5, and 4.6) and a composite score for each individual competency (Table 4.7) are presented.

Rating Score

As shown in Table 4.3, of the 28 participants who completed the baseline assessment form (B1), 21 worked in a practice setting giving a mean overall self-assessment score of 2.4, and 27 participants responded to the curriculum assessment portion of the form with a mean overall curricula score of 1.99. Twenty participants who completed the ongoing assessment form (B2) worked in a practice setting, giving an overall mean self-assessment score of 2.29, and 26 participants responded to the curriculum assessment portion of the form giving an overall mean rating of 2.02. Fifteen participants who completed the second ongoing assessment form (B4) worked in a

Table 4.3												
Competency Data Assessments: Mean Scores												
Self Assessment Results							**Score Change**					
	B1 (1 month)		**B2 (4 months)**		**B4 (8 months)**		**B1 to B2**		**B2 to B4**		**B1 to B4**	
Participant	**Practice**	**Curricula**	**Practice**	**Curricula**	**Practice**	**Curricula**	**Practice**	**Curricula**	**Practice**	**Curricula**	**Practice**	**Curricula**
1	1.6	2.4	2.8	2.8	2.8	2.8	1.2	0.4	0	0	1.2	0.4
2	2.6	1.8	3.2	2.8	2.6	3.4	0.6	1	-0.6	0.8	0	1.6
3	2	1	1.6	N/C	2.2	1.8	-0.4	N/C	0.6	N/C	0.2	0.8
4	N/A	N/A	N/A	1.6	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
5	2.8	2.4	2.4	2.2	N/C	N/C	-0.4	-0.2	N/C	N/C	N/C	N/C
6	2	2.6	2.4	2.8	2	2.6	0.4	0.2	-0.4	-0.2	0	0
7	3.6	3.6	3.2	3	N/C	N/C	-0.4	-0.6	N/C	N/C	N/C	N/C
8	1.6	1.4	1.6	1.4	1.4	1.6	0	0	-0.2	0.2	-0.2	0.2
9	1.2	1.4	1	1	N/C	N/C	-0.2	-0.4	N/C	N/C	N/C	N/C
10	N/A	3.6	N/A	2.2	N/A	1.8	N/A	-1.4	N/A	-0.4	N/A	-1.8
11	2.8	2	2.2	1.8	N/C	N/C	-0.6	-0.2	N/C	N/C	N/C	N/C
12	1.8	1.2	2.2	1.8	2.4	2.8	0.4	0.6	0.2	1	0.6	1.6
13	2.4	1.2	2	1.8	2.4	2.2	-0.4	0.6	0.4	0.4	0	1
14	2.4	2.4	2.8	1.4	2.8	2.4	0.4	-1	0	1	0.4	0
15	2.4	1	2.2	1.2	1.6	1.4	-0.2	0.2	-0.6	0.2	-0.8	0.4
16	N/A	1	N/A	1	N/A	2.6	N/A	0	N/A	1.6	N/A	1.6
17	2.4	3.4	2.2	3.4	2.2	3.6	-0.2	0	0	0.2	-0.2	0.2
18	3.4	3	1.8	1.4	3	1.4	-1.6	-1.6	1.2	0	-0.4	-1.6
19	N/A	1.6	N/A	2.2	N/C	N/C	N/A	-0.6	N/C	N/C	N/C	N/C
20	3.4	3	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
21	2.8	1.4	3.4	2.2	2.6	2.2	0.6	0.8	-0.8	0	-0.2	0.8
22	N/A	2.2	N/A	2	N/C	N/C	N/A	-0.2	N/C	N/C	N/C	N/C
23	2	1.2	2.2	1.6	2.2	1.6	0.2	0.4	0	0	0.2	0.4

Table 4.3												
Competency Data Assessments: Mean Scores												
Self Assessment Results							**Score Change**					
	B1 (1 month)		**B2 (4 months)**		**B4 (8 months)**		**B1 to B2**		**B2 to B4**		**B1 to B4**	
Participant	**Practice**	**Curricula**	**Practice**	**Curricula**	**Practice**	**Curricula**	**Practice**	**Curricula**	**Practice**	**Curricula**	**Practice**	**Curricula**
Continued												
24	2.4	2	2.2	2	2.2	3.2	-0.2	0	0	1.2	-0.2	1.2
25	N/A	2.2	N/A	1.8	N/C	N/C	N/A	-0.4	N/C	N/C	N/C	N/C
26	3.2	2	2.6	3.2	N/C	N/C	-0.6	1.2	N/C	N/C	N/C	N/C
27	N/A	1	N/A	2	N/A	2.2	N/C	1	N/A	0.2	N/A	1.2
28	1.6	1.6	1.8	1.8	2.4	2.2	0.2	0.2	0.6	0.4	0.8	0.6
Sum	50.4	53.6	45.8	52.4	34.8	41.8	-1.2	0.4	0.4	6.6	1.4	8.6
N	21	27	20	26	15	18	20	25	15	17	15	18
Mean	2.4	1.99	2.29	2.02	2.32	2.32	-0.06	0.016	0.027	0.39	0.093	0.48
Compliant Subsample (n=17) Mean	2.24	1.89	2.34	1.98	2.33	2.35	0.1	0.0824	-0.0143	0.388	0.0857	0.459
29	Replaced #20 involvement				2.4	3	N/A	N/A	N/A	N/A	N/A	N/A
30	Replaced #19 involvement				3	1.8	N/A	N/A	N/A	N/A	N/A	N/A

Table 4.4										
Faculty Champions Competency Data Baseline Assessment Scores—B1 (1 month post workshop) for Practice and Curriculum Assessment										
Participant	**Taking PEH History**		**Making Referrals for EH Hazards**		**Involvement with Community for EH Risk**		**Resource Utilization for EH Hazards**		**Reporting Incidents with Regulatory Requirements**	
	Practice	**Curricula**	**Practice**	**Curricula**	**Practice**	**Curricula**	**Practice**	**Curricula**	**Practice**	**Curricula**
1	2.0	3.0	2.0	2.0	1.0	1.0	1.0	3.0	2.0	2.0
2	2.0	2.0	2.0	2.0	4.0	2.0	4.0	2.0	1.0	1.0
3	2.0	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0	1.0
4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5	2.0	2.0	3.0	3.0	-	-	4.0	4.0	4.0	2.0
6	2.0	4.0	1.0	2.0	3.0	2.0	3.0	3.0	1.0	2.0
7	3.0	4.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0
8	2.0	2.0	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0
9	2.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
10	N/A	3.0	N/A	3.0	N/A	4.0	N/A	4.0	N/A	4.0
11	4.0	3.0	4.0	3.0	1.0	1.0	2.0	2.0	3.0	1.0
12	2.0	2.0	2.0	1.0	2.0	1.0	2.0	1.0	1.0	1.0
13	3.0	2.0	3.0	1.0	2.0	1.0	2.0	1.0	2.0	1.0
14	2.0	2.0	3.0	3.0	2.0	2.0	2.0	2.0	3.0	3.0
15	2.0	1.0	3.0	1.0	1.0	1.0	2.0	1.0	4.0	1.0
16	3.0	1.0	3.0	1.0	1.0	1.0	4.0	1.0	1.0	1.0
17	3.0	4.0	2.0	3.0	2.0	3.0	3.0	4.0	2.0	3.0
18	2.0	2.0	1.0	2.0	1.0	1.0	3.0	2.0	1.0	1.0
19	4.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	4.0	3.0
20	3.0	2.0	3.0	1.0	2.0	1.0	3.0	2.0	3.0	1.0
21	2.0	2.0	3.0	3.0	1.0	1.0	2.0	2.0	3.0	3.0

Table 4.4										
Faculty Champions Competency Data Baseline Assessment Scores—B1 (1 month post workshop) for Practice and Curriculum Assessment										
Participant	**Taking PEH History**		**Making Referrals for EH Hazards**		**Involvement with Community for EH Risk**		**Resource Utilization for EH Hazards**		**Reporting Incidents with Regulatory Requirements**	
	Practice	**Curricula**	**Practice**	**Curricula**	**Practice**	**Curricula**	**Practice**	**Curricula**	**Practice**	**Curricula**
Continued										
22	2.0	2.0	1.0	1.0	2.0	1.0	2.0	1.0	3.0	1.0
23	3.0	2.0	2.0	2.0	2.0	2.0	3.0	2.0	2.0	2.0
24	1.0	2.0	1.0	2.0	-	3.0	3.0	3.0	1.0	1.0
25	3.0	2.0	4.0	2.0	4.0	2.0	3.0	2.0	2.0	2.0
26	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
27	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	2.0	2.0
Average	2.4	2.2	2.2	2.0	2.0	1.7	2.5	2.1	2.2	1.7

Table 4.5										
Faculty Champions Competency Data Ongoing Assessment Scores-B2 (4 months post workshop) for Practice and Curriculum Assessment										
Participant	**Taking PEH History**		**Making Referrals for EH Hazards**		**Involvement with Community for EH Risk**		**Resource Utilization for EH Hazards**		**Reporting Incidents with Regulatory Requirements**	
	Practice	**Curricula**	**Practice**	**Curricula**	**Practice**	**Curricula**	**Practice**	**Curricula**	**Practice**	**Curricula**
1	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.0	2.0
2	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	1.0	2.0
3	2.0	-	1.0	-	2.0	-	2.0	-	1.0	-
4	N/A	2.0	N/A	1.0	2.0	1.0	N/A	1.0	N/A	1.0
5	3.0	3.0	3.0	2.0	1.0	1.0	3.0	2.0	1.0	2.0
6	3.0	4.0	2.0	2.0	2.0	3.0	3.0	2.0	2.0	2.0
7	3.0	3.0	3.0	3.0	4.0	3.0	4.0	4.0	2.0	2.0
8	2.0	1.0	2.0	2.0	1.0	1.0	2.0	2.0	1.0	1.0
9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
10	3.0	4.0	3.0	1.0	4.0	4.0	3.0	4.0	N/A	1.0
11	3.0	4.0	3.0	1.0	1.0	1.0	3.0	2.0	N/A	1.0
12	3.0	2.0	2.0	1.0	2.0	2.0	3.0	2.0	N/A	N/A
13	3.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.0	1.0
14	3.0	1.0	3.0	1.0	3.0	2.0	3.0	2.0	2.0	1.0
15	2.0	2.0	3.0	1.0	1.0	1.0	2.0	1.0	3.0	1.0
16	3.0	1.0	1.0	1.0	2.0	1.0	3.0	1.0	1.0	1.0
17	3.0	4.0	2.0	3.0	2.0	3.0	3.0	4.0	1.0	3.0
18	3.0	2.0	1.0	2.0	2.0	1.0	1.0	1.0	2.0	1.0
19	2.0	2.0	N/A	2.0	N/A	2.0	3.0	3.0	N/A	2.0
20	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 4.5										
Faculty Champions Competency Data Ongoing Assessment Scores-B2 (4 months post workshop) for Practice and Curriculum Assessment										
Participant	**Taking PEH History**		**Making Referrals for EH Hazards**		**Involvement with Community for EH Risk**		**Resource Utilization for EH Hazards**		**Reporting Incidents with Regulatory Requirements**	
	Practice	**Curricula**	**Practice**	**Curricula**	**Practice**	**Curricula**	**Practice**	**Curricula**	**Practice**	**Curricula**
Continued										
21	4.0	3.0	3.0	2.0	3.0	2.0	4.0	2.0	3.0	2.0
22	N/A	3.0	N/A	2.0	N/A	1.0	N/A	3.0	N/A	1.0
23	2.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	3.0	1.0
24	3.0	3.0	2.0	2.0	2.0	2.0	3.0	2.0	1.0	1.0
25	N/A	2.0	N/A	2.0	3.0	2.0	N/A	2.0	N/A	1.0
26	3.0	3.0	2.0	3.0	4.0	3.0	3.0	4.0	1.0	3.0
27	N/A	3.0	N/A	2.0	N/A	2.0	N/A	2.0	N/A	1.0
28	3.0	3.0	3.0	3.0	1.0	1.0	1.0	1.0	1.0	1.0
Average	2.7	2.5	2.3	1.9	2.3	2.0	2.7	2.2	1.6	1.4

Table 4.6										
Faculty Champions Competency Data Ongoing Assessment Scores -B4 (8 months post workshop) for Practice and Curriculum Assessment										
Participant	**Taking PEH History**		**Making Referrals for EH Hazards**		**Involvement with Community for EH Risk**		**Resource Utilization for EH Hazards**		**Reporting Incidents with Regulatory Requirements**	
	Practice	**Curricula**	**Practice**	**Curricula**	**Practice**	**Curricula**	**Practice**	**Curricula**	**Practice**	**Curricula**
1	4.0	4.0	2.0	2.0	2.0	2.0	4.0	4.0	2.0	2.0
2	N/A	4.0	3.0	4.0	4.0	4.0	4.0	4.0	N/A	1.0
3	3.0	2.0	2.0	2.0	3.0	2.0	2.0	2.0	1.0	1.0
4	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
5	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
6	3.0	4.0	N/A	2.0	2.0	2.0	3.0	3.0	N/A	2.0
7	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
8	N/A	1.0	N/A	2.0	1.0	2.0	3.0	2.0	N/A	1.0
9	-	-	-	-	-	-	-	-	-	-
10	4.0	3.0	N/A	-	4.0	3.0	N/A	-	N/A	-
11	4.0	3.0	2.0	2.0	1.0	1.0	3.0	3.0	1.0	1.0
12	3.0	3.0	N/A	2.0	3.0	3.0	4.0	4.0	N/A	2.0
13	2.0	2.0	3.0	2.0	3.0	3.0	2.0	2.0	2.0	2.0
14	3.0	2.0	3.0	2.0	3.0	3.0	3.0	3.0	2.0	2.0
15	3.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0
16	N/A	4.0	N/A	2.0	N/A	2.0	4.0	4.0	N/A	1.0
17	3.0	4.0	1.0	3.0	2.0	3.0	3.0	4.0	2.0	4.0
18	4.0	2.0	4.0	2.0	1.0	1.0	3.0	1.0	1.0	1.0
19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
20	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
21	3.0	3.0	3.0	2.0	3.0	2.0	3.0	2.0	-	2.0

Table 4.6										
Faculty Champions Competency Data Ongoing Assessment Scores -B4 (8 months post workshop) for Practice and Curriculum Assessment										
Participant	**Taking PEH History**		**Making Referrals for EH Hazards**		**Involvement with Community for EH Risk**		**Resource Utilization for EH Hazards**		**Reporting Incidents with Regulatory Requirements**	
	Practice	**Curricula**	**Practice**	**Curricula**	**Practice**	**Curricula**	**Practice**	**Curricula**	**Practice**	**Curricula**
Continued										
22	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
23	2.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	3.0	-
24	3.0	4.0	2.0	2.0	2.0	4.0	3.0	4.0	1.0	2.0
25	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
26	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
27	N/A	3.0	N/A	2.0	N/A	1.0	N/A	2.0	N/A	3.0
29	3.0	3.0	3.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Average	3.1	2.9	2.5	2.1	2.3	2.3	2.9	2.7	1.6	1.8

Table 4.7						
Faculty Champions Composite Scores--Competency Data Assessments						
Assessment Interval						
Competency	**Baseline August 2006**		**Ongoing November 2006**		**Ongoing March 2007**	
	Practice	**Curricula**	**Practice**	**Curricula**	**Practice**	**Curricula**
Completion of pediatric environmental history-taking	2.4	2.2	2.7	2.5	3.1	2.9
Making referrals for preventative/curative interventions for possible environmental health hazards	2.2	2.0	2.3	1.9	2.5	2.1
Involvement with community groups\organizations (e.g., PTA, daycare) for environmental health hazards, risk communication	2.0	1.7	2.3	2.0	2.3	2.3
Utilization of resources for pediatric environmental hazards	2.5	2.1	2.7	2.2	2.9	2.7
Reporting incidents for regulatory requirements	2.2	1.7	1.6	1.4	1.6	1.8

practice setting, with a mean overall self-assessment score of 2.32 while 18 participants responded to the curriculum assessment portion of the form giving an overall mean curricular assessment score of 2.32. Self-assessment scores improved an average of 0.027 points from four months to eight months post training workshop (B2 to B4), 0.093 points from one month to eight months post training workshop (B1 to B4), and decreased an average 0.06 points from one month to four months post training workshop (B1 to B2) (Table 4.3). Curricula scores improved an average of 0.016 points from one month to four months post training workshop (B1 to B2), 0.39 points from four months to eight months post training workshop (B2 to B4), and 0.48 points from one month to eight months post training workshop (B1 to B4).

Compliant Subsample

As shown in Table 4.3, fourteen participants who worked in practice settings completed the baseline (B1) and ongoing (B2 and B4) assessment forms. Mean average self-assessment scores for the B1, B2, and B4 assessments were 2.24, 2.34, and 2.33, respectively. Self-assessment scores for practice improved an average 0.1 points from baseline to the four month assessment period and 0.0857 points from baseline to the eight month assessment period. Self-assessment scores decreased an average 0.0143 points from the four month to the eight month assessment period.

Three additional participants who did not work in a practice setting completed the baseline (B1), four month (B2), and eight month (B4) assessment forms. Of these 17 participants in the compliant subsample completing their curricula assessments, mean scores for baseline (B1), four month (B2), and eight month (B4) assessments were 1.89, 1.98, and 2.35, respectively. Scores improved an average 0.0824 points from baseline to

the four month assessment period, 0.388 points from the four month to eight month assessment period, and 0.459 points from baseline to the eight month assessment. Of participants in the compliant subsample, 6 of the 14 (43 percent) working in a practice setting reported a decreased self-assessment score between baseline and the eight month assessment period and 2 of the 17 (12 percent) reported a decreased curricula assessment score from baseline to the eight month assessment period.

Additional Assessment Data

Faculty Champions reported training faculty and other health care professionals during the first interval period, August 2006 through October 2006, again during the second interval period, November 2006 through March 2007, and also indicated the number of referrals made for pediatric/environmental health issues for each interval reporting period (Table 4.8).

The expectation was that each Faculty Champion would train 10 trainees (28 Faculty Champions x 10 trainees = 280). Clearly, the number of health professionals receiving training by Faculty Champions (n=1,517) exceeded the expected number. Table 4.9 displays responses at the four month ongoing competency data assessment (B2 Form) performed in November 2006, and Faculty Champions reported they used NEEF slides provided to them by NEEF after the training workshop in the following ways:

- Lecture presentations to nursing and medical students,
- Noon lunch sessions with residents and medical students,
- Grand round presentations,
- Presentations to allied and community health professionals,
- Presentations to Departments of Health and child care centers,
- Increased effort in pediatric/environmental health history-taking,
- Presentations at national nursing conferences,
- Placed slides on online courses in health promotion, health assessment, and child health.

Table 4.8			
Reported Number Trained and Referrals Made			
Health Professionals	**Interval Period August - October 2006**	**Interval Period November 2006 - March 2007**	**Total**
Physician	233	213	446
Nurse	312	439	751
Other	164	156	320
Total	709	808	1,517
Referrals Made	42	35	77

Table 4.9

Faculty Champions Competency Data Assessment Summary—at 4 Months Post Workshop (B2)

Name	Number of Faculty Trained			Number Referrals Made	Use of NEEF Slides	Examples of PEH Incorporation
	MD	Nurse	Other			
1	0	35	0	4	Yes - Gave presentation to nursing students	- Added lecture to health maintenance course - Asking more about EH issues
2	0	105	0	16	Yes - (unclear)	- Added PEH content to both undergraduate/graduate nursing courses - Increase PEH history-taking
3	3	2	3 (CMA)	0	No	- Included EH into lecture for 3rd year med students - Asking more EH questions on history-taking
4	0	0	0	0	Yes - Will be doing presentations to Community Health Department - Added Community Health Nursing classes Fall 06, Spring 07 - Used by masters students for outreach to rural public health nurses	None
5	12	0	20 (med students)	2	Yes - Lectures to residents and med students	- Increased awareness of incorporating PEH in history-taking and - Integrated PEH into history-taking forms
6	0	15	0	1	Yes - Presented to graduate nursing students in Bay area	- Published policy piece in *Journal of Pediatric Health Care* – which has distribution to 7,000 advanced practice nurses
7	16	0	48 (3rd yr med students)	0	Yes - EH history-taking	- Lecture to each cohort of med students on EH
8	0	0	0	0	Not yet	None
9	0	0	0	0	No	None
10	0	40	20 (PA and allied health)	0	Yes - Faculty presentations to nursing and allied health	- Incorporated PEH content into physician/physician assistant/nursing clinical rotations - Incorporated PEH content into public health course

Table 4.9						
Faculty Champions Competency Data Assessment Summary—at 4 Months Post Workshop (B2)						
Name	**Number of Faculty Trained**			**Number Referrals Made**	**Use of NEEF Slides**	**Examples of PEH Incorporation**
	MD	**Nurse**	**Other**			
Continued						
11	0	1	10 (Pediatric Residents)	0	No	- Creating smoking cessation program in Ambulatory Clinic - Noon conference on EH - Helped create encounter form for pediatric asthma with new section on PEH - Helped create with nursing Lead poisoning letters to families
12	1	2	2	0	Yes (Not described)	- Case examples presented to nursing students to practice PEH history-taking - power point presentations made to students on EH issues (e.g., lead, mercury, asthma, pesticides)
13	6	0	0	3	Yes - Used in workshops with child care centers regarding EH exposures	- Residents now asking about parental occupations - Auditing charts for passive smoking - Periodic Noon conference with residents on EH exposures
14	6	0	0	2	No	- Incorporating some EH content in pediatric rotation lectures - Using EH screening questions in continuity clinics
15	0	0	0	0	No	None
16	1	70	0	0	No	- Lecture to undergraduate nursing students
17	0	0	0	0	No	- Better exposure history-taking especially with asthma - Promoting skin health/safety in clinics through resources from workshops
18	0	0	0	0	No	- Residents are expected to take detailed EH histories - Increase awareness of EH issues like pesticides in morning rounds with residents/attending MDs - Lecture included for 2nd year med students

Table 4.9

Faculty Champions Competency Data Assessment Summary—at 4 Months Post Workshop (B2)

Name	Number of Faculty Trained			Number Referrals Made	Use of NEEF Slides	Examples of PEH Incorporation
	MD	Nurse	Other			
Continued						
19	6	0	0	0	No	- Proposed 18 sessions on PEH over next 3 years for noon conference curriculum. Will use NEEF slides and materials for this - PEH content will be included in Mid-Atlantic Conference on child health and environment which we are hosting
20	40	6	3 (teacher, community members)	10	Yes - used slides in presentation	- Met with medicine course directors about incorporating EH content, history-taking, and use of forms - Teaching EH history-taking now to first year med students
21	0	25	0	0	Yes - Placed slides on online health assessment course	- Incorporating EH content into undergraduate courses - Working on PEH articles for publication
22	30	0	0	0	No	- Pediatric / Family Practice residency lecture - Medical office Lead poisoning questions - Obtained quit smoking cards for parents
23	0	2	0	2	Yes - To develop training materials for National Association of Pediatric Nurse Practitioners (NAPNAP) conferences - Develop course materials for health promotion course	- Increases awareness of EH in clinical rotation - National presentation at NAPNAP planned for March 2007
24	0	5	9	0	No	- Working with undergraduate nursing faculty to incorporate PEH into curriculum - Met with 4 county health departments to encourage them to use students for environmental assessments and offered to do in-service education
25	112	4	25	2	Yes - Grand Rounds, Public Health Seminars	None

Table 4.9						
Faculty Champions Competency Data Assessment Summary—at 4 Months Post Workshop (B2)						
Name	**Number of Faculty Trained**			**Number Referrals Made**	**Use of NEEF Slides**	**Examples of PEH Incorporation**
	MD	**Nurse**	**Other**			
Continued						
26	0	2	35 (Masters Nursing students)	0	Yes - Presentation on Children's Unique Vulnerabilities in EH Concepts course	- Met with faculty member in Community Health Nursing and Pediatric Nursing course about NEEF and resources
27	0	0	0	0	No	None
Total	233	312	164	42		

Faculty Champions also reported integration of pediatric/environmental health content (Table 4.9) in several ways including:

- Lecture content added to graduate and undergraduate nursing courses and to medical school courses,
- Increased emphasis on pediatric/environmental health history-taking,
- Changing assessment forms in patient records to include questions on environmental health hazards,
- Publications in journals on environmental health,
- Providing clinical rotations related to environmental health,
- Noon conferences on environmental health topics,
- Creating smoking cessation programs,
- Initiating chart audits for environmental health,
- Performing grand rounds on environmental health, and
- Increased awareness by residents and nursing students to ask about environmental health issues.

Table 4.10 displays responses at the eight month ongoing competency assessment (B4 Form) completed in March 2007. As summarized in Table 4.10, Faculty Champions reported good use of NEEF slides from the training workshop and use of other NEEF resource materials. Examples included:

- Presentation at National Nursing Conference (NAPNAP),
- Presentations at four Physician Assistant conferences,
- Several training sessions for nurses, nursing students, medical students, residents, and physicians, and
- Information put on website and You Tube.

During this period integration of pediatric/environmental health into practice and curriculum were reported in several ways by Faculty Champions (Table 4.10). General themes included:

- Presented content on environmental health risks in developing countries, Hispanic initiative, and other topics,
- Increased exposure in clinical rotations and increased counseling on P/EH topics with patients,
- Increased emphasis on screening (Hg, Pb) and health assessments on environmental toxins to physicians, nurses, and for students,

Table 4.10						
Competency Data Assessment Summary—at Eight Months Post Workshop (B4)						
Name	**Number of Faculty Trained**			**Number Referrals Made**	**Use of NEEF Slides**	**Examples of PEH Incorporation**
	MD	**Nurse**	**Other**			
1	0	130	0	2	Yes - Gave presentation at NAPNAP National Conference to 130 PNPs	- Presented info on EH risk in developing countries and how this compares to US - Planning international clinical experience in Nicaragua which will include increased EH risk awareness
2	0	75	0	9	Yes - Training nurses and students on asthma	- Taught undergraduate students about PEH assessment - Health assessment questions on mercury and fish included on research study
3	1	2	16 (Med students)	0	Yes - With medical students lectures	- Working with University of Texas faculty to study effects of low level lead on neurodevelopment in children
4	0	110	0	0	Yes - Gave presentation at NAPNAP	- Making PEH history part of web-based pediatric health promotion course - Developed planning committee for Fall Conference for Contemporary Forums and will include environmental health content to physicians, nurses, and physician assistants
5	0	0	0	0	Yes - Faculty presentation and with students	- Planning brown bag lunch to discuss EH risk with faculty - Worked with student on online learning module as part of pediatric course
6	0	0	0	0	No	None
7	0	15	0	0	Yes - Made presentation to 4 Physician Assistant professional organizations - Made presentation to nurse practitioner association conference	None
8	20	8	0	5	No	No change from last example

Table 4.10						
Competency Data Assessment Summary—at Eight Months Post Workshop (B4)						
Name	**Number of Faculty Trained**			**Number Referrals Made**	**Use of NEEF Slides**	**Examples of PEH Incorporation**
	MD	**Nurse**	**Other**			
Continued						
9	12	5	112	0	Yes - PPT prepared for presentations to MD, NP, grad nursing students on EH issues (lead, PEH history-taking)	- Discussion of use of screening tools for assessing child health/EH; forms used in clinic - Discussion of cases of EH issues in virtual clinical conferences for practitioners
10	0	0	5 (residents)	5	Yes - Resident and medical student training	- Developing resident rotation with Lead team
11	4	4	0	2	No	- Discussing with attending MDs incorporating EH history in pre-clinic didactic for residents and for nurses and faculty
12	0	0	0	0	No	None
13	1	0	0	0	No	None
14	0	0	0	0	No	No change from last example
15	0	0	0	0	Yes - Lecture to second year med students (n=180)	No change from last example
16	75	75+	10 (PA, med students)	10	Yes - Selected specific slides on EH and shared on You Tube video	- Noon conference for MD in training with case scenarios and NEEF materials as handouts; gave multiple choice questions
17	30	0	0	0	No	- Instituting "Lead Care" blood screening equipment in pediatric clinic
18	0	3	5 (PNP students)	0	Yes - Training PNP students on assessment and referral of patients related to EH issues	- Trained PNP students on EH issues for Hispanic Initiative to Mothers' Morning Out Program
19	0	0	0	0	No	- Included directed EH history questions on patient screening forms which physician reviews
20	0	2	0	0	Yes - PNP faculty were referred to website to review ppt presentations; students reviewed and were tested	- All PNP faculty and students reviewed EH history form in class

Table 4.10						
Competency Data Assessment Summary—at Eight Months Post Workshop (B4)						
Name	**Number of Faculty Trained**			**Number Referrals Made**	**Use of NEEF Slides**	**Examples of PEH Incorporation**
	MD	**Nurse**	**Other**			
Continued						
21	0	0	0	0	Yes - Preparing conference on lead toxicity for residents in continuity clinic - using NEEF slides	None
22	70	10	8	3	Yes - As a resource for developing presentations and for residents who give talks	- Extensive counseling on environmental management of asthma with family with multiple asthmagens in their home
Total	213	439	156	35		

- Added P/EH content in coursework and noon conferences for physicians, and
- Participant in research studies with environmental health emphasis.

Telephone Interviews

As part of the assessment/evaluation, Faculty Champions participated in two telephone interviews, one at six months (January 2007) and one at 12 months (July 2007) post workshop training. Faculty Champions were interviewed about strategies for pediatric/environmental health integration including methods of integration, topics covered, time committed to integration, clinical experiences, development of policies and procedures, and examples of institutional changes made. Participants were also asked to describe the overall impact of the training.

Data from telephone interviews are summarized in extensive detail in Table 4.11 and Table 4.12, respectively. Data from the first telephone interview indicated that nearly all Faculty Champions (n=21/24) had integrated PEH content into primarily coursework with some content provided at grand rounds or noon lectures. The amount of time committed to pediatric/environmental health content was limited, ranging from 0.5 to 20 hours per year.

With regard to clinical experiences with pediatric/environmental health integration, most settings (n=18/24) integrated this content into the rotations, although many approaches were different. Also, most faculty (n=19/24) had faculty practice settings. The development of policies/procedures was minimal with only 4 of 24 participants indicating this had been accomplished. Several Faculty Champions (17/24) indicated some form of institutional change had been made such as adding lecture content to courses, increased emphasis of pediatric/environmental health history-taking and

Table 4.11
NEEF Faculty Champion Telephone Interview Responses at Six Months

	Position	Target Audiences	Pediatric Environmental Health (PEH) Integration	PEH Topics Covered	Time	Clinical/Rotation Experience	Practice Setting Faculty	Development of Policies/Protocols/Procedures	Institutional Changes - Strategy Examples
1	Director (Dir) Pediatric Nurse Practitioner (PNP) Program	Graduate Nursing students (Family Nurse Practitioner [FNP]/PNP); Fast track Registered Nurse (RN) students	Courses: Health Promotion and Children (HP&C); Common Illness Management (CIM); Complex Management (CM) Course	HP&C: PEH history-taking (PEHHx), standard well child care, lead/hemoglobin screening; CIM: lead and environmental (envir) control of asthma; CM: asthma and envir toxins. No PEH training in fast track RN program	2 hours/ semester (sem)	NEEF tools distributed to students	PNP 10 hrs/week at primary care pediatric (ped) clinic PEHHx on 1-39% (regarding lead screening). Settings include: primary care, school settings, lead clinic	None yet	2-hour PEH lecture added
	Overall Impact: Increased awareness of need for PEH content in curriculum and availability of great NEEF tools and website for faculty use. Have distributed NEEF materials widely. Presenting at NAPNAP national conference on importance of PEH Screening.								
2	Dir of Nursing Centers Research Network; Robert Wood Johnson Executive Fellow; Associate (Assoc) Professor (Prof), School of Nursing	Nursing students--mostly PhD level, but some undergrad and grad students; med students in independent study on mercury assessment	Courses: Policy (PhD); Health Promotion (undergrad)	Policy: mercury, environmental tobacco smoke (ETS), lead, pesticides	PhD: 5 hours; undergrad 2 hr; all levels 2 hrs/sem during lecture	In community health nursing clinical students perform lead and mercury assessment/screening, also pushing to get experience at undergrad level. Workshop was presented to 125 nursing students/nurses on PEHHx and assessment	Performs practice based research at nursing centers regarding health education and screenings 10 hrs/month. PEHHx of 70-99%	Procedures at city/county health departments--contracts tightened standard operating procedures on nurses' health assessments with children--students more involved in practice component--more clearly outlined protocol. Student skills based learning into clinical	Structure built into health assessment practice, increased interest in parents about risks to self and child--especially mercury, lead, pesticides, and some tobacco. Integrated pesticide management activities with longevity of behavioral changes
	Overall Impact: Unbelievable amount of impact with practice and partner with community groups and centers. Has had a huge impact. To perform guest lecture to 300 nurses and nursing students on PEH.								

Table 4.11
NEEF Faculty Champion Telephone Interview Responses at Six Months

	Position	Target Audiences	Pediatric Environmental Health (PEH) Integration	PEH Topics Covered	Time	Clinical/Rotation Experience	Practice Setting Faculty	Development of Policies/Protocols/Procedures	Institutional Changes - Strategy Examples
Continued									
3	Assoc Prof; Department (Dept) of Pediatrics (Peds)	Medical (Med) students; Residents (Res)	Med students and Residents receive lecture of PEH	PEH topics in general…asthma, lead, sun exposure	Med students--45 minutes; Residents--60 minutes	PEH questions are part of history forms (secondhand smoke; sun exposure [exp]; lead screening)--residents are encouraged to ask questions	No	No--and does not plan to develop in near future	No examples
	Overall Impact: I now ask these questions…changed the way I practice…not sure about impact on residents and students.								
4	Assistant Director, Occupational & Environmental Health Nursing.	Nursing students, grad and undergrad.	Not yet under development. Community Health next spring to have added PEH content	N/A	N/A	PNP at various community based practice sites--no formal PEH content yet	Works as clinical occupational health nurse (OHN)	Hoping to integrate PEH into the occupational health nursing course next year	Added PEH to Community Health course. Two graduate students' projects are to insert pesticides information into graduate and undergraduate curricula
	Overall Impact: Additionally, a graduate student is working with department chair on creating a survey on stress on public health nurses when making home visits. It asks about how competent they feel doing environmental assessments. NEEF links to the environmental history-taking information were given to the nurses, who were very receptive to them, and reported the forms to be very helpful.								
5	Clinical Professor; Dept. of Family Health Care Nursing	Graduate Nursing (PNP)	Health Promotion course	Passive smoke, lead, and brief overview of other envir hazards	3 hours/ semester	Yes--in particular settings students perform PEH histories	PNP at City/county clinic 20 hours/week; PEHHx histories on 40-69% of patients	Not in faculty setting, but in practice setting instituting protocol where lead and secondhand smoke screening will be performed on every patient	Performed secondhand tobacco smoke training in practice setting and also increased training students on environmental hazards (will be expanding lecture on envr hazards as mentioned above)
	Overall Impact: Extremely helpful—wrote two publications as a result of the training on lead and other chemical exposures. Also gave a two-hour workshop to 125 Nurse Practitioners (NPs) covering all NEEF topics and will perform a presentation to residents at local hospital.								

Table 4.11
NEEF Faculty Champion Telephone Interview Responses at Six Months

	Position	Target Audiences	Pediatric Environmental Health (PEH) Integration	PEH Topics Covered	Time	Clinical/Rotation Experience	Practice Setting Faculty	Development of Policies/Protocols/Procedures	Institutional Changes - Strategy Examples
Continued									
6	Prof and Chair of Dept of Peds	Med students and residents	Third-year med students. Residents at grand rounds	Med Students: all NEEF topics. Res: various	Med Students: 18 hours total; Residents 1hr/year	Ped residents take PEHHx as appropriate	No	No plans to develop protocols, policies, or procedures	No dramatic change, but now able to use materials and forms provided to enhance teaching that she had already been performing. Involved in the community with Mothers and Others for Clean Air which strives to develop policies toward clean air for children in state
	Overall Impact: No dramatic change but finds NEEF tools useful in enhancing work she has already been performing.								
7	Assistant Professor; Dept. of Health, Injury, and Disease	Graduate Nursing (FNP)	Advanced Principles of Pediatric Primary Care	Sun, asthma, mercury, lead, pollutants	2-3 hours	Pediatric rotation--but no formal PEH content	Works full-time PNP at local emergency dept & works 8-12 hrs/month at a family practice office. Performs problem-focused PEHHx on 1-39% of patients (specific to asthma)	Not yet	Working with students on on-line learning module related to pediatric environmental health which, other students will perform the module as part of course work. Performed a pre-assessment of faculty on PEH and then gave a brown bag lunch on pediatric environmental health
	Overall Impact: More aware about asking envir histories, added more content to PEHHx she already performed. Also, students at the university get jobs in a military setting--and are often relocated in leadership positions--so they will be able to use the info on PEH to facilitate changes in their future positions.								

Table 4.11
NEEF Faculty Champion Telephone Interview Responses at Six Months

	Position	Target Audiences	Pediatric Environmental Health (PEH) Integration	PEH Topics Covered	Time	Clinical/Rotation Experience	Practice Setting Faculty	Development of Policies/Protocols/Procedures	Institutional Changes - Strategy Examples
	Continued								
8	Graduate (Grad) Program Director--Doctorate Nursing; President of the American College of Clinicians	Grad nursing--doctorate level	Not yet	N/A	N/A	No	10 hours/semester in a family practice setting as FNP (adult patients-no PEHHx)	No--states may possibly develop in future--but no plans yet	Plan to incorporate PEH topics in the health policy course by Spring of 2008, and also will encourage research on PEH topics
	Overall Impact: Increased awareness--supports concepts. "At the doctorate level, not as much room in curricula for this topic".								
9	Dean	Physician Assistant (PA) students, undergraduate nursing students, also performs national talks to NPs, PAs, and physicians	Not yet	N/A	N/A	No (plans to offer clinical pediatric environmental health in April 2008)	PA in occupational medicine setting 8 hrs/week. States he performs PEHHx on 1-39% of patients	No--plans to develop curricula changes and policies/procedures with the school of nursing and school of pediatric health	Has spoken with faculty and students about the importance of increasing awareness and prevention of pediatric environmental health issues. In practice setting, participant talks with employees (including migrant workers) about the risk of taking work exposure home to kids and also discusses pediatric environmental health history-taking. Participant also discusses PEH topics of lead, mercury, and asthma
	Overall Impact: Helped with changes in curricula and practice and increased awareness and prevention activities. Has also increased educational level of other faculty nurses and physicians on PEH topics.								

Table 4.11
NEEF Faculty Champion Telephone Interview Responses at Six Months

	Position	Target Audiences	Pediatric Environmental Health (PEH) Integration	PEH Topics Covered	Time	Clinical/Rotation Experience	Practice Setting Faculty	Development of Policies/Protocols/Procedures	Institutional Changes - Strategy Examples
				Continued					
10	Attending Physician, Assistant Professor--Dept of Peds; Division of Ambulatory Peds	Med students and residents	Residents: lunch and learn on PEH topics; not sure about med students curriculum	General PEH topics	Residents 2h/year; med students-unsure	Some med students get PEH practical experiences depending on clinical placements--not all receive PEH exp. Residents have practical PEH experiences especially with lead poisoning, asthma, and secondhand smoke in clinics	Works 55 hrs/week as attending physician in an outpatient setting and 2 months/year in an inpatient setting. PEHHx 70-99% of patients--(specifically on lead and secondhand smoke exposure)	Protocol: developed PEHHx form for children with asthma. No procedures or policies developed. Also developing pamphlet on smoking cessation/secondhand smoke exposure	Asking more about environmental exposure with asthma patients. Developed environmental health history form for residents to perform on children with asthma for residents to perform. Also in process of creating pamphlet materials on secondhand smoke to disperse to patients and caregivers
	Overall Impact: Very useful with clinics/education setting. In practice setting, information was not very useful and not as much has changed. Participant reports very little protocol or procedure help or change.								
11	Assistant Professor; School of Nursing	Graduate and undergraduate nursing students, medical students, faculty of the school of nursing	Courses: Advanced Health Assessment (grad), Adv Pediatric Nursing I and II (grad); Children and Family (undergrad).	Lead, pesticide, mercury, asthma, UV (grad and undergrad); Case study approach utilized and PEHHx basics covered	Grad: 12 hours/year; unsure about undergrad students	Yes (depends on setting and faculty member). Particularly asthma patients.	Works as PNP in elementary & middle school for 8 hrs/week. PEHHx 70-99%.	No formal changes just an increased emphasis on pediatric environmental health--was always in course work--now starting to weave more environmental issues in all courses and highlight environmental issues more comprehensive	Some success with asthma patients and parents (agree to smoke outside). Presented PEH to school nurses at a conference
	Overall Impact: Very helpful resource. Terrific. Shared with students. Students much more willing to recognize the environment and how it contributes to child's illnesses. Gave participants tools to use.								

Table 4.11
NEEF Faculty Champion Telephone Interview Responses at Six Months

	Position	Target Audiences	Pediatric Environmental Health (PEH) Integration	PEH Topics Covered	Time	Clinical/Rotation Experience	Practice Setting Faculty	Development of Policies/Protocols/Procedures	Institutional Changes - Strategy Examples
				Continued					
12	Director of Pediatric Residency Program; Division of General Pediatrics.	Residents and medical students. Also performs lectures at conferences and at continuity clinic for parents.	During rotation at continuity clinic (1/2 day a week). Noon lectures (3-4 a year on PEH). PEH topic discussion in didactic.	General PEH topics	20 hrs/year	Yes. Increased PEH questions in well child forms. Planning increased work in community settings including a lead clinic and performing home visits	Works as pediatrician 10 hrs/week in intercity clinic. PEHHx 70-99%	Not yet in faculty setting--changed well child forms in clinic	Institutional change at clinic--changed practice to make routine changes in well child forms and assessment. Changes still in process--residents now write in PEH questions in history forms--hoping to eventually get forms changed on institutional level
	Overall Impact: I have found it useful--don't have a lot of time but found ways to incorporate in settings and reminded myself of the importance to remember to ask and consider pediatric environmental health in assessment.								
13	Associate Dean; Nightingale Professor of Nursing; Dept of Nursing	Graduate and undergraduate nursing students. Also physicians, public health graduate students	Pediatric Nursing Course and Community Health (undergraduate). Option independent study--review of literature on PEH; Intro to Occupational Health course (graduate). Toxicology (graduate).	PN/CH: asthma, lead, history-taking; Tox: ATSDR case studies on PEH history-taking, lead exposure, and nitrate intoxication	Undergr: 6 hrs/total; grad: 9 hrs/total	Pediatric clinical experience (undergr)--not sure to what extent envir health is discussed	No	No--and no plans to develop.	Cannot provide examples at this point
	Overall Impact: Has shared materials with faculty so everyone can carry out PEH education. "Clearinghouse of materials".								

Table 4.11
NEEF Faculty Champion Telephone Interview Responses at Six Months

	Position	Target Audiences	Pediatric Environmental Health (PEH) Integration	PEH Topics Covered	Time	Clinical/Rotation Experience	Practice Setting Faculty	Development of Policies/Protocols/Procedures	Institutional Changes - Strategy Examples
				Continued					
14	Assistant Professor, Department of General Pediatrics	Med students and residents	Lead and asthma already covered	Lead, asthma	Unable to estimate	No formal PEH content in rotations	30 hrs/wk as pediatrician in group practice; 5 hrs/wk performing resident clinical education. PEHHx 1-39% (especially asthma patients)	No protocols/procedure/ policy development and no plans to develop.	Asthma forms developed on practice level. Uses pediatric environmental health information when counseling parents on use of sunscreen and has seen changes in parents. Has also joined up with an ozone alert initiative--where counseling provided to parents and info on actions to take on high risk behaviors
	Overall Impact: On a personal level with practice easier to make changes than on an institutional level. Plans to incorporate an environmental health lecture by next year covering NEEF topics that were covered in workshop.								
15	Section Chief-Allergy and Immunology, Pediatrics; Professor	Medical students, residents, and fellows	Med students: PEH lecture; Residents PEH in grand rounds.	Medical Students: overall importance of how environment affects children, developmental neurology, lead, mercury, ultraviolet light, case study on carbon monoxide poisoning	Med Students: 1 hr/year; Residents: 1 hr/year	Not formally	14 hrs/week hospital based clinic in pediatric allergy and immunology. PEHHx 100% of new patients	Not yet	Institution in final stages of changing to a completely smoke-free campus. At this year's golf tournament in the spring, trying to get sunburn as the hot medical topic (each year a medical news topic is selected)
	Overall Impact: Getting some mention of PEH into medical curricula is a major accomplishment considering the difficulty to change curriculum. Wants to speak with pediatric house staff eventually. Has discussed incorporating PEH with faculty in the dental school.								

Table 4.11
NEEF Faculty Champion Telephone Interview Responses at Six Months

	Position	Target Audiences	Pediatric Environmental Health (PEH) Integration	PEH Topics Covered	Time	Clinical/Rotation Experience	Practice Setting Faculty	Development of Policies/Protocols/Procedures	Institutional Changes - Strategy Examples
				Continued					
16	Fellow of Developmental and Behavioral Pediatrics; Child Development Unit	Residents (pediatric) and some med students, also speaks at faculty conferences	Ped residents: lunch and learn & grand rounds. Now PEH residency offered where residents perform all NEEF modules, and those who are signed up for the PEH residency perform pre and post tests (at the end of 3 years)	All NEEF topics	Ped residents: 6 hrs/year (for 3 years)	In primary care clinics, residents use intake forms and check lists from NEEF (lead, asthma, and UV were already being performed)	Volunteers 1day a month at Spanish speaking free clinic--pediatrician. PEHHx 100%	Protocols: PEH forms have been added to clinics--envir checklists added. No procedures developed. Policies: Pediatric residents required to perform the 18 PEH lunch and learns; added option to achieve the pediatric environmental health educator certification	In July, comparison of two practices, evaluating changes in of parental behaviors
	Overall Impact: Very significant; Much easier to recruit speakers--have slides for them to use; more comprehensive--adds structure. Have NEEF materials to train others--increased motivation of residents to get pediatric envir education certification to add to Curricula Vitae.								
17	Associate Director, Dept of Peds	Faculty, residents, nurses, NPs, school nurses, med students	Med students: Practice of Medicine--ER I	Med students: PEHHx tools	Med Students: 3 hrs a year	Exposure to patients with lead poisoning, case discussion of mercury	Works 30 hrs/week at: Pediatric Residents Clinic, faculty group practice, and regional maternal child health clinic at community department of health. PEHHx 25% of patients	No policies or procedures. Protocols: distributed handouts to use in screening questionnaire. Asthma protocol already in place, but has modified to clinic needs depending on community served. SHS, allergies, lead education performed	Has been a change in education to students. 1) uniform change so all med students perform PEHHx, 2) community clinic setting--doctor attitudes have broadened, 3) school health nurses received a presentation during a seminar to possibly change others
	Overall Impact: Definitely made a change, people know to contact participant for questions--able to teach others.								

Table 4.11
NEEF Faculty Champion Telephone Interview Responses at Six Months

	Position	Target Audiences	Pediatric Environmental Health (PEH) Integration	PEH Topics Covered	Time	Clinical/Rotation Experience	Practice Setting Faculty	Development of Policies/Protocols/Procedures	Institutional Changes - Strategy Examples
				Continued					
18	School of Nursing, Clinical Professor	Nursing students: grad and undergrad, PNP	Health assessment and management (HAM) course (undergrad); PNP online module on PEH	HAM: asthma, lead, some mercury	PNP: 4 hrs/sem; undergrad: unsure	Asthma health, lead experiences. Placed in pulmonary asthma clinic and in community schools	No	No—currently on grant year. Plan to develop curricula revisions over the summer. Power points useful, distributed to other faculty members	Grant year--unable to answer yet. Reviewing grant administration.
	Overall Impact: States the faculty champion workshop was very medical focused. More info on helping with managing patients with making envir modifications (i.e., changing carpeting, etc.). States nursing strategies were lacking. Thinks it would be useful to gather nurses again about how to change parent behaviors and strategies to pass onto students (instead of just diagnosis and treatment). More focus on behavior changes (i.e. asthma patient--how to manage client to keep out of emergency department, etc.).								
19	Associate Prof of Pediatrics; Section Head, General Pediatrics	Mainly residents, some med students; community physicians	Med students: receive info on lead poisoning. residents: rotation in community health & didactic	Med Students: lead poisoning; residents: general topics--lead, asthma	Residents: 6 hr/month in rotation & 4 hr/year of didactic	County health departments practice asthma and nutritional assessments	Works full time in general pediatric setting in hospital. PEHHx specifically on lead 100%	Not yet	Institutional: creation of center of environmental health in institution. Practice: has performed two lectures to increase pediatric environmental health awareness of residents and medical students.
	Overall Impact: Packet information great, power points great resource, uses green book and colleges use it as well. Increased participant's awareness. As Section Chief of eight other physicians, has been able to increase their PEH awareness as well. Plans to develop center of environmental health to provide a clearinghouse of information--to be a resource center to parents and physicians on all environmental issues.								

Table 4.11
NEEF Faculty Champion Telephone Interview Responses at Six Months

	Position	Target Audiences	Pediatric Environmental Health (PEH) Integration	PEH Topics Covered	Time	Clinical/Rotation Experience	Practice Setting Faculty	Development of Policies/Protocols/Procedures	Institutional Changes - Strategy Examples
	Continued								
20	Assistant Professor PNP program	Grad nursing students (PNP students)	Health Promotion. Envir issues are also woven into other courses	HP: envir safety, UV, asthma, indoor/outdoor pollution, lead, pesticides, mercury	2 hrs/sem	Yes	Works 8 hrs/week as PNP in Ped Neurology clinic. PEHHx 100%	No protocols or procedures. Policies: enhanced teaching and practice--would like to present to pediatric grand rounds which could lead to policy and institutional changes. (no policy change yet)	No examples
	Overall Impact: Incorporated PEH into courses, practice, outreach (with Hispanic moms, at health fairs), and Health Promotion course.								
21	Dept of Peds, Pulmonary medicine	Med students, residents, eventually fellows	Not formally--topics are currently woven throughout coursework	Lead, mercury, smoke, carbon dioxide, asthma, and other envir topics	Unable to estimate time allotted	Yes	Works 25 hrs/week in hospital at a Ped Pulmonary Clinic. PEHHx 100%	No--states she is new to the institution, no plans in immediate future	A lot of changes with smoking education on second hand smoke since she has started
	Overall Impact: N/A…participant did not attend workshop.								

Table 4.11
NEEF Faculty Champion Telephone Interview Responses at Six Months

	Position	Target Audiences	Pediatric Environmental Health (PEH) Integration	PEH Topics Covered	Time	Clinical/Rotation Experience	Practice Setting Faculty	Development of Policies/Protocols/Procedures	Institutional Changes - Strategy Examples
Continued									
22	Adjunct Faculty--"Voluntary Physicians", County Dept. of Peds; Assoc Prof--Division of Community Health Services; Maternal and Child Health Program; SPH	All master and doctoral public health students--includes physicians, dentists, nurses, nursing students, nutritionists; residents, med students, attendees	Maternal Child Health Outcomes and Measures (MCHOM) course; grand rounds on envir health topics	MCHOM: all topics from NEETF workshop, and maternal exposures and what happens at an embryonic development level when exposures occur	MCHOM: 10 hrs/sem	Performs grand rounds for attendees, residents, and 4th year med student on PEH topics	Works 4 hrs/wk in Ped envir health specialty clinic as physician consult for patients exposed to toxins. PEHHx 100%	Started to develop--not implemented--Protocol to recommend PEH histories of all children, and how to conduct PEH history, what cues in health history to follow up with envir history questions, performing differential diagnosis	States she is not at liberty to answer that
	Overall Impact: Found resources useful at school of public health and in practice setting in increasing awareness. Over time efforts to integrate PEH into curricula and practice need to be sustained and maintained.								
23	Project Director; Global Health Initial (mobile clinic), College of Nursing	Undergrad and masters level nursing students	Population Based Concepts (PBC) (graduate-level course)	PBC: PEHHx form, all NEEF topics, vulnerabilities of children	PNP: 3 hrs total; other mast: 1/2 hour total; undergrad: not sure	Not formally--PNP have clinical at community based practice sites--PEH content depends on site and preceptor. mobile health clinic when many ped cases seen and NEETF envir health modified form to be used. Not sure about undergrad or other master nursing students	No	Nothing developed yet. Plan on developing policy to require PEHHx performed on all patients when mobile health clinic developed	No examples
	Overall Impact: Developing the mobile health practice--PEH will be considered. Increased awareness of need and importance of PEHHx. Now devote 1/2 hour on PEH to all master nursing students which was not performed before workshop. PNP program, looking to concentrate material to one session instead of bits and pieces throughout coursework. Talked with faculty head of Bachelor of Science in Nursing (BSN) program and introduced NEEF material--states BSN program now uses modified NEEF PEHHx form. Also states she spoke with PNP coordinator about PEHHx form.								

Table 4.11
NEEF Faculty Champion Telephone Interview Responses at Six Months

	Position	Target Audiences	Pediatric Environmental Health (PEH) Integration	PEH Topics Covered	Time	Clinical/Rotation Experience	Practice Setting Faculty	Development of Policies/Protocols/Procedures	Institutional Changes - Strategy Examples
24	Associate Professor of General Pediatrics and Adolescent Medicine	Residents, some med students	Primary Care Clinic Conference (PCCC) (residents)	PCCC: smoking exposure, UV exposure, smoking cessation, poisoning, asthma, other envir exposures	4 hr/year PEH at PCCC	Not formally	No, professor in hypertension clinic works 10 hrs/week. performs assessment of smoke exposure on 70-99% of patients and diet and exercise assessment 100%	No--just added teaching material	States this is a nebulous question and not a worthwhile question. The workshop group is diverse so this question is not reasonable or meaningful. States all have learned something from the workshop
	Overall Impact: Found it useful--but participant states is not an envir health person and not able to implement fully because a lot of other items are on plate right now.								

Table 4.12
NEEF Faculty Champions Telephone Interview Responses at 12 Months

	Position Change	Target Audiences Changes	Pediatric Environmental Health (PEH) Integration Changes	PEH Topics Covered Changes	Time Change	Clinical/Rotation Experiences Changes	Practice Setting Faculty Changes	Development of Policy/Protocol/Procedures Changes	Institutional/Practice Changes - Strategy Examples
1	No Change	No Change	No Change	Increased awareness of pesticides	8-hr didactic; 6-hr clinical per semester	No Change	No Change	No Change	Discuss the hazards of passive smoking with parent at every clinic visit
	Overall Impact:	Huge impact, gave the asthma screening tools to the asthma instructors. These issues are now a part of the curricula where they were not in the past. Other avenues of education on environmental health risks for adults through another professor.							
2	No Change	Expanded to include community health nurses and public health students	Adding PEH courses Fall 2007	Added asthma	10 Clinical hours	Incorporated EH questions into electronic health record	No Change	Yes. Four questions now routinely included on PEH in patient record. Organizing special interest groups	Presented a series in the fall on PEH, where a knowledge test was administered before and after. They showed that there was a high level of knowledge gained through the workshop. She also had the participants follow up with an email giving examples of how they incorporated this knowledge into practice, and again found a high rate of incorporation. She also evaluated the satisfaction of the participants with the workshop
	Overall Impact:	Huge impact in terms of the number of people she has been able to reach and inform on the topics. People were impressed to hear that she was a "Faculty Champion" and associated with the initiative, and found that held a lot of weight among her colleagues and also in the general community. She suggested making the mercury presentation a bit different. The power point presentation and NEEF forms were incredibly useful. Participant mentioned several times that she accesses the NEEF web page frequently and finds it a valuable resource, particularly the pesticide information.							

Table 4.12
NEEF Faculty Champions Telephone Interview Responses at 12 Months

	Position Change	Target Audiences Changes	Pediatric Environmental Health (PEH) Integration Changes	PEH Topics Covered Changes	Time Change	Clinical/Rotation Experiences Changes	Practice Setting Faculty Changes	Development of Policy/Protocol/Procedures Changes	Institutional/Practice Changes - Strategy Examples
Continued									
3	No Change	No Change	Plans to add lecture on child workers in Spring 2008	No Change	No Change	No Change	No Change	No Change	Spoke at National AAOHN conference on PEH, provided participants NEEF website information. States participants were excited for the NEEF resources and mentioned potential/intentions to add to their respective clinics
	Overall Impact:	Graduate students to be placed in Latino community clinic. Will continue to provide guest lectures.							
4	No Change	No Change	Developing a web class to augment the course content given, for health promo class. PEH History and Pediatric Health Assessment, are both required courses	With the web content, all of the topics covered in the train-the-trainer workshop will be covered	3 hours per semester (next year)	Students now have asthma rotation during fourth year	No Change	No Change	Pediatric Asthma Management, incorporating this information into the clinic and conveying it to the parents and families who come through the door
	Overall Impact:	Found NEEF experience increased her awareness and education and increased integration. Due to the lack of time she had to look for this information on her own. She would like to see that information exchange continue. She felt that the follow-up was appropriate for the measures that needed to be collected from the Faculty Champions.							

Table 4.12
NEEF Faculty Champions Telephone Interview Responses at 12 Months

	Position Change	Target Audiences Changes	Pediatric Environmental Health (PEH) Integration Changes	PEH Topics Covered Changes	Time Change	Clinical/Rotation Experiences Changes	Practice Setting Faculty Changes	Development of Policy/Protocol/Procedures Changes	Institutional/Practice Changes - Strategy Examples
					Continued				
5	No Change	No Change	More integration of NEEF material	No Change	No Change	No Change	No but will be doing some work with Residents Fall 2007	No but will be developing policy and procedures on influenza specifically with biological agents	Nothing new
	Overall Impact:	Workshop provided valuable tools to refine teaching. She is looked upon as resident expert. More involved in community work.							
6	No Change	No Change	Provided CE for Dept of State to MD, NP, PAs in Vienna, Singapore, and Miami incorporating EH content	No Change	No Change	No Change	None now as pediatricians left and took patients with them	None yet but have plans to have students incorporate PEHHx with clinic patients	None
	Overall Impact:	Feels like she is just getting started. Would like to have info about what other Faculty Champions have accomplished.							
7	No Change	No Change	No Change (but plan to offer clinical PEH in 4/08)	Not Applicable	Not Applicable	Not Applicable	No Change	No Change	Has given two presentations on PEH topics to NPs
	Overall Impact:	No change but plans to develop curriculum changes in School of Nursing, Pediatrics, and Radiology Tech Program. Has contacted American Association of Physician Assistants (AAPA) to endorse NEEF initiative and would be happy to mentor future PAs.							

Table 4.12
NEEF Faculty Champions Telephone Interview Responses at 12 Months

	Position Change	Target Audiences Changes	Pediatric Environmental Health (PEH) Integration Changes	PEH Topics Covered Changes	Time Change	Clinical/Rotation Experiences Changes	Practice Setting Faculty Changes	Development of Policy/Protocol/Procedures Changes	Institutional/Practice Changes - Strategy Examples
Continued									
8	No Change	No Change	Creating smoking cessation room in clinic	No Change	No Change	No Change	No Change	Developed follow-up form for patients with elevated blood lead levels. Developed asthma pediatric envir health history form	Form for asthma and smoking cessation /second hand as previously described
	Overall Impact:	Program helped introduce PEH topics, but it is a challenge to sustain initiative in work environment. More follow-up from NEEF for implementing institutional change would be helpful.							
9	No Change	No Change	Added PEH to existing case studies	No Change	Integrated - too difficult to estimate	No Change	No Change	No Change	Question about household smoking added to intake form
	Overall Impact:	Been able to integrate Pediatric EH throughout the Nurse Practitioner curricula and she's introducing it into the Family Nurse Practitioner curricula. She is excited to continue her partnership with another MD, and they have plans to address new graduates who are beginning their internships, so they are able to "plant the seed" with them as well. She is scheduled to present to the faculty at large during a faculty developments series. She keeps using NEEF forms and other screening tools to assess children as part of annual health exams. She found NEEF to be very supportive, and found the materials we provided to be a big help. NEEF enabled her to share the information not only with her students, but with others in the community as well. She feels it's important for preceptors to have the same tools the students have, and they need to be targeted as well, since they are setting the example for the students. She also found the power point presentations to be very helpful.							
10	No Change	No Change but will be added to the Pediatric grand rounds	Developed a booklet for each clinic site	Booklet will include PEH topics which residents will review	No Change	No Change	No Change	Not Applicable	None
	Overall Impact:	More of a model now for residents to ask PEH questions. Higher level of confidence gained about PEH from NEEF experience. Plan to go to community hospital to speak about PEH issues.							

Table 4.12
NEEF Faculty Champions Telephone Interview Responses at 12 Months

	Position Change	Target Audiences Changes	Pediatric Environmental Health (PEH) Integration Changes	PEH Topics Covered Changes	Time Change	Clinical/Rotation Experiences Changes	Practice Setting Faculty Changes	Development of Policy/Protocol/Procedures Changes	Institutional/Practice Changes - Strategy Examples
Continued									
11	No Change	No Change but has added some talks to high school about Envir Health (EH)	Started integration of EH to a group of high school students including lab; Has grant pending to fund this summer program	No Change	No Change	No Change	No Change	Not Applicable	None
	Overall Impact:	EH becoming more visible at the School of Nursing. Need to have more of a critical mass of Faculty Champions at a single institution to effect changes.							
12	No Change but less clinical work	No Change	No Change	No Change	No Change	No Change	Now works 25 hours per week in practice setting	No change No plans	Uncertain but "senses there has been a change in how residents ask questions"
	Overall Impact:	Believed workshop was helpful, especially the resources. Felt participants died out and he should have asked for more guidance. Elective resources most helpful.							
13	No Change	No Change	No Change - but gave CME on PEH and covered mercury toxicity	No Change	No Change	No Change	No Change	No Change	None

Table 4.12
NEEF Faculty Champions Telephone Interview Responses at 12 Months

	Position Change	Target Audiences Changes	Pediatric Environmental Health (PEH) Integration Changes	PEH Topics Covered Changes	Time Change	Clinical/Rotation Experiences Changes	Practice Setting Faculty Changes	Development of Policy/Protocol/Procedures Changes	Institutional/Practice Changes - Strategy Examples
				Continued					
	Overall Impact:	Has made small inroads in the medical school and has put EH into all Continuing Medical Education (CME) courses. Found it difficult to get peers engaged. Updates/emails helpful. Suggested providing material to journalists' interests.							
14	This position now held by a new staff member	No Change	Will be using NEEF materials in all primary care clinics by next year. Increase in EH in medical school curriculum	No Change	No Change	No Change	Now works in primary care clinics and outpatient clinic 30-40 hours/week. Incorporated PEHHx into patient interviews	Working on developing procedures. Lecture series is ongoing	Pending study on asthma and indoor air quality
	Overall Impact:	Did not attend workshop but will continue to integrate content.							
15	Yes- more teaching	No Change	No Change	PEH topics	No Change	No Change	No Change	No Change	None
	Overall Impact:	She found pre/post test helpful with the groups. She would like to continue with the program because everyone learns so much.							
16	Yes- 7/07 Chair of General Pediatrics Clinic	Uncertain as of yet	Uncertain as of yet	Uncertain as of yet	Uncertain as of yet	Uncertain as of yet	Uncertain as of yet	None	Was able to raise awareness about smoking cessation by putting materials in lobbies Also introduced lead testing
	Overall Impact:	Heightened awareness of PEH. She is beginning to introduce EH issues such as lead and work community leaders to address this. NEEF materials very helpful.							

Table 4.12
NEEF Faculty Champions Telephone Interview Responses at 12 Months

	Position Change	Target Audiences Changes	Pediatric Environmental Health (PEH) Integration Changes	PEH Topics Covered Changes	Time Change	Clinical/Rotation Experiences Changes	Practice Setting Faculty Changes	Development of Policy/Protocol/Procedures Changes	Institutional/Practice Changes - Strategy Examples
	Continued								
17	No Change	No Change	No Change	No Change	No Change	No Change	No Change	Not able to but has shared resources and developed list of web sites	Has been able to distribute info on sun exposure
	Overall Impact:	Successfully included EH content into required course and developed networking with other Nurse Practitioners.							
18	New position as Assc Dir of Family Health at State DHHS	No Change She has written grant for funding to work with community groups on environmental toxins	No Change	No Change	No Change	No Change	Clinic closed	Will work with stakeholders in new position on developing legislation on envir toxins exposure	None
	Overall Impact:	Was able to incorporate PEH into curricula and use NEEF to develop funding initiatives.							
19	No Change	Now also teaches NP	No Change	No Change	No Change	No Change	No Change	No Change but able to get EH content into required course	Working to develop mobile health unit for primary care for children
	Overall Impact:	After the train-the-trainer workshop, there were 3 areas where she injected the ideas and materials: 1) For the Pediatric Nurse Practitioner Program she introduced that group to our website and resources and they made the links available to students, also they added 2 or 3 questions based on the information from the NEEF website to the exam. 2) She held a session for the population focused care course relating the mobile health unit to the introductory EH information. 3) In her other teaching work she taught a primary health care course where she posted all of the links for the information and because these students are masters' students, they are expected to keep learning from the information. She felt like she made a lot of headway into these areas.							

Table 4.12 NEEF Faculty Champions Telephone Interview Responses at 12 Months									
	Position Change	**Target Audiences Changes**	**Pediatric Environmental Health (PEH) Integration Changes**	**PEH Topics Covered Changes**	**Time Change**	**Clinical/Rotation Experiences Changes**	**Practice Setting Faculty Changes**	**Development of Policy/Protocol/Procedures Changes**	**Institutional/Practice Changes - Strategy Examples**
Continued									
20	No Change	No Change	No Change	No Change	No Change	No Change	In the clinics she now asks 70-90% of patients EH questions	None	No Change
	Overall Impact:	Felt the power point slides were very helpful in teaching and all NEEF materials were good.							

assessment and changes in forms to include this content, developing smoking cessation programs, and more integration of pediatric and environmental health issues into overall curriculum and clinical rotations.

Data from the second telephone interview asked about changes or new events or integrations that had occurred since the previous telephone interview. Faculty Champions continued to add increased pediatric/environmental health content into lectures and into courses. Most indicated no changes in the amount of time devoted to the content, clinical rotation integration of environmental health, or faculty practice. These participants stated patient care forms or screenings had been changed to include environmental health questions. Additional institutional changes indicated development of smoking cessation programs and presentation of materials on environmental health to increase awareness.

Overall Impact

Faculty Champions indicated the overall impact of the training (Tables 4.11 and 4.12) was enormous. Examples included:

- Sustained changes in curriculum,
- Distribution of NEEF materials to faculty and students was very helpful,
- Presentations at National, state, and local conferences and publications reaching national audiences,
- Changes in students regarding integration of pediatric and environmental health emphasis into their learning,
- Discussions with community and policy makers about environmental health toxins to help make changes, and
- Increased Faculty Champions knowledge about pediatric/environmental health and environmental toxins.

CHAPTER V

Discussion

Increase in Pediatric/Environmental Health Knowledge

The NEEF Faculty Champions train-the-trainer workshop was highly effective in incorporating pediatric/environmental health (P/EH) information into the education and practice of medical and nursing professionals with a significant (P = < .0001) improvement in participants' knowledge of pediatric/environmental health which was sustained over at least a three month period. The average exam score of 52 percent in the first exam prior to the Faculty Champion's program demonstrates the lack of P/EH knowledge health professionals have in this content area and confirms that there is a lack of P/EH content in medical and nursing school curricula, verifying the need for P/EH training in curricula (Balbus et al., 2006; Kilpatrick et al., 2002; McCurdy et al., 2004; Roberts & Gitterman, 2003; Schenk et al., 1996; Woolf & Cimino, 2001). The lack of P/EH content in medical and nursing school curricula has been well documented (Balbus et al., 2006; Bellack et al., 1997; Graber et al., 1995; Hays et al., 2006; Kilpatrick et al., 2002; Liebman & Harper, 2001; McCurdy et al., 2004; Mushham et al., 1996; NEEF, 2004; Roberts & Gitterman, 2003; Roberts & Reigart, 2001; Schenk et al., 1996). An increase in knowledge is the essential first step in incorporating P/EH information into the education and practice of medical and nursing professionals.

Results from the competency self-assessments and telephone interviews demonstrated the gained knowledge in pediatric/environmental health based on changes in participants' integration of P/EH into pediatric practice. Involvement in the Faculty Champion's workshop also resulted in incorporation of P/EH into medical and nursing curricula at the participants respective settings. Areas participants reported as being the most competent, from competency data assessments, included taking a P/EH history and resource utilization for EH hazards. These topics are more basic components of P/EH and were a main focus of the workshop. Participants reported making referrals and involvement with the community as moderately competent, with reporting incidents with regulatory requirements as least competent. The ability to properly detect environmental toxin-related diseases is more complex and is followed up by making referrals and reporting incidents, which may explain decreased comfort of practitioners in these areas, especially considering many participants have limited time in practice settings. Additionally, due to hectic work schedules, some participants may not take time to become involved with their community. Participants also reported minimal policy/procedure change in their respective settings, which was not covered in depth during the one-day workshop. This demonstrates an increased need for training of Faculty Champions and their trainees regarding policy change and regulatory issues.

It must also be considered that these data are from self-assessments, which, due to its subjective nature, is a less accurate measure and assessment. Audits of Faculty Champions patient charts and institutional policy manuals may have revealed different findings or confirmed self-assessment data. Overall, the use of Faculty Champions as vehicles to integrate and distribute the message through a variety of approaches over the

course of a year was appropriate and extremely effective, and consistent with previous research findings (Goldman et al., 1999; Lindberg, 1998; Sachdeva, 2000; Schwartz et al., 1995).

Questions 6, 10, 11, and 19 were answered incorrectly by over half of the participants in all three examinations. Question six regarded components of routine environmental health histories for most infants, children, and teenagers. Questions 10 and 11 both focused on environmental tobacco smoke. Question 19 addressed control of dust mite triggers. Incorrectly answering questions 10 and 11 is surprising given that environmental tobacco smoke is a known pollutant. Incorrect responses may suggest a lack of initial knowledge of these topics and a need for increased focus on these areas in future workshops. Also, the wording and testing of the questions may need reexamination.

To assist Faculty Champions with knowledge retention, it may be useful to hold a second face-to-face meeting with participants to review information and address any questions regarding the NEEF material and topics. Additionally, encouraging participants to train students and other health professionals on all NEEF topics, not just a few power points selected by Faculty Champions, may assist with knowledge sustainability of all topics. Ongoing contact, possibly via teleconferences, throughout the year following the workshop may assist with sustained knowledge of Faculty Champions on all NEEF topics.

Integration of Pediatric/Environmental Health in Practice and Curricula

Faculty Champions completed an action plan within one week of the workshop training and provided numerous strategies each believed they could accomplish regarding

training other health professionals at their institutions and methods to integrate pediatric/environmental health content. Review of the action plans resulted in 17 themes for training and 15 themes for integration. In order to track Faculty Champions' progress in reaching their predetermined action plans, participants provided data throughout the year through completion of the baseline and two ongoing competency data assessments and telephone interviews. With exception to the action plan strategy—discussion with certification boards about incorporating pediatric/environmental health content questions on examinations—all strategies were achieved, demonstrating the remarkable effort and commitment by the Faculty Champions in achieving their goals consistent with Goldman et al. (1999) and Schwartz et al. (1995). No significant difference between nursing and medical faculty action plans or competency data assessments were noted. This may be due to the fact that the majority of the nurses (eight out of 13) were nurse practitioners, where they provide a similar service as physicians.

Overall, the Faculty Champions reported training 1,517 additional health professionals, well over NEEF's goal of 280 (i.e., 10 per champion). Additionally, participants reporting making 77 pediatric/environmental health patient referrals in the 8 months following the workshop. Mean self-assessment scores of changes in practice remained relatively constant, ranging from 2.29 to 2.40, throughout the program. Kilpatrick et al. (2002) found that, although pediatricians acknowledged the importance of environmental exposures in children's health, respondents of their survey reported low self-efficacy regarding environmental history-taking, discussing environmental exposures with parents, and finding diagnosis and treatment resources related to environmental exposures. The lack of sustained improvement in scores in this study may be due to

minimal time spent in practice settings by many Faculty Champions. This finding could suggest increased need for training Faculty Champions in incorporating P/EH into their own practice, including practical experience, such as required clinical experiences in nursing and medical school programs where students practice pediatric environmental health history-taking skills.

Mean curricula scores of the competency data assessments improved about one-half of a point on a scale of one to four between the one month post workshop and eight months post workshop assessments. This reflects consistency in self-scaling and demonstrates the reliability of participant responses over time. Considering that the workshop training occurred over one day, it is not surprising that the perceived improvement is slight. This initial training may spark further more in-depth knowledge acquisition on an individual basis. Evaluation of each specific competency showed much greater effective gains in both self-assessment in practice and curriculum assessment except in the competency of reporting incidents for regulatory requirement. It is unclear as to why this occurred but there could have been uncertainty about what to report or that specific incidents did not present themselves. It is also possible that respondents forgot some of the incidents they reported, or did not want to get involved with regulatory issues. This may also suggest an increased need for training regarding regulatory requirements and reporting incidents. Following the conclusion of the one year Faculty Champions project, NEEF continues to maintain contact and ongoing support to participants. It would benefit participants to receive information on how to report incidents and regulatory requirements.

Effective Strategies

The use of competencies are intended to assist in structuring the training experience, achieving consensus with respect to expectations of fellows and faculty, providing opportunities for fellows to assess their own needs or gaps in training, and identifying the expertise of fellowship graduates to potential employers (Etzel et al., 2003). The train-the-trainer workshop attended by the Faculty Champions was an effective strategy in initiating the program, educating participants, providing tools and resources to champions, and developing individual goals and competencies. In the workshop evaluation, the sessions were rated Highly Effective by the participants, many of whom have had little if any exposure to the content provided. Based on participant comments, the workshops also increased the motivation of the Faculty Champions to participate in the initiative. It is likely that Faculty Champions were interested in learning new information and motivated to participate in the initiative and advocate for change in their respective settings, consistent with previous studies (Goldman et al., 1999; Schwartz et al., 1995).

The NEEF tools provided to Faculty Champions were an effective strategy in getting P/EH information to healthcare professionals and students, and previous research has demonstrated the interest of faculty in medical and nursing schools in increasing P/EH content in coursework (Bellack et al., 1997; Graber et al., 1995; Musham et al., 1996). Provision of tools helped to motivate faculty and facilitate the integration of P/EH topics into curricula. In the competency assessment responses, Faculty Champions reported presenting slides provided to them by NEEF after the training workshop in a variety of ways including lecture presentations to nursing and medical students, noon

lunch sessions with residents and medical students, grand rounds presentations, discussions with personnel at community health departments and child care centers, professional conferences, and in online courses. Participants also reported using NEEF tools to increase efforts in pediatric/environmental health history-taking, including use of the NEEF history-taking forms in clinical settings and in personal practice, and also sharing history-taking forms with other faculty and health professionals. During the telephone interviews, participants commonly stated the usefulness of the NEEF materials provided during the workshop as extremely valuable resources. Without these available tools, not all participants would have had the time or expertise necessary to develop these comprehensive tools and forms. The tools and forms also were useful to faculty at participating institutions when screening for potential environmental exposures.

Additional strategies utilized by Faculty Champions reported from competency assessments and telephone interviews regarding integration of pediatric/environmental health content included several thematic areas. For themes related to curricula content and practicum experiences, lecture content was added to both graduate and undergraduate nursing and medical school courses and more P/EH content was added into clinical rotations. This is important because it can help to increase knowledge and practice integration of P/EH for those learning about the importance of environmental toxins. This, in turn, provides a strong foundation for sustained integration of P/EH content.

Previous research regarding the incorporation of P/EH content into curricula states an important goal is to provide students with an organizing framework for integrating environmental health into clinical practice and an innovative tool for understanding community-level components of public health (Hays et al., 2006). Studies

have shown that primary-care residency faculty trained in environmental/occupational health have increased the environmental/occupational health education offered at their schools, and after physicians attended an interactive asthma seminar, the children they saw experienced fewer hospitalizations and fewer subsequent emergency department visits (Frazier et al., 1999; Clark et al., 2000). Previous studies have shown that Faculty Champions can help to implement curricula, influence the career choices of students, introduce topics that serve as an impetus for change, advocate for research funding, and ensure the material is taught in their classes (Goldman et al., 1999; Schwartz et al., 1995). Furthermore, studies support that faculty leadership is key to integrating prevention-related topics (Lindberg, 1998; Sachdeva, 2000; Skochelak et al., 2001; Susman & Pascoe, 2001).

Themes related to increasing efforts for P/EH history-taking which resulted in changing intake/interview forms with specific questions were also derived from the Faculty Champions reporting. Emphasizing these elements clearly would provide a structured approach to addressing P/EH when performing patient assessments thereby encouraging increased integration and formalizing this content into practice. Numerous studies have found that practitioners do not perform comprehensive environmental health histories, and if they do, many practitioners focus on only one or two specific exposures (Kilpatrick et al., 2002; McCurdy et al., 2004; Roberts & Gitterman, 2003; Roberts & Reigart, 2001; Woolf & Cimino, 2001).

Themes related to community outreach and information dissemination resulted in publications regarding P/EH topics and giving lectures at professional organizational meetings, conferences, child care centers, and health departments regarding P/EH. One

participant reported posting P/EH information on the popular website You Tube. This is valuable in getting the message out regarding the importance of P/EH to a large dynamic audience. Although assessing the impact of children's exposures to environmental toxins is a subspecialty in clinical pediatrics, pediatric health professionals in practice may not be familiar with critical information necessary to diagnose and manage environmental toxic exposures in children (Woolf & Cimino, 2001). Primary care providers must have resources available to competently provide initial management to children, families, and community groups who have had potential exposure to toxins (Burns, Dunn, & Sattler, 2002). By providing these topics at national conferences and meetings, larger audiences can be reached, helping to decrease the current knowledge gap of P/EH. Giving presentations at health departments and child care centers and the posting of information on a popular website reaches a broader non-medical community.

The theme of development of protocols and procedures resulted in responses such as inclusion of environmental health history-taking forms at institutions and instituting chart audits to evaluate if P/EH histories are being performed. More than one respondent reported developing a smoking cessation program at their facilities. It was reported in the telephone interview responses that the development of policies/procedures was minimal. Nevertheless, Faculty Champions indicated the overall impact of the training was enormous considering the ability of participants to spread the knowledge to a larger audience, begin to influence institutional and curricula changes, distribute NEEF materials to faculty and students, champion for changes with students regarding integration of pediatric and environmental health emphasis into their learning, discuss with community and policy makers about environmental health toxins to help make

changes, and increase personal knowledge about pediatric/environmental health and environmental toxins.

Barriers

Barriers to integration of P/EH practice and institutional changes reported by Faculty Champions included time limitations in practice settings, perceived/actual lack of influence in their institutional and practice settings, barriers to change in institutional and practice settings (i.e., lack of support and knowledge of P/EH by upper management), lack of time to influence change, and lack of training during the workshop regarding initiation of policy and procedural changes in academic and practice settings. In a study by Roberts and Reigart (2001) researchers concluded that data were insufficient to determine that one lecture changed history-taking practices. Increased support and contact from NEEF staff throughout the year following the initial workshop may have kept the initiative and program in the forefront of participants' conscience, and helped maintain motivation to continue to push for changes in their institutions as well as remember to ask comprehensive environmental health histories of all patients. Additionally, inviting at least two faculty members from each discipline at each institution, that is, two nursing and two medical faculty, may give the participants a sense of peer support at their institution and also would increase the likelihood of implementing P/EH content in curricula in both academic programs at a possibly faster rate.

Competency Evaluation

The NEEF Faculty Champions competencies to be achieved were:

1) performing pediatric environmental history-taking;

2) making referrals for preventative/curative interventions for possible environmental health hazards;
3) involvement with community groups/organizations (e.g., PTA, daycare) for environmental health hazards, risk communication;
4) utilization of resources for pediatric environmental hazards; and
5) reporting incidents for regulatory requirements.

The NEEF train-the-trainer workshop curricula introduced Faculty Champions to each competency. Workshop instruction in the first competency related to pediatric environmental history-taking provided the background data, knowledge, and insight that go into making a differential diagnosis and managing environmental exposures, including environmental history-taking using NEEF's environmental history form. As stated previously, statistical analysis of the pretest and posttests indicated the train-the-trainer workshop significantly (P = < .0001) increased participants' knowledge of pediatric/environmental health which sustained over time, and therefore, accomplished competency one. Previous studies have found a lack of consistent and comprehensive environmental health history-taking. A study by Balbus et al. (2006) showed that most respondents in both groups did not frequently diagnose or ask questions about pesticide toxicity on patient histories. Woolf and Cimino (2001) found that although 90 percent of pediatricians and 82 percent of nurses and nurse practitioners stated that they routinely asked about parental occupations, only 35 percent of both groups asked about parental hobbies, 58 percent of the groups asked about smoke detectors in the home, and only 18 percent of nurses and 9 percent of pediatricians queried families about their use of radon detectors. A survey by Kilpatrick et al. (2002) found that fewer than one in five

pediatricians reported having received training in environmental history-taking. The probability of self-reported history-taking varied with the specific exposure, with environmental tobacco smoke and pets most frequently queried about, and asbestos, mercury, formaldehyde, and radon rarely queried about (Kilpatrick et al., 2002). An increase in P/EH knowledge is necessary to accomplish the remaining competencies and is the first step in integrating P/EH into curricula and practice.

Workshop instruction in competencies two, three, and four (making referrals, community involvement, and resource utilization) addressed longer-term and wider concerns for managing environmental exposures. When asked questions by patients, 64 percent of practitioners and 69 percent of nurses felt poorly prepared to answer them (Balbus et al., 2006). Kilpatrick et al. (2002) found that practitioners reported low self-efficacy regarding performing environmental health assessments, finding environmental health disease diagnoses and treatment resources, and discussing environmental exposures with parents. Pediatric medical and nursing education currently lacks the environmental health content necessary to appropriately prepare pediatric health care professionals to prevent, recognize, manage, and treat environmental-exposure-related-disease (McCurdy et al., 2004). Primary care providers must have resources available to competently provide initial management to children, families, and community groups who have had potential exposure to toxins (Burns et al., 2002).

Competency five, reporting cases of exposure to regulatory authorities, can help patients regarding hazard mitigation once detected and also help in surveillance efforts. This is extremely valuable for public health efforts to track environmental exposures, allocate funding, and target programs based on community needs. During the workshop

participants were also introduced to environmental health training tools, referral services, websites, and additional relevant information sources to help them continue to stay abreast of P/EH trends, issues, and hot topics, as well as, share the resources with their trainees. Balbus et al. (2006) found that many practitioners relied on poison control centers for assistance with management of acute cases of environmental toxicities, demonstrating a need for education and training on environmental exposure reporting.

In the competency data assessment forms, Faculty Champions provided baseline and ongoing assessment data about the extent children's environmental health competencies are taught as part of the curricula at their institutions and their own ability to achieve these five competencies. Additionally, the ongoing competency data assessment forms and telephone interviews specifically asked Faculty Champions to identify ways in which they have incorporated pediatric environmental health history-taking into curricula and practice, assessing competencies one through five, and the number of referrals made for preventive and curative interventions. The use of the action plans assisted participants in determining how to best achieve and maintain competencies in their respective settings. Review of the pretests and posttests, competency data assessments, and telephone interview data revealed that all competencies were successfully met by Faculty Champions, and demonstrated that the majority of Faculty Champions utilized similar strategies to achieve their goals. This demonstrates the effectiveness of the NEEF program in integrating P/EH into curricula and practice, and reveals the program and tools provided are valuable resources that should be repeated and distributed to additional institutions.

Reasons for Success and Non-Success

Overall, the NEEF Faculty Champions program was highly successful. A large contribution to the success for the program lies in the previous and ongoing work of NEEF in educating health professionals on environmental health issues. The affiliations already in place at NEEF allowed staff to compile a planning committee of experts in the fields of pediatric and environmental health. The cumulative knowledge regarding previous research and projects by NEEF and other members of the planning committee allowed the committee to determine a best-practices approach to integrating pediatric/environmental health information into the education and practice of medical and nursing professionals. Participants particularly benefited from the tools and resources provided during the workshop, making it extremely easy to share resources with faculty, students, health professionals, and communities in their various roles.

There are a several potential reasons for non-success. Many participants reported no or limited time in practice settings, which may have contributed to a lack of perceived ability to properly perform pediatric environmental health histories as well as proper referral and reporting. A study by Hegmann & Dehn (2006) of physician assistant program directors found that lack of time was a large factor which is detrimental to faculty members' time spent on research activities and publications. Previous studies also found a lack of perceived ability in performing pediatric environmental health histories (Balbus et al., 2006; Kilpatrick et al., 2002; Woolf & Cimino, 2001). Balbus et al. (2006) found that practitioners in their study relied on the poison control center for cases of environmental toxin exposure demonstrating a lack of comfort with P/EH referral and reporting. Participants in a study by Kilpatrick et al. (2002) reported low self-efficacy in

following up on environmental histories also demonstrating a lack of comfort with P/EH referral and reporting. Likewise, some of the Faculty Champions worked only minimally in a faculty setting and may have felt a lack of influence on their parts in their institutional and practice settings. Additionally, the busy schedule of many Faculty Champions may have prevented some of them from fully engaging in the strategies suggested in the workshop to incorporate P/EH in to curricula and practice.

Many Faculty Champions reported barriers to change in institutional and practice settings (i.e., lack of support and knowledge of P/EH by upper management) and stated that change in academic settings is a slow and difficult process. This contradicts previous research which found that upper management positions in universities support a moderate amount of P/EH content in curricula (Bellack et al., 1997; Graber et al., 1995; Mushham et al., 1996). The lack of training during the workshop regarding initiation of policy and procedural changes in academic and practice settings may explain the minimal change of policy and procedures in Faculty Champions' respective settings. Some participants cited insufficient ongoing support post workshop in their telephone interviews. Faculty Champions also may have experienced "project fatigue" after being engaged in this effort for more than a year with virtually only self-motivation to continue their strategies. To combat this incentives could be provided to Faculty Champions such as a modest stipend or an opportunity for a publication. Future programs should include training on policy change and involve at least two representatives from each institution for increased Faculty Champion support. A second face-to-face meeting with participants to share and discuss strategies that work and address questions may also contribute to increased success and sustained knowledge of Faculty Champions following the workshop.

Encouraging Faculty Champions to train students and health professions on all P/EH topics may also help with sustained knowledge following the workshop.

D' Eon & AuYeung (2001) evaluated the use of audio teleconferences to provide follow-up for a train-the-trainer workshop in Saskatchewan, a largely rural province in western Canada. The teleconferences began 6 weeks after the workshop and were held at approximately 6-week intervals, with five conference calls in total (D' Eon & AuYeung, 2001). Each call lasted about 45 minutes (D' Eon & AuYeung, 2001). Participants were interviewed to determine their view of the value of the teleconferences (D' Eon & AuYeung, 2001). Participants reported learning from the teleconferences and feeling more prepared to conduct CME sessions due to their participation in the teleconferences (D' Eon & AuYeung, 2001). Participants missed teleconferences only for extenuating circumstances (e.g., emergency deliveries) (D' Eon & AuYeung, 2001). D' Eon & AuYeung (2001) found that audio teleconferences following train-the-trainer programs allow for and encourage professional discussion that is crucial to changing practices. They are an effective way to incorporate follow-up to train-the-trainer workshops when participants travel great distances to attend (D' Eon & AuYeung, 2001). The use of similar teleconferences in future PEH train-the-trainers may asses with increased practice changes related to P/EH and may also assist Faculty Champions with sustaining knowledge post-workshop.

The original intention of the NEEF program was to follow the ten trainees of participants and have the trainees complete pretests and posttests and ongoing assessments. The hectic schedules of the Faculty Champions, along with the other demands of the program (i.e., ongoing assessments) did not make this feasible. This was

consistent with Burr et al. (2006) findings that out of 193 health care providers attending a train-the-trainer program, only 18 went on to train others. In future projects, it may be useful to select a subsample of 10 faculty champions whose only goal is to train others and conduct examinations and ongoing assessments of their trainees.

Limitations

Because this original study used a pre-experimental design some limitations exist. The lack of a comparison group prevents the ability to determine that the independent variable, the NEEF workshop, caused the dependant variables, knowledge gained, changes in practice, and incorporation of PEH into curricula. The lack of a comparison group also brings the potential for threats to internal validity, such as attrition, history, and maturation. Since the study lasted over a year, these threats are amplified, and also may have contributed to fatigue of participants over time. Lack of institutional support is another limitation. Nevertheless, since the NEEF workshop was conducted in a real-world setting with limited resources, it is inevitable that some limitations exist.

Future Research

Future research should continue to evaluate the effectiveness of intervention programs aimed at increasing the integration of P/EH into curricula and practice. Specifically, this program should be performed at additional institutions, including suggested changes addressing barriers, reasons for non-success, and limitations. Identifying and testing strategies that work is necessary to reach a larger audience in the most effective and cost efficient way. Additionally, future research should evaluate what content is essential in P/EH training programs and evaluate effective ways to change practice and policy in institutional and practice settings. Research could also be

conducted on evaluating whether program content should vary among practitioner types (i.e., nurse, nurse practitioner, physician, physician assistant). Evaluation of different strategies and approaches to program implementation and content should be done for varying geographic locations due to cultural/regional differences.

Policy Implications

Landrigan et al. (2002) estimates that the total annual costs for environmentally attributable childhood diseases in the United States—lead poisoning, asthma, cancer, and developmental disabilities—is $54.9 billion. A concerted effort to prioritize pediatric and environmental health by governmental organizations and foundations is essential in providing the resources and expertise to set policy and provide the tools for teaching pediatric and environmental health to health care providers (McCurdy et al., 2004).

In the 1970s, government efforts to reduce childhood lead poisoning and to monitor birth defects and cancer began (Goldman et al., 2004) as concern for the relationship between children and the environment heightened among health professionals and researchers. In the 1990s, federal efforts to protect children from detrimental health effects of environmental toxins accelerated with the Food Quality Protection Act, the Agency for Toxic Substances and Disease Registry/Environmental Protection Agency Pediatric Environmental Health Specialty Units, and National Institute of Environmental Health Sciences/Environmental Protection Agency Centers of Excellence in Research in Children's Environmental Health (Goldman et al., 2004). Additional and ongoing policy developments regarding the mitigation of environmental toxin exposure to individuals is necessary to preventing the detrimental effects of such hazards.

The President of the Ambulatory Pediatric Association appointed a six-member Fellowship Oversight Committee to guide the development of the fellowship program and to draft competencies for Fellows in Pediatric Environmental Health (Etzel et al., 2003). The committee developed a list of competencies for graduates of Pediatric Environmental Health fellowships (Etzel et al., 2003). These skills were identified as very important for specialists to have for minimal competency in the practice of pediatric environmental health (Etzel et al., 2003). One competency included is "Appreciate the policy implications and formulate recommendations based on clinical and epidemiologic research findings" (Etzel et al., 2003).

This study confirms the need for increased P/EH content in all medical and nursing school programs to help with the identification, appropriate management, and proper reporting of environmental toxin-related diseases. Accrediting programs need to consider P/EH topics as vital knowledge of students and include P/EH content as a requirement of all programs. Likewise, inclusion P/EH on licensure and certification examinations will ensures that this content is covered in academic settings and that this knowledge is viewed as vital.

Considering that industries contribute to the release of environmental toxins into the environment, occupational and environmental health nurses must be coginzent of environmental health issues. Additionally, if proper industrial hygiene is not practiced in the workplace, employees in some industries may unknowingly transport environmental toxins home where their spouse (who may be of childbearing age) and children live. For these reasons, policy changes should be implemented to expand the role of occupational and environmental health nurses to practice in the environmental health arena as well.

Leading nursing organizations, such as American Association of Occupational Health Nurses and American Nurses Association should advocate for and develop position statements supporting this expanded role.

Implications for Occupational and Environmental Health Nursing

Occupational and environmental health nurses (OHNs) have the opportunity to educate employees on pediatric/environmental health issues. OHNs working in industries where environmental toxins could be transmitted to employees' homes have a responsibility to educate staff on the hazard and controls to prevent employees from exposure, as well as methods to prevent carrying the toxin home. Most employees have children, are pregnant, are of childbearing age, or have grandchildren and have vested interests in preventing the detrimental effects of environmental toxins on this vulnerable population. The increased emphasis on health promotion in the workplace provides a forum for occupational and environmental health nurses. OHNs should participate in future NEEF Faculty Champions regarding P/EH to educate themselves and their peers on this important issue.

Conclusion

Despite the importance of the need for health care provider proficiency in evaluating environmental exposures of pediatric patients, pediatric medical and nursing education currently lacks the environmental health content necessary to appropriately prepare pediatric health care professionals to prevent, recognize, manage, and treat environmental-exposure-related disease (McCurdy et al., 2004). The need for improvements in health professionals' environmental health knowledge has been expressed by leading health institutions (NEEF, 2004). Organizations supporting this goal

include the Institute of Medicine, American Medical Association, American Academy of Pediatrics, American College of Preventive Medicine, Ambulatory Pediatric Association, The U.S. Department of Health and Human Services (DHHS) Division of Nursing, and the American Nurses Association (American Academy of Pediatrics Committee on Environmental Health, 2003; American College of Preventive Medicine; 2003; American Nurses Association, 2003; Committee on Environmental Health, 1993; Etzel et al., 2003; NEEF, 2004; Pope & Rall, 1995; Pope et al., 1995; U.S. DHHS, 2002).

The train-the-trainer initiative is considered a highly effective method and should be sustained and modeled in other arenas. Faculty Champions highly exceeded reaching their target training audiences to provide pediatric/environmental health content through lectures, presentations, grand rounds, faculty discussions, and noon conferences. Faculty Champions trained 1,517 trainees, at a rate 5.4 times the set goal of 280. The efforts of the Faculty Champions were extremely effective; however, there seemed to be difficulty in developing policies and procedures in the participants' settings. Strategies to alter this might include offering more assistance following the initial workshop, increasing the cadre of Faculty Champions engaged in each institution to avoid the feeling of isolation to achieve the goal, providing instruction at the workshop on how to develop policies and procedures, and supporting at least one additional face to face meeting so Faculty Champions could share strategies, successes, barriers, and opportunities.

APPENDIX A

National Environmental Education Foundation (NEEF) Planning Committee

NEEF Planning Committee	
Member	**Institution/Association**
Sophie Balk, MD	Albert Einstein College of Medicine, The Children's Hospital at Montefiore
Joel Forman, MD	Mount Sinai Medical Center
Christine Johnson, MD	Naval Medical Center San Diego and Representative, Ambulatory Pediatric Association
Leyla Erk McCurdy, MPhil	National Environmental Education Foundation
Mary Musholt, MSN, PNP	University of Wisconsin-Madison, School of Nursing and Representative, National Association of Pediatric Nurse Practitioners
C. Fay Raines, PhD, RN	University of Alabama in Huntsville, College of Nursing and Representative, American Association of Colleges of Nursing
James Roberts, MD, MPH	Medical University of South Carolina and Representative, American Academy of Pediatrics
Bonnie Rogers, DrPH, COHN-S, FAAN	University of North Carolina at Chapel Hill, School of Public Health
Elaine Rubin, PhD	Association of Academic Health Centers

APPENDIX B

Organizations Endorsing the National Environmental Education Foundation's Health Professionals and Environmental Health Education Position Statement
(as of May 14, 2007)

Ambulatory Pediatric Association
American Academy of Pediatrics
American Association of Colleges of Nursing
American Association of Occupational Health Nurses
American Association of Pesticide Safety Educators
American College of Occupational and Environmental Medicine
American College of Preventive Medicine
American Medical Student Association
American Nurses Association
American Public Health Association
Association of Academic Health Centers
Association of Clinicians for the Underserved
Association of Faculties of Pediatric Nurse Practitioners
Association of Occupational and Environmental Clinics
Center for Children's Health and the Environment at the Mount Sinai School of Medicine
Children's Environmental Health Network
Greater Boston Physicians for Social Responsibility
Institute for Children's Environmental Health
Learning Disabilities Association of America
Migrant Clinicians Network
National Association of Pediatric Nurse Practitioners
National Medical Association
National Nursing Centers Consortium
National Student Nurses Association
Physicians for Social Responsibility
Physician Assistant Education Association
University of Medicine & Dentistry of New Jersey School of Public Health

APPENDIX C

National Environmental Education Foundation
Pretest/Posttest Instrument

_____
Name

Children's Environmental Health
Faculty Champions
Pretest/Posttest

As part of the upcoming Children's Environmental Health Faculty Champions workshop, we are asking you to complete this pretest which will be repeated as a posttest at the end of the workshop. This should only take about 10 minutes of your time. Please write in your name at the top of the page so we can check-off that we received your pretest when you fax it back. A number will be given and names will then be removed so there will be no identifiers in the analysis. Data will be analyzed in group form.

To complete the pretest, please print it off and fax back to Amanda Gannog at NEEF at 202-261-6464 by Friday, June 15, 2006. Thank you very much.

Please circle the correct response.

1. All of the following are important when the pediatric health provider is evaluating a child's environment except:

    a. The source of water in the home
    b. The proximity of the home to roadways and industry
    c. The age of the home
    d. The type of roofing on the home

2. In the US, a person's lifetime risk of malignant melanoma of the skin will change from 1 in 1500 in 1930, to an estimated (fill in the blank) in 2010.

    a. 1 in 1000
    b. 1 in 500
    c. 1 in 100
    d. 1 in 50

3. As compared to adults, infants and small children:

    a. Generally have a slower metabolic rate and are therefore exposed to more of a given contaminant than an adult in the same environment
    b. Have a greater chance of developing a disorder with a long latency period between environmental exposure and disease
    c. Are exposed to less mercury vapor in an environment because the vapors rise and children are closer to the ground
    d. Have more resilient nervous systems and are less likely to demonstrate symptoms from environmental neurotoxicants

4. Diseases referred to as the 'New Pediatric Morbidity' include all of the following except:

    a. Asthma
    b. Learning disabilities
    c. Mental retardation
    d. Obesity

5. Which of the following is NOT true?

    a. Melanoma is the most common cancer of women ages 25 – 29
    b. Melanoma is the 2nd most common cancer of women ages 20 –24
    c. Melanomas in children most often have classic characteristics (ABCDE = Asymmetry, irregular Borders, variegated Color, Diameter $\geq$ 6 mm, Evolving)
    d. The incidence of melanoma in children and teens is rising

6. Routine environmental health histories for most infants, children and teenagers should include questions about exposure to all of the following except:

    a. Secondhand smoke
    b. Lead
    c. Sun
    d. Exposures to occupational or para-occupational hazards

7. Which of the following statements about sunscreens is correct?

    a. Sunscreens with an SPF (Sun Protection Factor) of 30 provide twice the sun protection as compared to sunscreens with an SPF of 15
    b. Sunscreens have been shown to prevent squamous cell carcinoma
    c. The SPF refers to UVA and UVB protection of a product
    d. Sunscreens have been shown to prevent melanoma

8. About what proportion of teenagers age 11 –18, reported using tanning parlors within the past year?

    a. 2%
    b. 5%
    c. 10%
    d. 20%

9. The primary outcome measure used in intervention studies related to environmental tobacco smoke exposure is:

    a. Air nicotine samples
    b. Cotinine levels
    c. Respiratory symptoms
    d. Self-report

10. The optimal source to evaluate environmental tobacco smoke exposure is:

    a. Blood
    b. Hair
    c. Skin
    d. Urine

11. The annual cost associated with environmental tobacco smoke exposure in the US is:
    a. $100-400 million
    b. $450-600 million
    c. $700million-1 billion
    d. $1.5-3.5 billion

12. The most important means of diagnosing and treating mercury poisoning is:

    a. Serial blood levels and chelation therapy
    b. Exposure history and chelation therapy
    c. Exposure history and removal of potential sources
    d. Hair analysis and removal of potential sources

13. The proportion of children exposed to environmental tobacco smoke in the home is:
    a. 5-20%
    b. 20-50%
    c. 60-70%
    d. 80-90%

14. The number one source of lead is:

    a. Leaded gasoline
    b. Lead-based paint in older homes
    c. Imported pottery
    d. Lead in foods

15. The clinical presentation of significant elemental mercury exposure includes all of the following except:

    a. Increased appetite
    b. Emotional lability and memory impairment
    c. Hypertension
    d. Erythematous rash

16. What is the Air Quality Index?

    a. The same as an "ozone alert"
    b. An indicator of overall air quality with an EPA rating of 200 tells you it is okay for kids with asthma to be outside
    c. Measure of several air pollutants which should guide outdoor activity
    d. All of the above

17. Which of the following statements about asthma and environmental triggers is not correct?

    a. Bathing cats and dogs twice a week effectively reduces animal allergen exposure
    b. Nocturnal asthma symptoms indicate mold exposure
    c. Inexpensive interventions are highly effective to control dust mite exposure
    d. Cockroaches are a very common asthma trigger in the inner city

18. Risk-based questions for lead exposure include all of the following except:

    a. Live in or regular contact with a house built before 1960
    b. Sibling or playmate being treated or followed for lead poisoning
    c. Live with an adult with a job or hobby involving exposure to lead
    d. Live near a coal-fire power plant

Answer question 19 based on the following scale, where:
a = 1, 2, 3 are correct b =1, 3 are correct c =2, 4 are correct d =4 only is correct

19. What is/are the best ways to control dust mite triggers?

1. Encase pillows in allergen impermeable cover
2. Wash bedding weekly in warm water
3. Vacuum weekly with HEPA vacuum cleaner
4. Use an Ionic air cleaner

a. = 1, 2, 3 correct
b. = 1, 3 correct
c. = 2, 4 correct
d. = 4 correct

Answer question 20 based on the following scale, where:
a = 1, 2, 3 are correct b =1, 3 are correct c =2, 4 are correct d =4 only is correct

20. Correct statements about mold exposure and mold control include:

1. Areas less than 15 sq feet can be cleaned with 1-1 bleach solution
2. Control humidity with air conditioner or dehumidifier
3. Kill the mold first then control moisture in the home
4. Discard items that are too moldy to clean

a. = 1,2,3 correct
b. = 1,3 correct
c. = 2,4 correct
d. = 4 correct

APPENDIX D

Workshop Evaluation Form

NEEF
Children's Environmental Health Faculty Champions
Train-the-Trainer Workshop Evaluation Form

I. Power Point Presentations
Use the scale below to indicate if the power point presentations will be effective tools for your training with trainees.

Please circle the appropriate number for each topic. Below each presentation topic please indicate if there are specific improvements that could enhance the presentation.
Highly Effective = 1 Moderately Effective = 2 Somewhat Effective = 3 Not Effective = 4

Topic:

Taking an Environmental History: **1** **2** **3** **4**

Comments:

Environmental Management of Pediatric Asthma: **1** **2** **3** **4**

Comments:

Environmental Tobacco Smoke: **1** **2** **3** **4**

Comments:

Exposure to Ultraviolet Light: **1** **2** **3** **4**

Comments:

Lead and Mercury: **1** **2** **3** **4**

Comments:

II. Do you think this workshop was effective in providing you the tools needed to be a pediatric environmental health champion? Explain briefly.

APPENDIX E

Competency Data Assessment Form B1

August 2006
Faculty Champions
Competency Data Baseline Assessment Rating Scale

Please check appropriate rating descriptor for both Self-Assessment and Curriculum Assessment

	Self Assessment					**Curriculum Assessment**				
1. Competency	**N/A**	**Not Done**	**To Little Extent**	**To Moderate Extent**	**To Great Extent**	**N/A**	**Not Done**	**To Little Extent**	**To Moderate Extent**	**To Great Extent**
A. Completion of pediatric environmental history-taking										
B. Making referrals for preventative/curative interventions for possible environmental health hazards										
C. Involvement with community groups/organizations (e.g., PTA, daycare) for environmental health hazards, risk communication										
D. Utilization of resources for pediatric environmental hazards										
E. Reporting incidents for regulatory requirements										

APPENDIX F

Competency Data Assessment Form B2

November 2006
Faculty Champions
Competency Data Assessment Rating Scale

Please check appropriate rating descriptor for both Self-Assessment and Curriculum Assessment

	Self Assessment					**Curriculum Assessment**			
2. Competency	**N/A**	**Not Done**	**To Little Extent**	**To Moderate Extent**	**To Great Extent**	**Not Done**	**To Little Extent**	**To Moderate Extent**	**To Great Extent**
A. Completion of pediatric environmental history-taking									
B. Making referrals for preventative/curative interventions for possible environmental health hazards									
C. Involvement with community groups/organizations (e.g., PTA, daycare) for environmental health hazards, risk communication									
D. Utilization of resources for pediatric environmental hazards									
E. Reporting incidents for regulatory requirements									

N/A = Please use this only if you do not have any clinical duties

2. **As of October 31, 2006:**

   A. **How many faculty members have you trained on children's environmental health ?**

   Physicians Number =_____
   Nurses Number=_____
   Others (Specify) Number =_____

   B. **How many referrals have you made for preventative or curative interventions (write in N/A if indicated).**

   Number =_____

3. **Have you used the NEETF Power Point presentations you received after the July 2006 training workshop?**

   _____
   Yes/No

   If yes, please provide a brief description of how they were used?

   _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____

4. **Please describe briefly 2 or 3 examples of how you have incorporated pediatric environmental health history training into curricula and practice.**

   Example 1

   _____
   _____
   _____
   _____

Example 2

_____

_____

_____

_____

Example 3

_____

_____

_____

_____

APPENDIX G

Competency Data Assessment Form B4

March 2007
Faculty Champions
Competency Data Assessment Rating Scale

Please check appropriate rating descriptor for both Self-Assessment and Curriculum Assessment

	Self Assessment					**Curriculum Assessment**			
1. Competency	**N/A**	**Not Done**	**To Little Extent**	**To Moderate Extent**	**To Great Extent**	**Not Done**	**To Little Extent**	**To Moderate Extent**	**To Great Extent**
A. Completion of pediatric environmental history-taking									
B. Making referrals for preventative/curative interventions for possible environmental health hazards									
C. Involvement with community groups/organizations (e.g., PTA, daycare) for environmental health hazards, risk communication									
D. Utilization of resources for pediatric environmental hazards									
E. Reporting incidents for regulatory requirements									

N/A = Please use this only if you do not have any clinical duties

2. **Between November 1, 2006 and March 31, 2007:**

   C. **How many faculty members have you trained on children's environmental health?**

   Physicians Number =_____
   Nurses Number=_____
   Others (Specify) Number =_____

   D. **How many referrals have you made for preventative or curative interventions (write in N/A if indicated).**

   Number =_____

3. **Have you used the NEETF Power Point presentations you received after the July 2006 training workshop, since the last report November, 2006?**

   _____
   Yes/No

   If yes, please provide a brief description of how they were used?

   _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____

4. **Please describe briefly 2 or 3 examples of how you have incorporated pediatric environmental health history training into curricula and practice since your last report from November 2006.**

   Example 1

   _____
   _____
   _____
   _____

Example 2

_____

_____

_____

_____

Example 3

_____

_____

_____

_____

APPENDIX H

Children's Environmental Health Faculty Champion
Action Plan Guide
for
Integrating Environmental Health into Education and Practice
July 2006-July 2007

Name:

Institution:

I. Training Faculty Members:

Opportunities:

Barriers:

Strategies to Overcome Barriers:

Planned Activities:

II. Integrating Environmental Health Content into Curricula and Patient Care Documents

Opportunities:

Barriers:

Strategies to Overcome Barriers:

Planned Activities:

III. Other:

APPENDIX I

National Environmental Education Foundation Faculty Champions

Telephone Interview 1

National Environmental Education & Training Foundation
Children's Environmental Health Faculty Champions
Train-the-Trainer Initiative
Follow-up Telephone Interview Questionnaire

Date:
Name of participant:
Place of Employment:

1. What is your position and department?

2. Who is your teaching audience (i.e. med students/residents, nursing grad/undergrad, etc.)?

3. Have you incorporated pediatric environmental health (PEH) into your curricula?

    a. If NO:
        i. Did you already have (PEH) in you curricula and what is generally covered?
        ii. Do you plan to incorporate PEH into your curricula?
    b. If YES:
        i. In what courses are PEH topics covered?
        ii. What PEH topics are generally covered?
        iii. How much overall time is allotted to PEH topics?
        iv. Are there practical experiences (i.e., clinic work) related to PEH in the curriculum, i.e, PEH history-taking?

4. Do you also work in a practice setting (in addition to faculty setting)?
    a. IF NO: Skip to question 5.
    b. IF YES:
        i. Where do you work—i.e., facility type/what is your position?
        ii. How many hours per week do you devote to this practice setting?
        iii. Do you do PEH history-taking with patients in this setting?
            1. IF YES: Do you ask PEH histories of all (100%), most (70-99%), some (40-69%), few (1-39%), or none of the caregivers/patients?

5. As a result of your involvement in this initiative, have any of the following institutional interventions/materials been developed related to PEH and generally how this was accomplished:
    a. Protocols?
    b. Procedures?
    c. Polices?
    d. Other?
    e. IF NO: Do you plan on developing these types of materials/interventions?

6. Please give 2-3 examples of institutional strategies and 2-3 examples of practice strategies that have resulted in institutional changes (or behavioral) changes in parents or children (for example, day care centers that have resulted in a decreased exposure to environmental pollutants). (NOTE: if necessary, allow participant to email these responses within 1 week)

7. Overall, can you describe the impact of the train-the-trainer program on curricula and practice, and any institutional change? (i.e., have they found it useful in their respective settings).

APPENDIX J

National Environmental Education Foundation Faculty Champions

Telephone Interview 2

National Environmental Education & Training Foundation
Children's Environmental Health Faculty Champions
Train-the-Trainer Initiative
Follow-up Telephone Interview Questionnaire-2

This second and final telephone interview is being conducted as part of an evaluation of the workshop you attended in July 2006 to determine the impact of the workshop on curricula, practice and institutional changes. Information obtained will be reviewed and aggregated with other responses received. All names and identifiers will be removed from the data for analysis.

Date:
Name of Participant:
Place of Employment:

1. Has your position and department changed?

2. Has your teaching audience (i.e. med students/residents, nursing grad/undergrad, etc.) changed?

3. For this question, if they answered NO to the original, ask again; if, they answered YES to the original, ask if there are any changes.

   Have you incorporated pediatric environmental health (PEH) into your curricula?

   a. If NO:

      i. Did you already have (PEH) in you curricula and what is generally covered? OR

      ii Do you plan to incorporate PEH into your curricula?

   b. If YES:

      i. In what courses are PEH topics covered?

      ii. What PEH topics are generally covered?

      iii. How much overall time is allotted to PEH topics?

iv. Are there practical experiences (i.e., clinic work) related to PEH in the curriculum, i.e, PEH history-taking?

4. For this question, if they answered NO to the original, ask again; if, they answered YES to the original, ask if there are any changes.

   Do you also work in a practice setting (in addition to faculty setting)?

   c. IF NO: Skip to question 5.

   d. IF YES:

      i. Where do you work—i.e., facility type/what is your position?

      ii. How many hours per week do you devote to this practice setting?

      iii. Do you do PEH history-taking with patients in this setting?

      IF YES: Do you ask PEH histories of all (100%), most (70-99%), some (40-69%), few (1-39%), or none of the caregivers/patients?

5. As a result of your involvement in this initiative, have any of the following institutional interventions/materials been developed related to PEH and generally how this was accomplished, that have occurred since the last telephone interview.

   A. protocols?

   B. procedures?

   C. polices?

   D. other

   IF NO: Do you plan on developing these types of materials/interventions?

6. Can you please give 1-2 examples of institutional strategies and 1-2 examples of practice strategies that have resulted in institutional changes (or behavioral) changes in parents or children (for example, day care centers that have resulted in a decreased exposure to environmental pollutants). (NOTE: if necessary, allow participant to email these responses within 1 week).

7. Overall, can you describe the impact of the train-the-trainer program on curricula and practice, and any institutional change ? (i.e., have they found it useful in their respective settings).

8. Future plans to sustain efforts?

9. Additional feedback?

APPENDIX K

National Environmental Education Foundation

Children's Environmental Health Faculty Champions

Train-the-Trainer Workshop Agenda

8:00-8:30 am	**Continental Breakfast**
8:30-8:45 am	**Welcome and Workshop Goals**: Leyla Erk McCurdy, NEETF
8:45-9:15 am	**Taking Environmental History to Address Children's Unique Vulnerabilities to Environmental Exposures**: Joel Forman, MD, Mount Sinai Medical Center
9:15-9:45 am	**Environmental Management of Pediatric Asthma**: James Roberts, MD, MPH, Medical University of South Carolina
9:45-10:15 am	**Environmental Tobacco Smoke**: Cara Krulewitch, CNM, PhD, University of Maryland School of Nursing
10:15-10:45 am	**Break**
10:45-11:15 am	**Exposure to Ultraviolet Light**: Sophie J. Balk, MD, Albert Einstein College of Medicine, The Children's Hospital at Montefiore
11:15-11:45 am	**Pesticide Competency Guidelines**: Bonnie Rogers, DrPH, COHN-S, FAAN, University of North Carolina – Chapel Hill, School of Public Health
11:45-12:15pm	**Lead and Mercury**: Christine Johnson, MD, Naval Medical Center San Diego
12:15-1:30 pm	**Lunch**
1:30-3:30 pm	**Strategies for Integrating Environmental Health into Education and Practice**
1:30-2:30 pm	**Break-Out Sessions:** **1. Training Other Faculty Members: Identify Opportunities and Develop Strategies to Overcome Barriers – Session Leaders: Balk, Forman, Krulewitch** **2. Incorporating Environmental Health Content into Curricula and Patient Care Documents: Identify Opportunities and**

	Develop Strategies to Overcome Barriers – Session Leaders: Johnson, Roberts, Rogers (rotating)
2:30-3:30 pm	**Break-Out Sessions Repeated**
3:30-3:45 pm	**Break**
3:45-4:45 pm	**Report Out and Development of Individual Action Plans**
4:45-5:15 pm	**Wrap Up: Review of Program Commitments, Post -Test**
5:15 pm	**Adjourn**

REFERENCES

Akinbami, L., & Schoendorf, K. (2002). Trends in childhood asthma: Prevalence, healthcare utilization and mortality. *Pediatrics,* 110(2 Pt 1): 315-322.

Almqvist, C., Larsson, P.H., Egmar, A.C., Hedren, M., Malmberg, P., & Wickman, M. (1999). School as a risk environment for children allergic to cats and a site for transfer of cat allergen to homes. *Journal of Allergy Clinic Immunology,* 103: 1012-1017.

American Academy of Pediatrics, Committee on Environmental Health. (1999). *Handbook of Pediatric Environmental Health*. Elk Grove, IL: American Academy of Pediatrics.

American Academy of Pediatrics, Committee on Environmental Health. (2003). *Pediatric Environmental Health* (2nd ed.). Elk Grove, IL: American Academy of Pediatrics.

American Academy of Pediatrics, Committee on Environmental Health. (2004). Ambient Air Pollution: Health Hazards to Children. *Pediatrics,* 114(6): 1699-1707.

American College of Preventative Medicine. (2003). Letter to Senate VA/HUD Subcommittee urging for increased appropriations for ATSDR for FY 2004. 2003--045 (H). Accessed October 31, 2007 at: http://www.acpm.org/2003045H.htm

American Nurses Association. (2003). *American Nurses Association Adopts Precautionary Principle.* Accessed October 31, 2007 at: http://www.nursingworld.org

Agency for Toxic Substances and Disease Registry (ATSDR). (1999). ToxFAQs for mercury. Accessed October 31, 2007 at: http://www.atsdr.cdc.gov/tfacts46.html

Anderko, L. (2003). Protecting the health of our nation's children through environmental health tracking. *Policy, Politics, & Nursing Practice,* 4: 14-21.

Balbus, J.M., Harvey, C.E., & McCurdy, L.E. (2006). Educational needs assessment for pediatric health care providers on pesticide toxicity. *Journal of Agromedicine*, 11(1): 27-38.

Baldi, I., Filleul, L., Mohammed-Brahim, B., Fabrigoule, C., Dartigues, J.F., Schwall S., et al. (2001). Neurophychologic effects of long-term exposure to pesticides: results from the French Phytoner study. *Environmental Health Perspectives,* 109: 839-844.

Barone, S., Jr., Das, K.P., Lassiter, T.L., & White, L.D. (2000). Vulnerable processes of nervous system development: a review of markers and methods. *Neurotoxicology*, 21(1-2): 15-36.

Bell, H.M., McElnay, J.C., Hughes, C.M., & Gleadhill, I. (2000). Primary schoolteachers' knowledge of asthma: The impact of pharmacist intervention. *Journal of Asthma*, 37: 545-555.

Bellack, J.P., Musham, C., Hainer, A., Graber, D.R., & Holmes, D. (1997). Environmental health competencies: A survey of nurse practitioner programs. *American Association of Occupational Health Nurses Journal*, 45(1): 6.

Breysse, P. Farr, N., Galke, W., Lanphear, B., Morley, R., & Bergofsky, L. (2004). The relationship between housing and health: children at risk. *Environmental Health Perspectives*, 112(15): 1583-1588.

Brook, U., & Shiloh, S. (1994). Teachers' knowledge about asthma: Assessment, correlates, and sources. *Pediatric Asthma and Allergies,* 8: 99-104.

Brooks, J., & Jones, K. (1992). Schoolteachers' perceptions and knowledge of asthma in primary schoolchildren. *British Journal of General Practice*, 42: 504-507.

Buchdahl, R., Willems, C.D., Vander, M., & Babiker, A. (2000). Associations between ambient ozone, hydrocarbons, and childhood wheezy episodes: A prospective observational study in south east London. *Occupational and Environmental Medicine,* 57: 86-93.

Burns, C., Dunn, A.M., & Sattler, B. (2002). Resources for environmental health problems. *Journal of Pediatric Health Care*, 16: 138-142.

Burr, C.K., Storm, D.S., & Gross, E. (2006). A faculty trainer model: Integrating knowledge and changing practice to improve perinatal HIV prevention and care. *AIDS Patient Care & STDs,* 20(3): 183-192.

California Environmental Protection Agency (EPA). (2005). *Proposed Identification of Environmental Tobacco Smoke as a Toxic Air Contaminant: Part B. Health Effects.* Sacramento, CA: California Environmental Protection Agency.

Canfield, R.L., Henderson, C.R., Cory-Slecht, DA., Cox, D., Jusko, T.A., & Lanphear, B.P. (2003). Intellectual impairment in children with blood lead concentration below 10 ug/dL. *New England Journal of Medicine*, 348: 1517-1526.

Centers for Disease Control and Prevention (CDC). (1996). Asthma surveillance programs in public health departments. *Morbidity and Mortality Weekly Report (MMWR)*, 45: 802-804.

Centers for Disease Control and Prevention (CDC). (1997). *Screening children for lead poisoning: Guidance for state and local public health officials.* Atlanta, GA: Centers for Disease Control and Prevention.

Centers for Disease Control and Prevention (CDC). (2002). *Managing elevated blood lead levels among young children: Recommendations from the Advisory Committee on Childhood Lead Poisoning Prevention.* Atlanta, GA: Centers for Disease Control and Prevention.

Centers for Disease Control and Prevention (CDC). (2004). Lead poisoning from ingestion of a toy necklace. *Morbidity and Mortality Weekly Report (MMWR)*, 53: 509–511.

Centers for Disease Control and Prevention (CDC). (2006). State-specific prevalence of current cigarette smoking among adults and secondhand smoke rules and policies in homes and workplaces—United States, 2005. *Morbidity and Mortality Weekly Report,* 55(42): 1148-1151.

Clark, N.M., Gong, M., Schork, M.A., Kaciroti, N., Evans, D., Roloff, D., Hurwitz, M., Maiman, L.A., & Mellins, R.B. (2000). Long-term effects of asthma education for physicians on patient satisfaction and use of health services. *European Respiratory Journal*, 16(1): 15-21.

Children's Environmental Health Network/Public Health Institute (1999). *Training Manual on Pediatric Environmental Health: Putting It into Practice.* San Francisco, CA: Children's Environmental Health Network/Public Health Institute. Accessed October 31, 2007 at: http://www.CEHN.org

Committee on Environmental Health. (1993). Ambient air pollution: Respiratory hazards to children. *Pediatrics,* 91(6): 1210-1213.

Cook, D.G., & Strachan, D.P. (1999). Summary of effects of parental smoking on the respiratory health of children and implications for research. *Thorax,* 54: 357-366.

Crain, E.F. (2000). Environmental threats to children's health: A challenge for pediatrics. Ambulatory Pediatric Association (APA) Presidential Address. *Pediatrics*, 106: 871-875.

Daniels, J.L., Olshan, A.F., & Savitz, D.A.(1997). Pesticides and childhood cancers. *Environmental Health Perspectives,* 105: 1068-1077.

Davis, K.J., Cokkinides, V.E., Weinstock, M.A., O'Connell, M.C., & Wingo, P.A. (2002). Summer sunburn and sun exposure among U.S. youths ages 11 to 18: National prevalence and associated factors. *Pediatrics*, 110(1): 27-35.

Delfino, R.J., Zeiger, R.S., Seltzer, J.M., Street, D.H., & McLaren, C.E. (2002). Association of asthma symptoms with peak particulate air pollution and effect modification by anti-inflammatory medication use. *Environmental Health Perspectives*, 110: A607-A617.

D'Eon, M.F., & AuYeung, D. (2001). Follow-up in train-the-trainer continuing medical education events. *The Journal of Continuing Education in the Health Professions,* 21: 33-39.

Devesa, S.S., Blot, W.T., Stone, B.J., Miller, B.A., Tarove, R.E., & Fraumeni, J.F. Jr. (1995). Recent cancer trends in the United States. *Journal of the National Cancer Institute,* 87: 175-182.

Dietert, R.R., Etzel, R.A., Chen, D., Halonen, M., Holladay, S.D., Jarabek, A.M., Landreth, K., Peden, D.B., Pinkerton, K., Smialowicz, R.J., & Zoetis, T. (2000). Workshop to identify critical windows of exposure for children's health: immune and respiratory systems work group summary. *Environmental Health Perspectives,* 108(Suppl 3): 483-490.

Dunn, A.M., Burns, C., & Sattler, B. (2003). Environmental health of children. *Journal of Pediatric Health Care,* 17(5): 223-231.

Eggleston, P.A. (2000). Environmental causes of asthma in inner city children: The national cooperative inner city asthma study. *Clinical Review of Asthma Immunology,* 18: 311-324.

Epstein, B.L. (2001). Childhood asthma and indoor allergens: The classroom may be a culprit. *Journal of School Nursing*, 17: 253-257.

Erikson, L., & Thompson, T. (2005). A review of a preventable poison: Pediatric lead poisoning. *Journal for Specialists in Pediatric Nursing*, 10(40): 171-182.

Eskinazi, B, Bradmen, A., & Castorina, R. (1999). Exposure of children to organophosphate pesticides and their potential adverse health effects. *Environmental Health Perspectives,* 107 (suppl 3): 409-419.

Eskenazi, B., Marks, A.R., Bradman, A., Harley, K., Barr, D.B., Johnson, C., Morga, N., & Jewell, N.P. (2007). Organophosphate pesticide exposure and neurodevelopment in young Mexican-Amercian children. *Environmental Health Perspectives,* 115(5): 729-798.

Etzel, R.A., Crain, E.F., Gitterman, B.A., Oberg, C., Scheidt, P., Landrigan, P.J. (2003). Pediatric environmental health competencies for specialists. *Ambulatory Pediatrics*, 3(1): 60-63.

Evans, G.W., & Kantrowitz, E. (2002). Socioeconomic status and health: The potential role of environmental risk exposure. *Annual Review of Public Health,* 23: 303-331.

Evans, G.W., & Marcynyszyn, M.A. (2004). Environmental justice, cumulative environmental risk, and health among low- and middle- income children in upstate New York. *American Journal of Public Health,* 94(11): 1942-1944.

Fenske, R.A., Bradman, A., Whyatt, R.M., Wolff, M.S., & Barr, D.B. (2005). Lessons learned for the assessment of children's pesticide exposure: Critical sampling and analytical issues for future studies. *Environmental Health Perspectives*, 113(10): 1455-1462.

Fenske, R.A., Lu, C., Simcox, N.J., Loewenherz, C., Touchstone, J., Moate, T.F., et al. (2000). Strategies for assessing children's organophosphorus pesticide exposures in agricultural communities. *Journal of Expo Anal Environmental Epidemiology*, 10: 662-67.

Fields, S. (2001). How dangerous is CCA? *Environmental Health Perspectives,* 109: A263-A269.

Frazier, L.M., Berberich, N.J., Moser, R., Jr., Cromer, J.W., Jr., Hitchcock, M.A., Monteiro, F.M., & Greenberg, G.N. (1999). Developing occupational and environmental medicine curricula for primary care residents: Project EPOCH Envi. Educating Physicians in Occupational Health and the Environment. *Journal of Occupational and Environmental Medicine*, 41(8): 706-11.

French, D.J., & Carroll, A. (1997). Western Australian primary schoolteachers' knowledge about childhood asthma and its management. *Journal of Asthma*, 34: 469-475.

Gauderman, W.J., Gilliland, G.F., Vora, H., Avol, E., Stram, D., McConnell, R., Thomas, D., Lurmann, F., Margolis, H.G., Rappaport, E.B., Berhane, K., & Peters, J.M. (2002). Association between air pollution and lung function growth in southern California children: Results from a second cohort. *American Journal of Respiratory Critical Care Medicine*, 166(1): 76-84.

Gauderman, W.J., McConnell, R., Gilliland, F., London, S., Thomas, D., Avol, E., Vora, H., Berhane, K., Rappaport, E.B., Lurmann, F., Margolis, H.G., & Peters, J**.** (2000). Association between air pollution and lung function growth in southern California children. *American Journal of Respiratory Critical Care Medicine*, 162(4): 1383-1390.

Geller, A.C., Colditz, G., Oliveria, S., Emmons, K., Jorgensen, C., Aweh, G.N., et al. (2002). Use of sunscreen, sunburning rates, and tanning bed use among more than 10,000 US children and adolescents. *Pediatrics*, 109(6), 1009-1014.

Gergen, P.J., Fowler, J.A., Maurer, K.R., Davis, W.W., & Overpeck, M.D. (1998). The burden of environmental tobacco smoke exposure on the respiratory health of children 2 months through 5 years of age in the United States: Third National Health and Nutrition Examination Survey, 1988 to 1994. *Pediatrics*, 10(2): E8.

Giullette, E.A., Meza, M.M., Aquilar, M.G., Soto, A.D., & Garcia, I.E. (1998). An anthropological approach to the evaluation of preschool children exposed to pesticides in Mexico. *Environmental Health Perspectives,* 106: 347-353.

Gold, D.R. (2002). Environmental tobacco smoke, indoor allergens, and childhood asthma. *Environmental Health Perspectives*, 108: 643-651.

Goldman, L., Falk, H., Landrigan, P.J., Balk, S.J., Reigart, J.R., & Etzel, R.A. (2004). Environmental pediatrics and its impact on government health policy. *Pediatrics*, 113(4): 1146-1157.

Goldman, R.H., Rosenwasser, S., & Armstrong, E. (1999). Incorporating an environmental/occupational medicine theme into the medical school curriculum. *Journal of Occupational & Environmental Medicine*, 41(1): 47-52.

Goveia, M.G., Shaikh, N., Windham, G., Bembom, O., Feldman, K., & Kreutzer, R. (2005). Asthma-related environmental practices and awareness in California child care centers. *Pediatric Asthma, Allergy & Immunology,* 18(1): 12-24.

Graber, D.R., Musham, C., Bellack, J.P., & Holmes, D. (1995). Environmental health in medical school curricula: Views of academic deans. *Journal of Occupational Environmental Medicine*, 37(7): 801-811.

Graff, J.C., Murphy, L, Ekvall, S., & Gagnon, M. (2006). In-home toxic chemical exposures and children with intellectual and developmental disabilities. *Pediatric Nursing, 32(6): 596-603.*

Greenwood, M.R. (1985). Methlymercury poisoning in Iraq. An epidemiological study of the 1971-1972 outbreak. *Journal of Applied Toxicology,* 5: 148-159.

Haley, V.B., & Talbot, T.O. (2004). Geographic analysis of blood lead levels in New York State children born 1994-1997. *Environmental Health Perspectives,* 112(15): 1577-1582.

Harada, M. (1995). Minamata disease: Methylmercury poisoning in Japan caused by environmental pollution. *Critical Review in Toxicology,* 25: 1-24.

Hays, J.C., Davis, J.A., & Miranda, M.L. (2006). Incorporating a built environment moduleinto an accelerated second-degree community health nursing course. *Public Health Nursing,* 23(5): 442-452.

Hegmann, T.E., & Dehn, R.W. (2006). Physician assistant program director: Opinions regarding the importance of faculty research and publication. *Journal of Physician Assistant Education,* 17(2): 5-10.

Israel, B.A., Parker, E.A., Rowe, Z., Salvatore, A. Minkler, M., Lopez, J., Butz, A., Mosley, A., Coates, L., Lambert, G., Potito, P.A., Brenner, B., Rivera, M., Romero, H., Thompson, B., Coronado, G., & Halstead, S. (2005). Community based participatory research: Lessons learned from the Centers for Children's Environmental Health and Disease Prevention Research. *Environmental Health Perspectives*, 113(10): 1463-1471.

Jacobsen, J.L., & Jacobsen, S.W. (1996). Intellectual impairment in children exposed to polychlorinated biphenyls in utero. *New England Journal of Medicine,* 355: 783-789.

Jones, T.F., Moore, W.L., Craig, A.S., Reasons, R.L., & Schaffner, W. (1999). Hidden threats: Lead poisoning from unusual sources. *Journal of the Ambulatory Pediatric Association Monograph*, 104(2): 1223–1225.

Juhn, Y.I., St. Sauver, J., Shapiro, E.D., & McCarthy, P.L. (2002). Child care program directors' level of knowledge about asthma and facts associated with knowledge. *Clincal Pediatrics,* 41: 111-116.

Karalliedde, L, Feldman, S., Henry, J., & Marrs, T. eds. (2001). *Organophosphates and Health.* River Edge, NJ: World Scientific Publishing.

Kennedy, C., Bajdik, C.D., Willemze, R., & Gruijl, F.R. (2003). The influence of painful sunburns and lifetime sun exposure on the risk of actinic keratoses, seborrheic warts, melanocytic nevi, atypical nevi, and skin cancer. *Journal of Investigative Dermatology,* 120(6): 1087-1093.

Kilpatrick, N., Frumkin, H., Trowbridge, J., Escoffery, C., Geller, R., Rubin, L., Teaque, G., & Nodvin, J. (2002). The environmental history in pediatric practice: A study of pediatricians' attitudes, beliefs, and practices. *Environmental Health Perspectives*, 110(8): 823-827.

Koh, H.K., Geller, A.C., Miller, D.R., Grossbart, T.A., & Lew, R.A. (1996). Prevention and early detection strategies for melanoma and skin cancer. Current status. *Archives in Dermatology*, 132(4): 436-443.

Kriger, J., & Higgins, D.L. (2002). Housing and health: time again for public health action. *American Journal of Public Health,* 92(5): 758-768.

Kwong, T.C. (2002). Organophosphate pesticides: Biochemistry and clinical toxicology. *Therapeutic Drug Monitoring,* 24(1): 144-149.

Lanphear, B.P., Byrd, R.S., Auinger, P., & Schaffer, S.J. (1999). Community characteristics associated with elevated blood lead levels in children. *Pediatrics,* 101: 264-271.

Landrigan, P.J., Carlson, J.E., Bearer, C.F., Cranmer, J.S., Bullard, R.D., Etzel, R.A., et al. (1998). Children's health and the environment: A new agenda for prevention research. *Environmental Health Perspectives,* 106 (Suppl 3): 787-794.

Landrigan, P.J., Schechter, C.B., Lipton, J.M., Fahs, M.C., & Schwartz, J. (2002). Environmental pollutants and disease in American children: Estimates of morbidity, mortality, and costs for lead poisoning, asthma, cancer, and developmental disabilities. *Environmental Health Perspectives*, 110: 721-728.

Liebman, A., & Harper, S. (2001). Environmental health perceptions among clinicians and administrators caring for migrants. *MCN Streamline: the migrant health news source*, 7(2): 1-4.

Lewis, S.A., Antoniak, M., Venn, A.J., Davies, L., Goodwin, A., Salfield, N., Britton, J., & Fogarty, A.W. (2005). Secondhand smoke, dietary fruit intake, road traffic exposures, and the prevalence of asthma: a cross-sectional study in young children. *American Journal of Epidemiology,* 161: 406-411.

Lin-Fu, J.S. (1973). Vulnerability of children to lead exposure and toxicity. *New England Journal of Medicine*, 289: 1289-1293.

Lindberg, M.A. (1998). The process of change: stories of the journey. *Academic Medicine,* 73(9): S4-S10.

Litonjua, A.A., Carey, V.J., Burge, H.A., Weiss, S.T., & Gold, D.R. (2001). Exposure to cockroach allergen in the home is associated with incident doctor-diagnosed asthma and recurrent wheezing. *Journal of Allergy Clinical Immunology, 107: 41-47.*

Lotke, E., Rasmussen, C., Carter, A., & Borosage, R.L. (2007). *Toxic Trade, Globalization and the Safety of the American Consumer.* Accessed October 31, 2007 from: http://home.ourfuture.org/assets/toxic-trade.pdf

Maguire-Eisen, M., Rothman, K., & Demierre, M.F. (2005). The ABCs of sun protection for children. *Dermatology Nursing*, 17(6): 419-433.

Maher, H.K. (2007). Secondhand smoke. *AAOHN Journal*, 55(1): 65-74

Mannino, D.M., Home, D.M., Akinbami, L.J., Moorman, J.E., Gwynn, C., & Redd, S.C. (2002). Surveillance for asthma—United States, 1980-1999. *MMWR Surveillance Summary*, 51: 1-13.

Markowitz, M., (2000). Lead poisoning. *Pediatrics in Review,* 21: 327-335.

Markowitz, M., & Rosner, D. (2000). Cater to the children: The role of the lead industry in a public health tragedy, 1900-1955. *American Journal of Public Health,* 90: 36-46.

McConnell, R., Berhane, K., Gilliland, F., London, S.J., Islam, T., Gauderman, W.J., Avol, E., Margolis, H.G., & Peters, J.M. (2002). Asthma in exercising children exposed to ozone: A cohort study. *Lancet*, 359: 386-391.

McCurdy, L.E., Roberts, J., Rogers, B., Love, R., Etzel, R., Paulson, J., Witherspoon, N.O., & Dearry, A. (2004). Incorporating environmental health into pediatric medical and nursing education. *Environmental Health Perspectives*, 112: 1755-1760.

Musham, C., Bellack, J.P., Graber, D.R., & Holmes, D. (1996). Environmental health training: A survey of family practice residency program directors. *Family Medicine*, 28(1): 29-32.

National Academy of Sciences. (1993). *Pesticides in the diets of infants and children*. Washington, DC: National Academy Press.

The National Environmental Education Foundation (NEEF). (2002a). *Implementation Plan: National Strategies for Health Care Providers: Pesticides Initiative.* Washington, DC: NEEF, U.S. EPA, U.S. Dept. of Agriculture, U.S. Dept. of Health and Human Services, U.S. Dept. of Labor. Accessed October 31, 2007 at: http://www.neefusa.org/health/pesticides/implplan.htm

The National Environmental Education Foundation (NEEF). (2002b). *National Strategies for Health Care Providers: Pesticides Initiative.* Washington, DC: NEEF. Accessed October 31, 2007 at: http://www.neefusa.org/health/pesticides/implplan.htm

The National Environmental Education Foundation (NEEF). (2003). *National Pesticide Competency Guidelines for Medical & Nursing Education*. Washington, DC: NEEF. Accessed October 31, 2007 at: http://www.neetf.org/Health/PesticidesGuidelinePublications/Education.shtm

The National Environmental Education Foundation (NEEF). (2004). *Health Professionals and Environmental Health Education Position Statement*. Washington, DC: NEEF. Accessed October 31, 2007 at: http://www.neetf.org/Health/PositionStatement2.pdf

The National Environmental Education Foundation (NEEF). (2005). *Health Care Provider Initiative Strategic Plan*. Washington, DC: NEEF. Accessed October 31, 2007 at: http://www.neefusa.org/pdf/HCPInitiativeStrategicPlan.pdf

The National Environmental Education Foundation (NEEF). (2007). *Children's Environmental Health Faculty Champions Initiative*. Accessed October 24, 2007 at: http://www.neefusa.org/health/champions/index.htm

National Research Council. (1993). *Pesticides in the Diets of Infants and Children*. Washington, D.C.: National Academy Press.

Needleman, H.L., Davidson, I., Sewell, E.M., & Shapiro, I.M. (1974). Subclinical lead exposure in Philadelphia schoolchildren. Identification by dentine lead analysis. *New England Journal of Medicine,* 290(5): 245-248.

Needleman, H.L., Gunnoe, C., Leviton, A., Reed, R., Presie, H., Maher, C., et al. (1979). Deficits in psychological and classroom performance of children with elevated dentine lead levels. *New England Journal of Medicine,* 300: 689-695.

Needleman, H.L., Riess, J.A., Tobin, M.J., Biesecker, G.E., & Greenhouse, J.B. (1996). Bone lead levels and delinquent behavior. *Journal of the American Medical Association, 274: 363-369.*

Needleman, H.L., Schell, A., Bellinger, D., Leviton, A., & Allred, E.N. (1990). The long term effects of exposure to low doses of lead in childhood—an 11-year follow-up report. *New England Journal of Medicine,* 322: 83-88.

Perera, F.P., Rauh, V., Tsai, W.Y., Kinney, P., Camann, D., Barr, D., et al. (2003). Effects of transplacental exposure to environmental pollutants on birth outcomes in a multiethnic population. *Environmental Health Perspectives*, 111: 201-206.

Pew Charitable Trusts. (1999). *Public Opinion Research on Public Health, Environmental Health and the Country's Public Health Capacity to Adequately Address Environmental Health Problems*. Philadelphia, PA: Pew Charitable Trusts.

Pew Environmental Health Commission. (1999). *America's Environmental Health Gap: Why the Country Needs a Nationwide Health Tracking Network.* Baltimore, MD: John Hopkins School of Public Health.

Pihl, R.O., & Parkes, M. (1977). Hair element content in learning disabled children. *Science,* 198: 204-206.

Physicians for Social Responsibility (PSR). (2006). Key concepts in pediatric environmental health. *Pediatric Environmental Health Toolkit.*

Pike-Paris, A. (2004). Indoor air quality: Part I—What it is. *Pediatric Nursing,* 30(5): 430-433.

Pike-Paris, A. (2005). Indoor air quality: Part II—What it does. *Pediatric Nursing,* 31(1): 39-49.

Pinkerton, K.E., & Joad, J.P. (2000). The mammalian respiratory system and critical windows of exposure for children's health. *Environmental Health Perspectives,* 108(suppl 3): 457-462.

Plopper, C.G., & Fanucchi, M.V. (2000). Do urban environmental pollutants exacerbate childhood lung diseases? *Environmental Health Perspectives*, 108: A252-A253.

Plunkett, L.M., Turnbull, D., & Rodricks, J.V. (1992). Differences between adults and children affecting exposure assessment. In Guzelian, P.S., Henry, C.J., Olin, S.S., eds. *Similarities and Differences Between Children and Adults: Implications for Risk Assessment* (pp. 79-96). Washington, DC: ILSI Press.

Pope, A.M., & Rall, D.P., eds. (1995). *Environmental Medicine: Integrating a Missing Element into Medical Education, Institute of Medicine Report.* Washington, D.C.: National Academy Press.

Pope, A.M., Snyder, M.A., & Mood, L.H., eds. (1995). *Nursing, Health, & the Environment, Institute of Medicine Report.* Washington, D.C.: National Academy Press.

Princeton Survey Research Associates for Health-Track. (2000). *National Survey of Public Perceptions of Environmental Health Risks.* Washington, D.C.: Princeton Survey Research Associates for Health-Track.

Ray, D.E., & Richards, P.G. (2001). The potential for toxic effects of chronic, low-dose exposure to organophosphates. *Toxicology Letters,* 120: 343-351.

Reddy, M.M., Reddy, M.B., & Reddy, C.F. (2004). Scientific advances provide opportunities to improve pediatric environmental health. *The Journal of Pediatrics*, 145, 153-156.

Reigart, J.R., & Roberts, J.R. (1999). *Recognition and management of pesticide poisonings.* (5th ed.). Washington, DC: U.S. Environmental Protection Agency.

Reigart, J.R., & Roberts, J.R. (2001). Pesticides in children. *Pediatrics Clinics of North America,* 48: 1185-1198.

Rhodes, A.R. (1995). Public education and cancer of the skin. What do people need to know about melanoma and nonmelanoma skin cancer? *Cancer*, 75(2 Suppl.): 613-636.

Roberts, J.R., & Gitterman, B.A. (2003). Pediatric environmental health education: A survey of U.S. pediatric residency programs. *Ambulatory Pediatrics,* 3(1): 57-59.

Roberts, J.R., & Reigart, J.R. (2001). Environmental health education in the medical school curriculum. *Ambulatory Pediatrics,* 1(2): 108-111.

Robinson, J.K., Rigel, D.S., & Amonette, R.A. (1997). Trends in sun exposure knowledge, attitudes, and behaviors: 1986 to 1996. *Journal of the American Academy of Dermatology*, 37: 179-86.

Robinson, J.K., Rigel, D.S., & Amonette, R.A. (2000). Summertime sun protection used by adults for their children. *Journal of the American Academy of Dermatology*, 42: 746-753.

Rogers, B. (2004). Environmental health hazards and health care professional education. *American Association of Occupational Health Nurses Journal*, 52, 154-155.

Ruckart, P.Z., Kalolewski, K., Bove, F.J., & Kaye, W.E. (2004). Long-term Neurobehavioral effects of methyl parathion exposure in children in Mississippi and Ohio. *Environmental Health Perspectives*, 112(1): 46-51.

Sachdeva, A.K. (2000). Faculty development and support needed to integrate the learning of prevention in the curricular of medical schools. *Academic Medicine*, 75(suppl 7): S35-S42.

Samet, J.M., Dominici, F., Curriero, F.C., Ciyrsac, I., & Zeger, S.L. (2000). Fine particulate air pollution and mortality in 20 US cities, 1987-1994. *New England Journal of Medicine,* 343: 1742-1749.

Sattler, B., Atzal, B., Condon, M., Belka, E., & McKee, T. (2001). *Healthy Learning Places: Environmentally Healthy Schools*. Washington, D.C: American Nurses Association.

Schantz, S.L., Widholm, J.J., & Rice, D.C. (2003). Effects on PCBs exposure on neuropsychological function in children. *Environmental Health Perspectives*, 111: 201-206.

Schenk, M., Popp, S.M., Neale, A.V., & Demers, R.Y. (1996) Environmental medicine content in medical school curricula. *Academic Medicine,* 71(5): 499-501.

Scherrer, C.S., Dorsch, J.L., & Weller, A.C. (2006). An evaluation of a collaborative model for preparing evidence-based medicine teachers. *Journal of the Medical Library Association*, 94(2): 159-165.

Schettler, T., Stein, J., Reich, F., & Valenti, M. (2000). *In harm's way: Toxic threats to child development*. Cambridge, MA: Greater Boston Physicians for Social Responsibility.

Schmid-Wendtner, M.H., Berking, C., Baumert, J., Schmidt, M., Sander, C.A., Plewig, G., & Volkenandt, M. (2002). Cutaneous melanoma in childhood and adolescence: An analysis of 36 patients. *Journal of the American Academy of Dermatology*, 46(6): 874-879.

Schwartz, B.S., Pransky, G., & Lashley, D. (1995). Recruiting the occupational and environmental medicine physicians of the future: Results of a survey of current residents. *Journal of Occupational & Environmental Medicine*, 37(6): 739-43.

Silverberg, N.B. (2001). Update on malignant melanoma in children. *Archives of Dermatology*, 67(5): 393-396.

Skochelak S, Barley G, & Fogarty J. (2001). What did we learn about leadership in medical education? Effecting institutional change through the Interdisciplinary Generalist Curriculum Project. *Academic Medicine,* 76(4 Suppl): S86-90.

Spann, M., Blondell, J., & Hunting, K. (2000). Acute hazards to young children from residential pesticide exposures. *American Journal of Public Health*, 90: 971-973.

Sporik, R., Squillace, S.P., Ingram, J.M., Rakes, G., Honsinger, R.W., & Platts-Mills, T.A.E. (1999). Mite, cat, and cockroach exposure, allergen sensitization, and asthma in children: a case-control study of three schools. *Thorax,* 54: 675-680.

Susman, J., & Pascoe, J. (2001). Recommendations to Institutions. *Academic Medicine*, 76(suppl 4): S137-S139.

Szneke, P., Nielsen, C., & Tolentino, N. (1994). Connecticut physicians' knowledge and needs assessment of environmentally related health hazards: a survey. *Connecticut Medicine*, 58: 131-135.

Takeucki, T., & Eto, K. (1999). *The pathology of Minamta disease: A tragic story of water pollution.* Kushu, Japan: Kyushu University Press.

Trasande, L., Landrigan, P.J., & Schechter, C. (2005). Public health and economic consequences of methyl mercury toxicity to the developing brain. *Environmental Health Perspective*s, 113, 590-596.

Tsao, H., Atkins, M.B., & Sober, A.J. (2004). Management of cutaneous melanoma. *New England Journal of Medicine*, 351, 998-1012.

U.S. Consumer Product Safety Commission (CPSC). (2007a). October 2007 Recalls and Product Safety News. Accessed November 1, 2007 at: http://www.cpsc.gov/cpscpub/prerel/prereloct07.html

U.S. Consumer Product Safety Commission (CPSC). (2007b). September 2007 Recalls and Product Safety News. Accessed September 27, 2007 at: http://www.cpsc.gov/cpscpub/prerel/prerelsep07.html

U.S. Department of Health and Human Services (DHHS). (2006). *The Health Consequences of Involuntary Exposure to Tobacco Smoke: A Report of the Surgeon General.* Atlanta, Georgia: US Department of Health and Human Services, CDC.

U.S. DHHS, Health Resources and Services Administration, Bureau of Health Professions, Division of Nursing. (2002). *Nurse Practitioners Primary Care Competencies in Specialty Areas: Adult, Family, Gerontological, Pediatric, and Women's Health*.

U.S. EPA. (2002). *Child Specific Exposure Factors Handbook (Interim Report).* EPA 600-P-00-002B. Washington, D.C.: U.S. Environmental Protection Agency, Office of Research and Development, National Center for Environmental Assessment.

U.S. EPA. (2003). *Indoor air quality and student performance.* Accessed October 31, 2007 at: http://www.epa.gov/iaq/pubs/index.html

U.S. EPA. (2001). *Latest Findings on National Air Quality: 2000 Status and Trends.* Research Triangle Park, NC: Environmental Protection Agency. Publication No. EPA 454/K-01-002.

U.S. EPA. (1993). *Respiratory Health Effects of Passive Smoking: Lung Cancer and Other Disorders.* NIH publication no. 93-3605. Washington, DC: Office of Research and Development, Office of Air and Radiation.

U.S. General Accounting Office. (2000). *Pesticides Industry Sales and Usage: 1996 1997 Market Estimates.* Washington, DC: US General Accounting Office. Publication RCED-00-40.

Wessels, D., Barr, D.B., & Mendola, P. (2003). Use of biomarkers to indicate exposure of children to organophosphate pesticides: implications for a longitudinal study of children's environmental health. *Environmental Health Perspectives,* 111(116): 1939-1946.

Wigle, D.T. (2003). *Child Health and the Environment*. New York: Oxford University Press.

Whitmore, R.W., Kelly, J.E., & Reading, P.L. (1992). *National Home and Garden Pesticide Survey. Final Report.* Vol. 1. Research Triangle Park, NC: Research Triangle Institute.

Wong, E.Y., Gohlke, J., Giffith, W.C., Farrow, S., & Faustman, E.M. (2004). Assessing the health benefits of air pollution reduction for children. *Environmental Health Perspectives,* 112(2): 226-232.

Woolf, A., & Cimino S. (2001). Environmental illness: educational needs of pediatric care providers. *Ambulatory Child Health,* 7: 43-51.