ALLIANCE OF NURSES FOR HEALTHY ENVIRONMENTS

Environmental Health in Nursing

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INTRODUCTION:

The Alliance of Nurses for Healthy Environments (ANHE) was begun in December 2008 when a gathering of 50 nurses representing national nursing organizations met to advance environmental health in nursing. The Mission of ANHE is: Promoting healthy people and healthy environments by educating and leading the nursing profession, advancing research, incorporating evidence-based practice, and influencing policy. According to the ANHE Wingspread Statement of 2009 "The Alliance will guide the nursing profession by strengthening education, advancing research, incorporating evidence– based practice and influencing policy to promote healthy people and healthy environments." In response to the 1995 Institute of Medicine (IOM) report, Nursing, Health and the Environment, ANHE developed strategies to assure that nurses have access to education about environmental health factors that affect nursing practice and the populations that nurses serve. The IOM report noted that no accrediting or regulating body mandated that environmental health content be included. This holds true today. Further, the report recommended that

- environmental health content be included into all levels of nursing education as well as for professional development;
- environmental health content be included in nursing licensure and certification examinations;
- education environmental health should be interdisciplinary;
- environmental health content be part of life-long learning and continuing education for nurses in practice; and
- resources and educational opportunities should be available through public and private organizations and agencies.

To address these recommendations the Education Workgroup of ANHE was formed and strategic goals were established.

At that time of ANHE's inception, one of the goals was to develop an open access electronic textbook for nurses and other health professionals. The offerings differ from a typical textbook in that some are written as chapters that would be familiar to most readers, others are presentations with voice added, and some are educational strategies that target academic and professional development educators. The contributors include experts in special areas salient to the environment and health. Through the intervening years portions of this book were completed and made available on the ANHE website. For this 2016 edition, earlier portions were updated and new information was completed to offer our first PDF version of this textbook. At the present time other contributors are completing additional material to add to this body of work that will be added in future versions.

The value of this online textbook is that it can reach a wide audience of nurses across the globe, is freely accessible, and has hyperlinks built into the chapters to bring the reader directly to well established and evidence based information from governmental and non-governmental agencies and organizations. The book is organized into 9 units that address a board range of topics essential for nurse knowledge in environmental health.

Unit 1 Why Nursing? serves to inform the reader of the relevance of environmental health content for nursing practice as well as mandates from not only the 1995 IOM report but also the inclusion of environmental health (currently Standard 17) into the ANA Scope and Standards of Practice: Nursing beginning as Standard 16 in 2010.

Unit 2 Harmful Environmental Exposures and Vulnerable Populations provides an overview of populations across the lifespan and their specific vulnerabilities as well as specific populations such as workers, immigrants and persons with alterations in cognitive and physical abilities.

Unit 3 Environmental Health Sciences includes information about sciences that inform environmental health such as ecology, toxicology, epidemiology and risk assessment.

Unit 4 Practice Settings addresses hazardous exposures in healthcare, Green Teams, green cleaning in hospitals, and pharmaceutical waste.

Unit 5 Sustainable Communities provides environmental health content that looks at communities. This includes information on green building initiatives, green cleaning in homes, transportation, Brownfields, food, antibiotic use in agriculture and environmental justice.

Unit 6 Climate Change informs the reader about the impact of climate change on health and its implications for nursing practice.

Unit 7 Energy introduces the ANA resolution on healthy energy and addresses the important topic of

Hydraulic Fracturing (Fracking) and its implications for health.

Unit 8 Advocacy includes information about advocacy for nursing practice, coalitions, legislative meetings and chemical policy reform.

Unit 9 Research includes summaries of interviews with 8 nurse researchers in environmental health.

Other resources available to educators are the curriculum recommendations developed by a team of nurse educators representing Associate Degree BS completion programs, basic entry into practice BS programs, and graduate programs. These were developed from the ANHE 2009 EH Competencies and the 2010 ANA Standard 16 Environmental Health to address information and curricula updates from the 1995 Institute of Medicine (IOM) report, Nursing, Health and the Environment curriculum integration points.

Unit 1:
Why Nursing?

ENVIRONMENTAL HEALTH IN ALL NURSING PRACTICE

Environment is one of four traditional concepts in nursing: nurse, patient/client, health, and environment. All nurses practice in one or more places that we can call an environment. Patients/clients live, work, learn, play, and worship in various environments. Nurses are to assist in creating healthy environments in which individuals, families, groups and communities can thrive (American Nurses Association, 2010).

This First Unit of the e-text describes environmental health, why nurses are involved in environmental health, and principles of environmental health in nursing. Environmental health nursing in homes/families, schools, communities, and faith communities is introduced. In this Unit, you will be introduced to some contemporary nurse luminaries and pioneers in environmental health. Also, the environmental health competences expected of all nurses are presented. See Unit IV for details of environmental health for nurses in hospital and institutional practice settings.

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American Nurses Association. (2010). Nursing: Scope and standards of practice, 2nd ed. American Nurses Association: Silver Spring MD.

WHY NURSES ARE INVOLVED WITH ENVIRONMENTAL HEALTH

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WHAT IS ENVIRONMENTAL HEALTH?

"The environment is one of the fundamental determinants of individual and community health" (Institute of Medicine, 1995, p. 1). The environment along with human behavior, genetics/biology and the health care system contribute to the health and illness among human populations (Dever, 1991).

Environmental health may be defined as that aspect of human health determined by physical, chemical, biological and psychosocial factors in the environment (WHO, 1993, cited in Sattler & Lipscomb, 2003, p. xiii). Others define environmental health as the freedom from illness or injury…[due] to exposure to toxic agents and other [hazardous] environmental conditions" (Institute of Medicine, 1995, p. 15).

Environmental health may be defined also as "the theory and practice of assessing, correcting, controlling and preventing factors in the environment" that negatively affect health (WHO, 1993, cited in Sattler & Lipscomb, 2003, p. xiii). Environmental factors that negatively affect health are often called environmental hazards.

"The environment is everything around us - the air we breathe, the water we drink and use, and the food we consume. It's also the chemicals, radiation, microbes, and physical forces with which we come into contact. Our interactions with the environment are complex and are not always healthy" (Centers for Disease Control & Prevention, National Center for Environmental Health, 2009).

Not only do we come in contact with our environment., our environment becomes us through the air, water, food and other exposures. Obviously, we are dependent upon our environment for our development, growth and survival. For example, food provides nutrients for development, growth, and energy; water composes many of our body fluids. When the physical environment is polluted, pollution is not only around us, but in us! Watch this video (22 minutes long) from the Environmental Working Group to learn eye-opening information about body burden [of chemicals] in children.

So what are we to do to reduce environmental hazards? How can we reduce human exposure to environmental hazards? What are we to do to promote healthier environments? We can respond as nurses, workers, students, parents, family members, group members, and citizens. Why are nurses especially equipped to address environmental health?

TOP TEN REASONS THAT NURSES & ENVIRONMENTAL HEALTH GO TOGETHER

1. Nurses provide healing and safe environments for people.
2. Nurses are trusted sources of information.
3. Nurses are the largest healthcare occupation.
4. Nurses work with persons from a variety of cultures.
5. Nurses effect decisions in their own homes, work settings, and communities.
6. Nurses are good sources of information for policy makers.
7. Nurses translate scientific health literature to make it understandable.
8. Nurses with advanced degrees are engaged in research about the environment and health.
9. Health organizations recognize nurses' roles in environmental health.
10. Nursing education and standards of nursing practice require that nurses know how to reduce exposures to environmental health hazards.

Florence Nightingale

Nurses have always been leaders in providing healing and safe environments for people. Nurses protect their patients and their communities. (See Florence Nightingale's Notes on Nursing published in 1860.) Nurses are everywhere that other people are. We work in hospitals and other health care settings, homes, schools and occupational sites. Each of these places has hazards that can cause illness, injury, or premature death. Nurses work to protect people from hazards and to reduce the hazards. Nurses advocate for environments in which people can not only survive, but thrive (ANA, 2007).

Nurses are trusted sources of information. The most recent Gallup poll of US residents shows that for the fourteenth year, nurses are ranked the most honest and ethical profession. When nurses speak, people listen. Nurses provide information to patients and the public about healthy and safe environments. These environments promote human health. They help prevent illness, disability and premature death.

Registered Nurses (RNs) are the largest healthcare occupation. (See Department of Health and Human Services, 2010) There are over 3 million RNs out of 323 million Americans (The Kaiser Family Foundation, 2016; US Census Bureau, 2016. One in every one hundred Americans is a Registered Nurse. Therefore, most residents of the United States come in contact with nurses.

Nurses have experience working with persons from various racial, ethnic, cultural and socio-economic backgrounds. We also work with persons across the lifespan, from pregnant women and newborns to those at the end of their life. Nurses build on these deep and broad communication networks to protect and improve human health.

Nurses have the capacity to effect decisions in their own homes, their work settings, and their communities. Nurses influence decisions in work setting---schools, clinics, homes, nursing homes, and hospitals. Health Care Without Harm is an international coalition of 473 organizations in more than 50 countries, working to transform the health care sector so it is safer for patients and workers. Nurses also help make decisions about health as members of community groups such as PTAs, churches, and other faith-based institutions. The numbers of nurses and their personal influence creates a unique opportunity to make change.

Nurses are uniformly viewed as trusted, un-biased sources of information by policy-makers and the public (Sattler & Lipscomb, 2003). Nurses partner with professional and citizen groups that are addressing a wide range of environmental hazards which affect human health. Some nurses are actively involved in policy and advocacy work at the state and federal government level. Safer Chemicals Healthy Families is a campaign led by nurses to improve U.S. federal policies that protect us from toxic chemicals.

Nurses are translators of scientific health literature. Nurses help patients, families, and members of their community to understand studies about environmental health. The Research Work Group of the Alliance of Nurses for Environmental Health (ANHE) is creating a library of nursing research articles on environmental health. This will better identify evidence-based practices that nurses can implement with individuals, families, and communities.

Nurses with advanced degrees are engaged in research about the environment and health. ANHE also is promoting nurse researchers and sharing information about funding sources for research. The Research Work Group of ANHE has surveyed nurses to explore the priorities for research related to environmental health and nursing. Nurses with a research-focused doctorate usually have a Doctor in Philosophy (PhD) degree and are leading this research.

KEEPING PATIENTS SAFE

Health organizations recognize nurses' roles in environmental health. The World Health Organization states that it is essential for nurses to promote healthy environments, especially homes (Adams, Bartram, & Chartier, 2008). The International Council of Nurses (2007) asserts that nurses should help reduce environmental hazards and promote clean water. In 2004, the Institute of Medicine (IOM) published the report, Keeping patients safe: Transforming the work environment of nurses. This report advocates for making hospitals and health care facilities safer for both patients and nurses. Nurses are to "create a safe care environment that results in high quality patient outcomes" (AACN, 2008, p. 31).

In 2010, the American Nurses' Association (ANA) added an environmental standard to Nursing: Scope and Standards for all RNs. This standard advocates that "the registered nurse integrates the principles of environmental health for nursing in all areas of practice" (ANA, 2010, p. 57). That means that every nurse should improve his or her knowledge and skills to reduce environmental hazards and promote health. No matter what our level of nursing education, no matter what our nursing experience, each of us needs to keep up with the expanding evidence about environmental health (AACN, 2006, 2008; NLNAC, 2008). Each of us needs to integrate that information into our nursing practice. (See Principles of Environmental Health for Nursing Practice later in this document.)

Nursing education organizations require nurses' roles in environmental health. All nurses are to serve as positive role models within healthcare settings and their community (National League for Nursing, NLN, 2000). All nurses need to know how to reduce exposure to environmental health hazards and provide safe physical environments. "Nurses use evidence-based decisions to deliver client care and [help] move clients toward positive health outcomes" (NLN, 2000, p. 14). Nurses with a diploma or an associate degree are focused primarily on the health of individuals and families (NLN). Every individual and every family has some environmental hazards.

Nurses with baccalaureate education expand their focus to include communities and population health (American Association of Colleges of Nursing, AACN, 2008; Association of Community Health Nursing Educators, ACHNE, 2010). Population health includes health promotion and disease/injury prevention with groups, communities, and populations (AACN, 2008; ACHNE, 2010).

Graduates with Master's degree in a nursing specialty or a Doctor of Nursing Practice (DNP) degree are educated to be leaders in nursing practice. As leaders in the practice arena, "DNPs provide a critical interface between practice, research, and policy" (AACN, 2006, p. 14). "The DNP graduate has a foundation in clinical prevention and population health" (AACN, 2006, p. 15. This foundation includes the nurses' ability to analyze occupational and environmental data to plan, implement and evaluate their practice for clinical prevention and population health.

PRINCIPLES OF ENVIRONMENTAL HEALTH FOR NURSING

All nurses are to be aware of the principles of environmental health for nursing. We are to integrate these principles into our practice, education, and research.

ANA'S PRINCIPLES OF ENVIRONMENTAL HEALTH FOR NURSING PRACTICE

1. Knowledge of environmental health concepts is essential to nursing practice.
2. The precautionary principle guides nurses in their practice to use products and practices that do not harm human health or the environment and to take preventive action in the fact of uncertainty. Precautionary Principle
3. Nurses have a right to work in an environment that is safe and healthy.
4. Healthy environments are sustained through multi-disciplinary collaboration.
5. Choice of materials, products, technology, and practices in the environment that impact nursing practice are based on the best available evidence.
6. Approaches to promoting a healthy environment reflect a respect for the diverse values, beliefs, cultures, and circumstances of patients and their families.
7. Nurses participate in assessing the quality of the environment in which they practice and live.
8. Nurses, other health care workers, patients, and communities have the right to know relevant and timely information about the potentially harmful products, chemicals, pollutants, and hazards to which they are exposed.
9. Nurses participate in research of best practices that promote a safe and healthy environment.
10. Nurses must be supported in advocating for and implementing environmental health principles in nursing practice.

Source: ANA's principles of environmental health for nursing practice with implementation strategies. (2007). American Nurses' Association: Silver Spring, MD. (May be purchased in booklet form at nursebooks.org)

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ENVIRONMENTAL HEALTH AND FAMILIES/HOMES

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Environmental Health is important throughout the life cycle. From pre-conception to aging populations, the environment is a contributor in health and illness. Childbearing families are particularly at risk. This is because babies developing in the womb and growing children are quite vulnerable to assaults from air pollution and chemicals present in water, food, and products.

For example,

- Epidemiological studies show that children whose parents work in the farming communities of California have a higher incidence of childhood leukemia (Wigle, Turner, & Krewski , 2009). It is suspected that exposure to pesticides is responsible.
- Air pollution has been linked to a number of adverse health effects such as pre-term labor and most recently autism in children.
- The phthalate DEHP has been eliminated from many newborn nurseries and neonatal intensive care units because of evidence implicating this chemical in male reproductive changes.
- BPA (bisphenol A), a component of many plastic products including children's toys has been described as an endocrine disruptor and linked to cancer and developmental delays.

CRITICAL WINDOWS

Critical windows of vulnerability have been defined in the literature as the following: "Periods during life when an exposure causes a stronger deficit in health later in life compared with other periods when exposure (could have) occurred" (Sanchez, Hu, & Tellez-Rojo, 2011, p. 1).

"Key developmental or reproductive life stages where the body can be more biologically vulnerable or influenced by exposures to chemicals in the environment" (Scott, 2015, p. 395).

Many of these critical windows occur as the fetus develops in utero. In this prenatal environment even small doses of chemicals can cause harm. Exposure to low-doses of chemicals rarely causes gross abnormalities that are obvious at birth. A more likely scenario is that they interfere with the programming that occurs during development, thus creating disease susceptibilities later in life.

According to the American Academy of Pediatrics, children also have unique vulnerabilities to environmental exposures because of their different metabolism, body structure, daily behavior, and lifestyle (Davis, 2007).

During puberty and adolescence the brain is still developing. Chemical exposures during this time can bioaccumulate and be passed to the baby during pregnancy and/or breastfeeding.

HOME EXPOSURES

Exposures to chemicals of concern often occur in the home. It has been estimated that Americans spend 90% of their time indoors. It then becomes important to recognize and decrease environmental stressors in the home environment. Harmful chemicals can be introduced through the foods that we eat, the water we drink, the products that we utilize, and the air that we breathe.

The foods we consume may contain pesticide residues. Plastic food wrap may expose families to phthalates such as bisphenol A (BPA). High fat foods such as meat and dairy may contain chemicals that are lipophilic such persistent organic pollutants (POPs). Fish may be contaminated with mercury, a known neurotoxin.

Petroleum products, pesticides and fertilizers may contaminate water, especially from wells.

Phthalates are chemicals that appear in personal care products as added fragrance. They are also components of many plastic products and may show up in children's toys. These chemicals are endocrine disruptors (EDCs). EDCs have the capacity to interfere with hormone regulation and this may cause permanent disruption of metabolic processes.

Lead is a heavy metal that was present in interior paints before it was gradually phased out in the 1970's. It may still be detectable in older homes built before 1978. It is a potent neurotoxin and can accumulate in dust.

Indoor air pollution is linked to volatile organic compounds or VOCs. Common sources of indoor VOC exposure include building materials, paints, household cleaning products, furniture made from particle board, and carpets. All of these products have the capacity to "off gas" chemicals such as formaldehyde and benzene.

NURSE RESPONSIBILITIES

Nurses have the potential to protect themselves and their families and to influence others by leading by example. Nurses who work with childbearing families have a special opportunity to educate and influence choices. Evidence

shows that reducing exposures to products that contain toxic chemicals can reduce body burden.

No one can completely eliminate chemicals from their lives. But making small changes especially in the home can reduce exposures. No one can do everything. But everyone can do something.

Studies have shown that making simple changes results in a lower body burden of chemicals of concern. Research results document that when children's diets change from conventional to organic, pesticide metabolites are reduced. Other studies show that avoiding canned foods and other dietary sources of bisphenol A reduces levels of that chemical in the body. And simple dietary changes can also decrease exposure to phthalates.

Changes do not have to be complicated. Take your shoes off at the door to avoid bringing offending chemicals such as lead and pesticides into the home. Keep the house well ventilated and open windows to let in fresh air even in the winter. Purchase fresh foods and buy local and organic when possible to reduce exposure to pesticide residues. Utilize the Environmental Working Group pesticide ratings of fruits and vegetables to decide where to spend money on organics. For example apples consistently have detectable levels of pesticide residue when tested. This is a fruit to consider buying organic or locally grown. Consider planting a "kitchen garden" or favorite vegetables and herbs. This will have the added benefit of teaching children where their food comes from. Children who are assisting with the garden will enjoy partaking of the produce as well. Eat foods with less animal fat since harmful chemicals are stored in fat. This means eating more fruits and vegetables and less meat and dairy.

Because household cleaning products can be sources of indoor air pollution it is best to avoid those that contain bleach and ammonia. Many green cleaning products are plant based or you can make your own using such common items as baking soda and vinegar. Vinegar is a natural bacteriostatic as well.

Consider purchasing furniture and flooring composed of real wood. Wood composite off-gasses VOC's as it is held together with toxic glues. Wood floors such as bamboo are also more environmentally friendly than composite or vinyl flooring and are economical as well. Purchase paints that are labeled "low VOC" and use water based glues.

To reduce mercury exposures, refer to the EPA/FDA guidelines which suggest eating smaller fish which contain less mercury like salmon, light tuna, and shellfish .

Because chemicals such as lead accumulate in dust, be sure to damp clean regularly.

Don't use pesticides in your home or garden. Keep out pests by sealing cracks and holes around doors and windowsills and baseboards. Choose plants that grow well where you live so you won't need harmful chemicals and learn about organic gardening.

Re-think your personal care products and learn to read labels. Some toothpaste contains triclosan, a chemical that is actually in the pesticide family. This chemical is added as a preservative. Formaldehyde and toluene are often added to nail polishes and both are linked to cancer. Buy nail formulations that are free of these additives. Avoid cosmetics that contain added fragrance. Fragrance generally contains phthalates which are known to be endocrine disruptors. There are many "green" personal care products on the market that are cost effective. This is especially true in baby care products.

Nurses are powerful. We have the potential to change exposures for ourselves and those we care for.

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ENVIRONMENTAL HEALTH IN THE SCHOOL SETTING

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"Physical environmental stressors in schools measurably and significantly affect children's achievement" (Healthy Schools Network, 2013, p.6). Although asthma and attention deficit disorder have increased, capital budgets to maintain healthy schools have decreased in the United States (Healthy Schools Network, 2013).

School nurses can play an important role in reducing environmental stressors and improving school environments (National Association of School Nurses, 2014). The school nurse's role includes assessment and education. In the assessment role the school nurse might uncover issues in the home and school environment that need to be addressed. Such stressors can include allergens, bites and need for integrated pest management, toxic paints and solvents, and carbon monoxide, among others. Education about reducing these stressors can be directed to school teachers and staff, parents, students, and the larger community.

School nurses also monitor healthy school environments. They can support interest in environmental issues and bring pressing student health concerns to the attention of other parties who can help to address them. A good reference for sources of pollutants in schools is published by the Children's Environmental Health Network (n.d.): Environmental Health in Schools. School nurses can stay informed about best practices around issues such as indoor air quality, asthma management, pesticide use, and neuro-toxins causing learning disabilities. The school nurse has the knowledge level to advocate for preventive environmental measures to help keep students and employees healthy and in school. Environmental health is a very important aspect of school health that tends to get overlooked, partly because the school nurse is typically the only one in the school setting with a health background. Promoting healthy school environments can help ensure that students are healthy and ready to learn.

REDUCING ASTHMA IN SCHOOLS

Data demonstrating a link between school environment and asthma has been part of the focus in the implementation of *Indoor Air Quality Tools for Schools*. An unhealthy school environment consisting of mold, vermin, dust, chemicals from cleaning supplies, poor air quality, or other such hazards can trigger asthma symptoms in students and staff (Sampson, 2012). Healthy schools can reduce asthma almost 40% and upper respiratory infections nearly 70% by adopting proven best practices to improve indoor air quality (IAQ) while also reducing absenteeism and increasing productivity (Kats, 2006). Intervening in the school environment can be instrumental in decreasing the impact of asthma by reducing student suffering and absenteeism, parental stress, and cost of medical care for acute asthma attacks.

The US Environmental Protection Agency (EPA) has focused on creating healthy school environment in schools across the nation and developed the *Tools for Schools* framework that schools can implement to improve indoor air quality (EPA, 2012). A study published in 2011 demonstrated the effectiveness of *Tools for Schools* (TfS) when implemented as part of a collaborative approach to improving the health of schools (Foscue & Harvey, 2011). Creating a healthy school environment may be able to prevent or help mitigate symptoms of illness.

SCHOOL NURSE ROLES IN ENVIRONMENTAL HEALTH

The school nurse can address environmental health issues by encouraging schools to utilize the EPA's *Indoor Air Quality Tools for Schools* action kit (TfS). TfS was developed by the EPA to provide Indoor Air Quality (IAQ) guidance for schools to make voluntary changes that will reduce exposures to indoor environmental contaminants in schools. Indoor air quality TfS recommendations are based on research and best practices and more information can be located on the tool kit website.

Green cleaning is another way to help students stay healthy and in school (Balek, 2012). Green cleaning is cleaning that uses less toxic products to protect the health of students and staff without harming the environment. It also increases the lifespan of facilities, preserves the environment and ultimately saves the school money. The biggest priority with green cleaning is implementing a green cleaning program that eliminates harmful chemicals, manages volatile organic compounds (VOCs), and reduces harmful bacteria keeping students and staff healthier.

Another role of a school nurse is that of advocacy. The school nurse can advocate for environmental health needs and concerns in the school setting in different ways. Some examples of this may be walking through the school on a routine basis looking for any concerns, addressing those within the nurse's scope, and then following up with school administrative personnel to ensure that those concerns are addressed routinely. Reaching out to your local, state or federal legislators with your concerns is another way to advocate for environmental health policy in schools. For example, this can occur by making a

request to a local legislator to submit legislation around green cleaning in schools. Asthma awareness month in one state was recognized by a U.S. senator from that state by holding a field hearing to bring awareness around asthma in schools and the impact the school environment has on students and staff (J. Leffers, personal communication, 2015). As a school nurse you have the knowledge and field experience to testify at such hearings.

RESOURCES FOR IMPROVING SCHOOL ENVIRONMENTS

There are a number of tools and resources to help support this work. Working together with facilities managers, custodial staff and administrators using these resources is a great place to start. A list of Web resources for school nurses can be found at the Alliance of Nurses for Healthy Environments (ANHE) Web Resources for School Nurses. Additional environmental health tools can be found at the National Association of School Nurses (NASN).

Healthy Schools Campaign is an independent nonprofit that believes each child deserves a healthy school. The Campaign is supported by industry leaders in the manufacture and distribution of green cleaning products and services. The following table lists resources from the Healthy Schools Campaign.

Quick + Easy Guide to Green Cleaning in Schools (2006)	greencleanschools.org
Blog on How School Nurses Can Lead the Way for Green Clean Schools	healthyschoolscampaign.org/blog/how-school-nurses-can-lead-the-way-for-green-clean-schools
Information on promoting diligent handwashing	healthyschoolscampaign.org/?s=handwashing
Resources on improving Indoor Air Quality	www.healthyschoolscampaign.org/programs/indoor-air-quality-in-schools/

CONCLUSION

Environmental health brings nurses back to the basics as Florence Nightingale writes in her memoirs. It is important that all nurses regardless of their type of nursing practice must be able to incorporate environmental health principles. The school setting is no exception and environmental issues should be part of every school nurse's practice on a daily basis.

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ENVIRONMENTAL HEALTH NURSING AT THE COMMUNITY LEVEL

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INTRODUCTION

Human health is influenced by an interconnected dynamic of factors from the individual's biology and genetics to the public policy that establishes access to health services. The Socio-Ecological Model (Figure 1) depicts the context of individual health within interpersonal, organizational or institutional, community, and public-policy factors (McLeroy, Bibeau, Steckler, & Glanz, 1988; Stokols, 1996).

Nurses are engaged in applying the nursing process to improve environmental health at all levels of the Socio-Ecological Model. For example, at the individual and interpersonal level, the nurse may assess a patient and family's environmental exposure history. Based on the assessment, the nurse may provide individualized education and strategies to enhance a family member's asthma control by reducing personal environmental exposures. At the organizational level, nurses may work to reduce medical waste burning practices in their employing agency. This section introduces environmental health nursing at the community level

COMMUNITY

A population is a group of people who share at least one common characteristic. Communities include one or more populations and their shared goals over time (Maurer & Smith, 2013). Most commonly, communities refer to people living in the same geographical location, like a town or county. However, communities can be formed around a purpose or profession (e.g. medical community), education (e.g. online learning community), economic interest (e.g. small business community), a faith community (e.g. Catholic community), or other common characteristics or special interests (e.g. lesbian community). More information on describing and understanding the community can be found at the Community Toolbox Website. The community health nurse applies the nursing process to the overall aggregate health of their community of focus (ANA, 2013). Most nurses who provide nursing care at the community level are educated at the baccalaureate level of nursing or higher.

Community health nurses have a focus on the systems context that is broader than direct delivery of care to patients and families alone. One of the key determinants of health at the community level is the physical environment, including environmental pollution. Often,

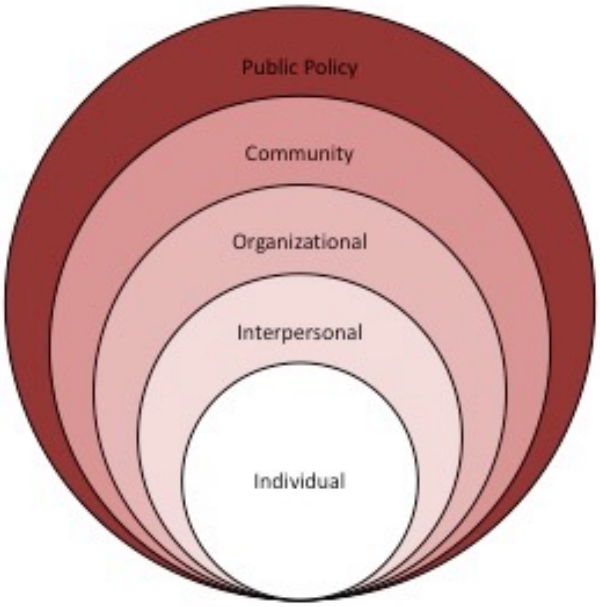

Figure 1: The Socio-Ecological Model

exposures to pollutants in the water, air, soil, and food supply are beyond the control of any one individual. In these circumstances, applying the nursing process at the community-level is necessary to improve health. The Sustainable Communities Unit of this eTextbook has more information on applying the nursing process at the community level.

The following video is a case example of environmental health nursing at the community level, entitled *Holding Polluters Accountable: A Community-Nurse Collaboration* (2014)

Holding Polluters Accountable: A Community-Nurse Collaboration Success Story

https://www.youtube.com/watch?v=HGzBLpZmGyM
(63:07 minutes)

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FAITH COMMUNITY: AN ENVIRONMENTAL PARTNER

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> *"Creation is not a property, which we can rule over at will; or, even less, is the property of only a few: Creation is a gift, it is a wonderful gift that God has given us, so that we care for it and we use it for the benefit of all, always with great respect and gratitude."* Pope Francis, May 21, 2014.

Partnering with the faith community is a natural fit for nurses when educating community members about environmental health risks and advocating for improved environmental regulations with policy makers. The faith community and the nursing profession share several environmental interests that could be developed into mutual programs to improve the health of individuals, families and communities. Some of the shared interests are:

- Stewardship of the earth
- Common good
- Climate change
- Justice/ Environmental Justice
- Sustainable practices
- Food security
- Solidarity with vulnerable groups
- Care of creation
- Workers' rights

While the scope of this text does not permit covering each faith practice in detail, a general description of faith practices relative to the environment offers the nurse a basic understanding. The Abrahamic faiths of Judaism, Christianity, and Islam include an imperative to care for the earth and also acknowledge that the earth's resources are a gift from the Creator that must be appreciated (Green Prophet, 2008). Eastern religions, such as Hinduism and Buddhism, do not make a distinction between the person and the natural environment; people and the natural environment are all part of an interconnected web of life that must be cared for (Green Faith, n.d.). Like Eastern religions, Native American and indigenous peoples view themselves as part of the earth and their connectedness to the earth has influenced their survival throughout history (Sherrer & Murphy, 2006). The list of faith based environmental organizations later in this section provides web links so you can learn more detail and perspectives of specific faith traditions related to the environment.

Some churches and other faith groups enlist the services of a parish nurse to meet the spiritual and health needs of their congregation (Whisnant, 1999). The parish nurse could be a valuable partner in collaborating to develop congregation wide environmental initiatives. If a faith community does not have a parish nurse, nurses could volunteer within their own faith communities to influence the environmental health of the congregation as well as the faith community's environmental impact. Partnering with the clergy and the leadership of the faith community can promote trust of the nurse within the congregation. Most faith communities also have resources that can assist them in serving as a center for environmental health outreach. For example churches, synagogues, mosques, and temples have meeting rooms, office space, and frequently volunteers to support environmental health initiatives. Furthermore, the faith community has a moral structure from which nurses can frame an environmental discussion (Green Prophet, 2008) to the congregation, the larger community, or policy makers.

There are many environmental faith based organizations. Some are single faith and others are multi-faith organizations. On the following page is a list of some faith based environmental organizations and their web sites.

Organization Name	Web Site	Organization Purpose
Catholic Climate Covenant	catholicclimatecovenant.org/about-us/	Catholic teaching related to care for creation and climate change
Coalition on the Environment and Jewish Life (COEJL)	www.coejl.org/	Strengthening stewardship of the Earth through outreach, activism and Jewish learning
Green Faith	greenfaith.org	Teach & mobilize people of diverse religious backgrounds for environmental leadership
Interfaith Power and Light	www.interfaithpowerandlight.org/	Interfaith group with a focus on climate change
Islamic Foundation for Ecology & Environmental Sciences	www.ifees.org.uk/green-guide-for-muslims	U.K. based organization. Provides a "Green Guide for Muslims"
National Religious Partnership for the Environment	www.nrpe.org/	Partnership of faith based environmental organizations. Good resources for various religions' environmental perspective
Pachamama Alliance	www.pachamama.org/	Influencing society to have environmentally sustainable partnerships with indigenous people
Quaker Earth Care Witness	www.quakerearthcare.org/	Network of Quakers addressing ecological and social world crises
Tribal P2: Pollution Prevention Network	tribalp2.org/	Collaborates with U.S. tribes to reduce environmental & health risks on tribal lands
Evangelical Environmental Network	www.creationcare.org/	A ministry for Evangelical Christians in the U.S. that educates, inspires, and mobilizes them in their effort to care for God's creation

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SPOTLIGHT ON NURSES

THE LUMINARY PROJECT

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The Luminary Project was developed in 2005 as a collaborative effort by the Health Care without Harm Nurses Workgroup as well as nurses and nursing organizations that support environmental health nursing. The Luminary Project was developed to share the stories of how nurses strategically address environmental health problems to improve environmental safety in hospitals; improve air, water and land quality; and reduce exposures to harmful chemicals across the life span. The name Luminary was chosen to reflect how nurses illuminate the way to a healthier environment through nursing practice, education, research and advocacy.

By reading about the nurse luminaries, nurses can be inspired to launch their own efforts to improve health through healthier environments. Each story shows not only what the luminary has accomplished but also who inspired the luminary, and what impact their work has made to advance environmental health nursing.

Follow this link in order to learn the many ways that nurses are involved in environmental health and to see the impact of this work: About the Luminary Project

MY ROAD TO ENVIRONMENTAL HEALTH

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When I am asked how I got involved in environmental health, my first impulse is to talk about the day in 1993 when Lewis Shaw, the engineer in charge of Environmental Quality Control (EQC) at the South Carolina Department of Health & Environmental Control (DHEC) approached me. We had been colleagues on the State Health Commissioner's Executive staff for several years where he was a Deputy Commissioner and I was Assistant Commissioner and State Director of Public Health Nursing.

I will never forget his words: "I think we need a nurse." He was asking me to transfer into his deputy area which carried responsibility for the state and federally-delegated programs of Air Quality, Water, Solid & Hazardous Waste, and the Environmental Laboratory. He saw the need for someone who could be a bridge between his staff of environmental scientists and engineers and communities that were impacted by environmental events and hazards.

At that time I had been a public health nurse for more than 20 years and from my position on the Commissioner's staff had a broad understanding of the interconnectedness of the agency's responsibility for public health and environmental protection. I also had working relationships of long-duration in most of the working units of the agency. The thought of creating a new job that would strengthen the link between health and environment as well as letting me spend time in local communities was very appealing.

For the next eight years, calls were directed to my office from citizens who were concerned about something in their environment:

- something looked unusual, smelled strange, tasted odd
- too many people around them were ill, especially with cancer
- they were uneasy about the industry nearby
- there were rumors that a landfill was coming to their neighborhood.

The list was long, and my job was to listen, to go and let them show me and talk with me about their worries. I spent a lot of my working hours at kitchen tables, country churches, and neighborhood meetings all across the state. Then I was to follow-through to assure that our staff made an appropriate response.

Sometimes the follow-up was supplying them with information we had and they did not, and providing for interpretation of data unfamiliar to them. Sometimes the problem called for an environmental investigation, often combined with analysis of health data for the area, particularly data from the cancer registry. Sometimes we provided public forums, with participation of experts in their issues of concern, to discuss and clarify and decide on a course of action. In these situations, I worked with the community to plan for where and when to meet and how to keep them informed over the course of resolving the issue.

Often my calls were from front-line staff in our environmental programs and district offices. There may be need to let a community know of an industry's application for an environmental permit. We may be involved in cleaning up a spill or other source of environmental contamination. In that case, my job was to alert the community, with the necessary information for them to protect themselves and/or become actively involved in the permitting or enforcement process. Sometimes the staff

just wanted me to go with them to meet with some upset citizens.

My job also carried responsibility for risk communication —helping staff to understand that risk was a combination of "hazard and outrage" and our job included addressing both! (Peter Sandman's work in this area was invaluable to me.) Over time, our staff came to understand how people react to risk and how we can prevent and allay fears by how we respond and communicate. Community meetings, which I often moderated, went from being situations filled with angry crowds where our staff felt they deserved "hazardous duty pay", to collaborative events. We all learned what valuable assets watchful citizens, who care about their environment, are to our work of surveillance and protection.

I was involved in planning and delivering continuing education for staff—in orientation sessions, in workshops, in immersion environmental learning experiences for local health department professionals, and in developing materials to aid the staff in responding to frequently occurring questions.

My work began to extend from a focus on our agency staff to lecturing to University classes in schools of nursing and public health. I was asked to chair the Institute of Medicine Study of Nursing, Health & Environment (1995) and then was often invited to speak about the resulting report to numerous groups in many states. With some pioneering colleagues at the University of Maryland, we developed a chapter on Environmental Health for Stanhope & Lancaster's Public Health Nursing text. Diana Mason asked that I contribute an environmental vignette for her book on Policy and Politics in Nursing and Health Care. I served on the Enforcement Subcommittee for EPA's National Environmental Justice Advisory Council, and that lead to involvement with other EPA and environmental justice initiatives, including organizing and implementing a Future Search conference in South Carolina. Being a part of the Alliance of Nurses for Healthy Environments (ANHE) has been an exciting and joy-filled experience, with new opportunities and relationships.

My career and world expanded in ways I had never imagined. I realize that my environmental health journey did not really begin with that conversation with Lewis Shaw. I began heading in this direction from my days as a nursing undergraduate when my public health nursing professor and life-long mentor, Virginia Phillips, taught me the multi-disciplinary nature of public health, modeled it in her practice and made it an integral part of my concept of the breadth of public health and my approach to solving public health problems. My graduate program in the School of Public Health at the University of SC included required course work in environment as well as multi-discipline practice seminars addressing real issues in our state. The connections between health and environment and the necessity of a variety of expertise to prevent and address problems in each domain were cemented into my DNA!

My commitment to protecting and improving our environment did not end with retirement. I am still actively involved, especially in issues of the built environment—public transportation, more livable communities with safe spaces for walking and biking, community design and development that considers access to goods and services for all of the population--and public policy decision-making that supports community involvement and sustainable living. I am active in my church's efforts to be a more "green congregation", rooted in our calling to "tend and care for all of creation."

My community knows me as an avowed "tree-hugger", and I have confirmed that again with the wonderful opportunity to work with high school students planting sequoia trees!

The first principle I learned in environmental health is that "everything is connected to everything else." That is a basic principle for the environment and health and for life itself.

ADVOCATING FOR ENVIRONMENTAL JUSTICE

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I grew up in a small southern town in Vance County, North Carolina in the 1950s and 60s. My family lived within the city limits about 100 yards from the city dump where the town's trash was burned in open space each afternoon. I vividly recall the dark smoke that would rise and the darkness and ash that would float overhead and descend over neighboring communities of African-American families. On wash day, we had to be sure to get the clothes off of the line before the tall pile of trash was ignited. In the summer time, it was difficult to sit outdoors because of the dust and dirt on our street. Occasionally, a city truck would drive by and spray a solution on the street, giving us temporary relief from the dusty particles.

As a young child I did not understand the nature of these problems, This was the way of life, and like my family, I adapted and co-existed with these environmental assaults. As I grew older and learned about the environment in secondary school, college, and beyond, I would revisit these childhood memories and be appalled by how our

health and well being had been threatened by such exposure.

During the 1970s, the State of North Carolina routinely dumped polychlorinated byphenyls (PCB)-laced oil, a highly toxic carcinogenic compound, on the roadbeds in certain areas of the state. After many years of protests and court action, the state removed the worn PCB-laced residue with the intention of burying it in a landfill in Warren County, NC, adjacent to Vance County. Opponents of that plan argued that Warren County was selected because the area was rural and the majority of the residents were poor, black and politically unable to determine their fate. My uncle, a well-regarded civic-minded local leader, joined other local and national civil rights leaders, community activists, and environmental groups from around the nation in protesting the intended burial of the toxic waste in the Warren County landfill. His accounts of this environmental injustice stimulated my personal and professional ambitions. My interest in community health nursing and the impact of environmental, economic, political, and racially-linked exposure of toxic substances on vulnerable populations was the stimulus that increasingly matured my interest and commitment to environmental and population health.

I served as Dean of the Howard University College School of Nursing for 18 years. During that time, a small group of public/community health-minded faculty and I became involved in the Mississippi Delta Project, funded by Agency for Toxic Substances and Disease Registry. The aim of the project was to increase awareness of environmental health concepts and practices in nursing curricula in schools of nursing in the Mississippi Delta. The Delta is a geographical area comprised of 219 counties over seven states where a plethora of corporate farms, industrial factories, petroleum refineries, and other "dirty industries," posed hazardous exposure to the area's residents, who were largely poor, under-educated, African-American and politically unengaged. Our work led to the development of a modular curriculum, Environmental Health and Nursing: The Mississippi Delta Project (1999), comprised of six modules: demographics of the Delta, culture, toxicology, environmental justice, community assessment, and community engagement and advocacy. I authored the environmental justice module which, along with other modules, continued to evolve and opened doors for collaboration with other schools of nursing, invited presentations around the county with nursing and non-nursing groups, and led to other publications and to my appointment to the EPA National Environmental Justice Advisory Committee.

MY JOURNEY AS AN ADVOCATE FOR ENVIRONMENTAL HEALTH IN NURSING

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It takes a village to get good things done. I have been one of many nurses who have discovered environmental health and decided to do something about it. My particular strengths are that I am enthusiastic, creative, and persuasive. That alone would never be enough to sustain forward motion - that required a great many patient, detail oriented, highly organized, and dedicated colleagues who followed through with the sometimes tedious efforts required to integrate environmental health into nursing education, practice, research and policy/advocacy. I salute us all.

There are a couple of things that have been motivators to me for as long as I can remember – social justice, the environment, learning, and having fun. My interest in human health was something that developed later in my 20s when I entered nursing school. I went to a hospital-based diploma nursing program that no longer exists and early in my nursing career I was a critical care nurse first in San Francisco and then in Baltimore – ICU, CCU, ER, and Burn Unit which I really loved. At the same time, I also was very involved in my nursing union and became part of the contract negotiation team. I learned a lot about the importance of collective action, the power of organizing, and how to work strategically to accomplish goals.

I don't actually have any degrees in nursing, just my Diploma that allowed me to sit for the Boards and become a Registered Nurse. My degrees are BS in Political Science, and both a Masters and Doctorate in Public Health from the Johns Hopkins School of Public Health. In between my two graduate degrees, I was the Executive Director of a small non-profit, MaryCOSH (Maryland Committee on Occupational Safety and Health) that worked on a variety of occupational health issues. My main focus was helping to pass a statewide worker right to know law so that workers could find information about the toxic chemicals that they were working with. Our success was largely a function of the diversity of the coalition that we created which included unionized workers, firefighters, health professionals and non-profit organizations like Clean Water Action and the American Lung Association. Learning to play with folks who have different agendas and yet finding a common one that we could all agree upon was a critical skill for future work.

Then I worked for the United Steelworkers Union. During that time I went to many different kinds of worksites where I began to understand how poorly we were

protecting workers from toxic exposures and, by extension, their families and communities.

My first job after grad school was directing the National Center for Hazard Communication where I did research and worked with labor, industry, and the government on developing the best tools to train and educate people (workers, community members, health professionals) about hazardous chemicals. As early as 1991, we developed a completely on-line degree on environmental management.

I left that Center, which was at the College Park Campus of the University of Maryland, and joined the faculty at the School of Medicine in the Baltimore Campus where I started the Environmental Health Education Center. My first center grants were from the US Environmental Protection Agency to work on lead poisoning prevention. This work expanded into a more comprehensive healthy homes initiative and continued to grow into healthy schools and then healthy hospitals.

I was struck by a 1985 report by the Institute of Medicine (IOM) that showed how physicians did not learn about occupational and environmental health – which was equally true for nurses. Two colleagues and I made an appointment and met with Andrew Pope at the Institute of Medicine to ask for a similar study to be created to look at what nurses learned about occupational and environmental health. We were able to compel him and the IOM. A committee was created that was chaired by Lillian Mood, a brilliant public health nurse from South Carolina who continues to do great environmental health work in her retirement.

The report, Nursing, Health and the Environment, created a framework for thinking about how to integrate environmental health into the nursing profession. This framework has consistently guided my environmental health and nursing work ever since. It calls for nursing to integrate environmental health into nursing education (our own education and our patient/community education), practice (by both integrating environmental assessments into our clinical care and attending to the environmental healthiness of our health care settings), research, and policy/advocacy. Later, when we created the Alliance of Nurses for Healthy Environments (ANHE), these four domains became our standing committees. An overarching value that is applied to all four domains is environmental justice.

After 6 or so years on the faculty at the Medical School, the Dean of the University of Maryland, School of Nursing asked me to bring the Environmental Health Education Center to nursing and help to develop the first environmental health and nursing program in the country. I did this with the help of Brenda Afzal, who was my associate and "partner in crime" for many years. There were also a great many other key players at Maryland like Claudia Smith who is an active member of ANHE's Education Work Group, Robyn Gilden who now heads up the Center, and Katie Huffling who is now the Director of Programs for ANHE.

At about the same time, I was able to secure a very generous grant ($1.4 million) from the Kellogg Foundation to work with nursing faculty from Howard University to develop and deliver faculty development training on the integration of environmental health into nursing education. We trained over 200 faculty in 17 states and then provided them with 2 additional years of support. This helped to seed a new crop of environmental health champions within schools of nursing. Pat Butterfield did similar workshops in Montana with funding from the Agency for Toxic Substances and Disease Registry (ATSDR). [At the time, ATSDR was a big supporter of nursing. It has since then essentially dropped its nursing efforts.]

While the IOM report was clear that all nurses should learn about environmental health, it became clear to me that some nurses needed to dig deeply into this area. With a grant from the Health Services Resources Administration (HRSA), I started the first Masters Degree Program in Environmental Health and Nursing. This was a fabulous program that helped to train some of today's nursing leaders. The nursing students who studied with me over the years went on to become executive sustainability officers in hospitals, directors in non-profit organizations, and faculty in environmental health nursing. Many of them expressed their leadership within their nursing specialty professional organizations, helping to bring educational programs and presentations to their national meetings. Though the program was a generalist program, the students often gained significant expertise in environmental topics, for example, Brenda Afzal on drinking water and Robyn Gilden on pesticide use and children's health.

In the late 1990s I was involved in the creation of a national campaign called Health Care Without Harm (HCWH). In one of the early meetings in California, we gathered environmentalists from a variety of organizations – Greenpeace, Environmental Working Group, the Center for Environmental Health, and others – along with a couple of physicians and a small group of nurses, including Charlotte Brody who is a brilliant strategist. It was brought to our attention that one of the biggest contributors to mercury in our air was medical waste

incinerator emissions. There were over 3,000 of them in the country at the time. Together, we ran a successful campaign that eliminated mercury thermometers in health care (and essentially everywhere else in the U.S.) and we closed down all but fewer than 100 medical waste incinerators.

For a few years I chaired the HCWH Nurses Work Group with my good friend and nursing colleague Susan Wilburn who was then a senior staff at the American Nurses Association in the Center for Occupational and Environmental Health. (The ANA closed that center down and changed their focus to nurses' wellness. I think they should have added wellness instead of eliminating health and safety.) We organized workshops all over the country called RN-NoHarm, helping to launch another cadre of nurses. In this case they were often focused on greening their hospitals. The HCWH campaign morphed into a non-profit organization that spawned a range of exceptional programs like Practice Green Health and the Global Green and Healthy Hospitals for which Susan now works (after an 8 year stint with the World Health Organization doing occupational and environmental health).

For several years, the Beldon Fund supported a collaborative nursing approach to green hospitals and address chemical policies in the U.S. The key players were the ANA's Center for Occupational and Environmental Health, HCWH's Nurses Workgroup, and the Environmental Health Education Center at the University of Maryland. This work included educational efforts and training of nurses in advocacy skills. Nurses worked closely with environmental and public health organizations in their state houses and capitals to advocate for sorely needed comprehensive chemical policy reform. Nurses also worked on many policies that addressed individual chemicals such as bisphenol A (BPA) and categories of products such as safe cosmetics. We worked with staff at the National Library of Medicine to include training on searching their databases for the best evidence regarding toxic chemicals. We remained scrupulous about being evidence-based in our assertions and in our writings.

We sponsored a half dozen writers' retreats/workshops for nurses who wanted to write articles about environmental health. These were both great fun and very productive and continued to build a "community" of nurses from around the country who were interested in and working on environmental health. These retreats often took place in extraordinary locations like the Northern California Coast and Martha's Vineyard. Some were at retreat centers but many of them were in nurses' homes.

With Beldon Funds, we organized a group of unions that represent nurses around the country to talk about how to use collective bargaining to better protect nurses from potentially toxic chemicals in hospital settings. The result was a compendium of model language that could be negotiated and inserted into contracts, thus adding another legal framework for protecting nurses (and by extension other employees and patients) from unnecessary harmful exposures in health care.

In 2008, there were a number of nurses around the country that were doing environmental health activities but they were poorly coordinated. We were not yet building a movement. With funding from the Kendeda Fund, we organized a 4-day retreat in Oracle, AZ, with 50 nursing leaders from around the country. At the end of the retreat we decided to create a national organization, which became an official non-profit organization, called the Alliance of Nurses for Healthy Environments (ANHE). I was a founding Board member and have since then been on and off the Board. This organization has created a wealth of resources, workshops, webinars, a website, a virtual "e" Textbook, and has effectively engaged in political advocacy. And it has helped to support the community of nurses who are interested in environmental health.

There are many ways that ANHE is now seen as the voice of environmental health nursing in the country. The ANA defers environmental health questions and efforts to ANHE. We helped to get the first "Environmental Standard" into the 2010 Scope and Standards of Professional Nursing Practice. After ANHE members visited with the head of the National Institute of Nursing Research and the National Institute of Environmental Health Science, these two NIH institutes put out a joint request for nursing research in environmental health. The major national and state environmentalist organizations seek ANHE to help support policy efforts in our state houses and capitals.

Until 2014, ANHE was a US and Canada-based organizations. After a working trip to Australia to meet with nursing unions there on greening their hospitals and on "fracking", I realized that they were wrestling with the same issues we were in the U.S. and that we should communicate with each other and share resources. We expanded ANHE's scope and created an international Climate Change Committee that incorporates work on fracking and other fossil fuel issues, with monthly calls and nurses from the UK, Australia, Canada and the US. We started with English-speaking countries but are committed to expanding to a great many other countries in the near future.

After retiring from the University of Maryland in 2012, I moved to California, where I am currently a full-time Professor at the University of San Francisco. I continue to be a Board member of ANHE and am the primary grant writer/fundraiser for the organization. I am working with the Jonas Nursing Center to develop a scholarship program for doctoral (PhD and DNP) students who are interested in environmental health. With colleagues in Australia and with Susan Wilburn of Global Green and Healthy Hospitals, I am developing a Global Environmental Health Nursing Certificate.

There are some things that "I" did regarding environmental health and nursing, but the vast majority of things "we" did. We have had some very generous funders over the years and a great many supporters. We have helped to birth nursing environmental health champions. I've been involved in 3 decades of work that is helping to form the next generation of nurses who we hope will consider environmental health a critical component of the nursing profession.

"The best way to predict the future is to design it." Buckminster Fuller

DESIRED ENVIRONMENTAL HEALTH COMPETENCIES FOR REGISTERED NURSES

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The Alliance for Nurses for Healthy Environments (ANHE) met in June 2009 to develop competencies for environmental health nursing for both the nurse at the basic level of education and for the nurse with advanced knowledge for practice. These competencies would serve as a guide for the development of ANHE educational tools such as the electronic textbook and curriculum recommendations for all levels of nursing education. During the fall of 2009, ANHE members collaborated with the American Nurses Association in ANA's development of Standard 16 Environmental Health (below).

ALLIANCE OF NURSES FOR HEALTHY ENVIRONMENTS - ENVIRONMENTAL HEALTH (EH) COMPETENCIES FOR NURSES (2009)

The registered nurse:

- Applies knowledge of basic EH concepts to nursing assessment, prevention, and control strategies.
- Incorporates environmental risk factors across the lifespan when assessing individuals, families, and/or communities.
- Utilizes scientific evidence and is guided by the precautionary principle.
- Reduces EH risks in the health care setting (chemical, biological, and radiological).
- Participates in creating environments that promote health and healing which include attention to sound/noise, light, and use of/access to nature.
- Collaborates with others to create and implement strategies that promote healthy environments.
- Promotes a healthy environment that respects the diverse values, beliefs, cultures, & circumstances of patients, their families, and communities.
- Advocates for healthy environments that include issues associated with air, water, soil, food/agriculture, the built environment and chemicals/products.
- Promotes one's right to know about potentially harmful products, chemicals, pollutants and hazards to which people may be exposed.
- Communicates EH risks and exposure reduction strategies with patients, families and /or communities.
- Advocates for environmental justice, including a commitment to the health of vulnerable populations and the elimination of health disparities (AACN 2008, Baccalaureate Competencies, pg 25, line 12).

Additional Competencies for the Advanced Practice Registered Nurse:

- Evaluates outcomes related to the implementation of EH strategies.
- Explains the impact of social, political, and economic influences upon the environment & human health exposures.
- Analyses information on human exposure to environmental hazards & their implications for practice, such as biomonitoring and geographic information systems (GIS).
- Critically evaluates the manner in which EH issues are presented by the popular media.
- Supports nurses in advocating for and implementing environmental principles in nursing practice.
- Establishes partnerships that support the creation and implementation of strategies promoting healthy environments.
- Demonstrates leadership in promoting environmentally healthy, safe, and sustainable policies & conditions.

The Alliance of Nurses for Healthy Environments (ANHE) has partnered with the American Nurses' Association (ANA) in the development and inclusion of an Environmental Health standard in the ANA's Scope and Standards of Practice for nurses (2010). ANHE also has developed the website (http://envirn.org) to assist you in developing competencies in Environmental Health. Read on to learn about what is expected of you as a nurse.

AMERICAN NURSES' ASSOCIATION (ANA) STANDARD FOR ENVIRONMENTAL HEALTH

This is an exciting time for nursing! The American Nurses Association (ANA, 2010) has released its new Scope and Standards for nursing practice that includes a standard for Environmental Health! These standards form the baseline for every practicing registered nurse in the United States. The concepts are not new to nursing; even Florence Nightingale recognized the environment as crucial to the health of patients and communities. However, Florence did not have as many challenges as we face today. For example, there are toxic chemicals all around us: at home in our personal care products, cleaning products and food; in schools and workplaces; and in the community. Pesticides are on our lawns and playing fields and in the food we eat.

Chemicals are linked to cancer, reproductive effects, immune systems effects, developmental delays, and endocrine effects. These chemicals are on the rise in our environment and inside our bodies as well.

ANA acknowledges that environmental health is important enough to include in the Scope and Standards. This environmental health standard helps raise awareness of nurses and others that nurses have a significant role to play. From gaining knowledge about EH concepts to creating changes in practice and policy, the 3 million RN's will have the tools they need to create a safer, healthier environment for all.

The following ANA (2010) Environmental Health standard identifies desired competencies for every registered nurse. This standard can guide every RN in developing his or her own competencies in environmental health. Use this standard to reflect on your own knowledge, skills and experiences. Identify examples from your own practice that demonstrate your Environmental Health competencies. Identify those competencies for which you require further development.

STANDARD 16. ENVIRONMENTAL HEALTH

- The registered nurse practices in an environmentally safe and healthy manner.

Competencies:

The registered nurse:

- Attain knowledge of environmental health concepts, such as implementation of environmental health strategies.
- Promotes a practice environment that reduces environmental health risks of workers and healthcare consumers.
- Assesses the practice environment for factors such as sound, odor, noise and light that negatively affect health.
- Advocates for the judicious and appropriate use of products used in health care.
- Communicates environmental health risks and exposure reduction strategies to healthcare consumers, families, colleagues and communities.
- Utilizes scientific evidence to determine if a product or treatment is a potential environmental threat.
- Participates in strategies to promote healthy communities.

Additional Competencies for the graduate-level prepared specialty nurse and the Advanced Practice Registered Nurse:

- The graduate-level prepared specialty nurse and the advanced practice registered nurse:
- Create partnerships that promote sustainable environmental health policies and conditions.
- Analyze the impact of social, political, and economic influences upon the environment and human health exposures.
- Critically evaluate the manner in which environmental health issues are presented by the popular media.
- Advocate for implementation of environmental principles for nursing practice.
- Support nurses in advocating for and implementing environmental principles in nursing practice.

Source: American Nurses Association (ANA). (2010). Nursing: Scope and Standards of Practice, Second Edition. Silver Spring, MD: Nursebooks.org.

Standard 16 became Standard 17 in 2015 when ANA published the third edition of Nursing: Scope and Standards of Practice (available for purchase through ANA). Although specific language has changed, the principles underlying the Standard remain the same. All nurses are to assess, communicate and reduce environmental health risks and participate in "promoting healthy communities and practice environments" (page 84). Graduate level prepared nurses, including APRNs, are to create "partnerships that promote sustainable global environmental health policies and conditions that focus on prevention of hazards to people and the natural environment" (page 84).

REFERENCES

American Nurses' Association (ANA). (2015). Nursing: Scope and standards of practice, 3rd ed. Nursesbooks.org: Silver Spring, MD.

THE ALLIANCE OF NURSES FOR HEALTHY ENVIRONMENTS (ANHE) AS A RESOURCE

The Alliance of Nurses for Healthy Environments (ANHE) has developed its website and this e-text to assist you in developing competencies in Environmental Health. Here you can attain knowledge regarding Environmental Health in Nursing and network with other nurses who have similar interests. The website enables you to exchange information and ideas, as well as collaborate, to promote healthy people and healthy environments.

This e-text is a good place to start if you want the basics. The e-text is being developed as a virtual "textbook" on environmental health in nursing. The writings are peer-reviewed and written by leaders in environmental health nursing. The e-text provides the latest information and

resources for use in academic, clinical, and public arenas. Other resources at EnviRN include teaching strategies and links to other outstanding topics for environmental health and nursing.

Unit II:
Harmful Environmental Exposures and Vulnerable Populations

INTRODUCTION

Unit I highlighted various roles of the nursing profession where knowledge of environmental exposures is central to practice. In Unit 2, the focus is upon population groups who are most vulnerable to harmful environmental exposures. While risks to adverse health outcomes can vary according to geography, housing and location of environmental exposures, some humans are at greater risk due to their biophysical and sociopolitical vulnerability. Unit 2 explains risk and vulnerability across the lifespan with a focus upon specific vulnerabilities and harmful effects at various developmental stages. A second chapter highlights anticipatory guidance for parents and caregivers to reduce environmental exposures for children from infancy to adolescence. Third, Unit 2 considers the impact of social determinants of health, which are commonly referred to as factors where people live, learn, work, play and pray. Social determinants at neighborhood and community levels impact individual level exposures. Finally, Unit 2 includes a chapter about the effects of social determinants on the vulnerability of immigrants and refugees. See Unit 5: Sustainable Communities, for the chapter about Environmental Justice, which addresses the adverse outcomes for those who live in more environmentally hazardous areas.

HARMFUL ENVIRONMENTAL EXPOSURES AND VULNERABLE POPULATIONS

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All humans are at risk for harmful effects of environmental hazards. For certain human populations the risks of harm are greater due to biologic, social, economic, or other factors. Such population groups are often referred to as vulnerable populations. A vulnerable person or group has "aggravating factors that place them at greater risk for ongoing poor health status than other at-risk persons" (Maurer, 2013, p. 528). Some vulnerable groups include children, the poor, those without homes, refugees, those with disabilities and those with mental illness. These vulnerable populations have been identified through epidemiological studies as having poorer health outcomes. This paper will discuss various factors that make specific populations across the life span more vulnerable to poor health outcomes from environmental stressors.

RISK AND VULNERABILITY

Risk is the likelihood that a harmful health event will occur in a given population during a specific time period. Our knowledge of risk emerges from the science of epidemiology. Epidemiology is the study of health and illness in human populations. Epidemiological studies show that environmental hazards can cause poorer health.

Environmental hazards can increase human risk of illness, disability and premature death. The Environmental Protection Agency (EPA) defines risk as the "chance of harmful effects to human health or to ecological systems resulting from exposure to an environmental stressor" (EPA, 2015). An environmental hazard is "any physical, chemical, or biological entity" that causes harm. The EPA also provides information on risk assessment for such hazards.

Some common factors that affect the risk of harmful health events cannot be changed. Such factors include age, gender, race or ethnicity. Other factors that affect the risk of harmful health events can be changed. These factors result from biophysical, environmental, psychosocial and sociopolitical circumstances (Leffers et al, 2004). When environmental threats to health are examined, all humans are at risk in relation to global climate change and the increasing use of untested and toxic chemicals.

Vulnerability can be defined as "a varying state of weakness or strength that can be mobilized when one encounters a threatening event" (Leffers et al, 2004, pg 19). This definition includes individual and experiential factors that result in variability of outcomes across populations.

Risk and vulnerability are related to each other. Some describe vulnerability as a series of threshold factors that increase or amplify risk and lead to poorer health outcomes. Others argue that vulnerability can vary according to the capacity of the individual and many not lead to poorer health outcomes. This view says that positive attributes of those identified as vulnerable can enable them to overcome risk and vulnerability, leading to better outcomes (Leffers et al, 2004). The North Carolina Preparedness and Emergency Response Research Center (NCPERRC) makes a similar distinction between risk and vulnerability. They note that risk is directly affected by a hazard while the degree of vulnerability is defined as "the characteristics of person or group and their situation that influences their capacity to anticipate, cope with, and resist and recover from the impact of an emergency" (NCPERRC, 2012).

The notion of "windows of vulnerability" refers to specific times during human development that have been identified for higher risks to health. For example, at times a child can have better recuperative capacity than adults. In other situations, children are at far greater risk (Brent, Tanski, & Weitzman, 2004; Sanchez, Hu, Litman & Tellez-Rojo, 2011).

Various populations have been identified as more vulnerable to environmental hazards. As stated earlier, individual and experiential factors can lead to different vulnerability across populations. These factors include those whose biophysical characteristics make them more vulnerable such as the developing fetus, infants, children and older adults. People with acquired biophysical factors such as chronic illness, those with differences in functioning due to trauma, and those with altered immunity also become more vulnerable to poor health outcomes. Additionally those born with congenital anomalies and with variations in cognitive and physical abilities may be at more risk from specific toxic exposures.

Behavioral factors such as developmental age appropriate behavior, activities, hobbies and occupational exposures all raise vulnerability. Social factors such as where a person lives, works or spends a great deal of time can also make him or her more vulnerable.

The following discussion will address biophysical, behavioral and social factors that increase vulnerability. For each of the areas, the topic will be addressed across the lifespan from fetal development through the older adult population.

EMBRYONIC AND FETAL DEVELOPMENT

Biophysical Factors

Healthy fetal development requires precise timing and feedback for cells to divide and mature properly for necessary cell replication and differentiation. For this to occur there is an interaction between genetic and environmental factors (Schettler, Solomon, Valenti and Huddle, 1999; Brent, Tanski & Weitzman, 2004). For the developing fetus the risks are acquired through exposures across the placenta from the pregnant mother. In fact, any exposure to the fetus from the mother is considered environmental ("Environmental Factors in Birth", 2009). So, while the only exposure pathway for fetal toxic exposures is placental, the fetus is particularly sensitive to the broad range of all environmental toxins that the mother is exposed to before and during her pregnancy. As will be discussed later, the pregnant mother's exposure risk varies throughout pregnancy due to the variations in maternal physiology during pregnancy. Toxins may affect both the structural development and biochemical function of cells in fetal organ systems. Fetal sensitivity to toxins occurs as a result of the flexibility of the cell and the capacity for changes during embryonic development. For each specific exposure, many things interact to create the risk and health outcomes. The magnitude of the exposure, the dose of the toxin, the embryonic stage, and metabolism of the mother and embryo all interact to vary the risk and the outcomes. The embryo is particularly sensitive to structural damage due to these mechanisms. Additionally, the blood brain barrier is not fully developed in the embryo allowing neurotoxins greater access to the fetus (Schettler et al, 1999). Often the woman is unaware that she is pregnant during this critical period when she may be exposed to toxins. Additionally, many chemicals have not been tested for toxicity to human development. Due to the stage of fetal development the impact of these risks can be very serious and harmful, resulting in life long impairments (Dietrich, et al, 2005). The study of what are referred to as windows of vulnerability or critical developmental periods is complex and requires sophisticated data analysis (Sanchez, Hu, Litman & Tellez-Rojo, 2011; Selevan, Kimmel & Mendola, 2000).

The healthy development of children must be a priority. Tickner & Hoppin (2000) argue that children are generally more vulnerable to environmental exposures and have less control of those environments than do adults. In addition, the risks to susceptible children are not well understood scientifically. Therefore, in the absence of clear evidence the Precautionary Principle must be followed (Tickner and Hoppin, 2000).

Many adverse health outcomes for the developing fetus are referred to as birth defects. Genetic factors as well as environmental exposures interact in ways to create problems with organ structure or function. While scientists agree that environmental exposures are not well understood, those exposures that are known require more action and those that are not known require more research ("Environmental Factors in Birth", 2009). Reported adverse health outcomes from environmental health threats such as toxic chemicals include low birth weight infants, congenital anomalies, pregnancy loss from miscarriage, and neurodevelopmental problems (See Table1). (Swanson, Entriner, Buss, & Wadhwa, 2009; Kim & Cizmadia, 2010)

Table 1: Commonly Identified Chemical Exposures and Birth Defects

Exposure	Birth Defect or Low Birth Weight
Arsenic	Cardiac Defects
Bisphenol A	Reproductive system anomalies
Dioxin	Neural Tube Defects Neurobehavioral Problems Hypospadias Oral Clefts
Lead	Cardiac Defects Neural Tube Defects Neurobehavioral Problems Hypospadias Oral Clefts
Methyl Mercury	Neural Tube Defects Neurobehavioral Problems
Particulate Matter in Air	Vascular Defects (Patent Ductus Arteriosis)
PCB's	Impaired hearing*
Sulphur Dioxide	Musculoskeletal defects Cardiac defects
Environmental Tobacco Smoke	Low Birth Weight
Air pollution	Low Birth Weight
Pesticides	Low Birth Weight Congenital Anaomalies

* Noted in animal studies

Also endocrine disrupting chemicals (EDCs) have been linked to altered gender development and sexual organ malformations. Common environmental estrogens that mimic estradiol and attach to estrogen receptors are certain polychlorinated biphenyls (PCBs), Bisphenol A (BPA), phthalates, and pharmaceutical estrogens. High-level exposures have been confirmed for their role in gender related effects and scientists fear that even low level exposure can also result in these birth defects ("Are EDCs blurring", 2005). Additionally, lead accumulates in children's bones and can be released to continue exposing the child to lead poisoning and serious neurological outcomes.

Another feature of exposure is bioaccumulation. Bioaccumulation is a process by which toxins accumulate as they move up the food chain. Humans are at the top of the food chain, absorbing chemicals from meat, fish and produce consumed in the diet and as a result carry more concentrated levels of chemicals in the body. Consequently, the pregnant woman may have large amounts of toxins in her body that are passed on to the very small fetus. Due to its small size, the developing fetus can be exposed to a greater proportion of the toxin, which can result in life-long neurological deficits (Schettler, Soloman, Valenti, & Huddle, 1999).

Scientists examine the relationship between in-utero development and adult health. Mounting evidence supports the argument that prenatal exposures lead to lifelong consequences in adulthood. These consequences include congenital anomalies, risk for hypertension, insulin resistance, kidney disease and other health conditions. Recent studies in the area of epigenetics indicate that prenatal exposure to environmental contaminants can adversely affect the fetal epigenome and put the fetus at risk of diseases and disorders throughout the lifespan and transgenerationally (Perera & Herbstman, 2011).

Finally, studies examine the likelihood of preterm birth resulting from exposures to environmental toxicants. Though no consistent evidence has been found to date, there are indications that future studies might document such evidence (Ferguson, O'Neill, & Meeker, 2013).

INFANTS

Biophysical Factors

Once delivery occurs, the newborn physiology must transition from life sustaining fetal processes to independent functioning that includes respiration, nutrition and elimination. The resting respiratory rate in infants is twice that of adults; this means that infants are exposed to 2 times more toxins per body weight than are adults. Nutritionally, infants take in 2 ½ times more water and 3 to 4 times more food per body weight than adults. This increases infant exposures to pesticides and other toxins in food and water much greater than exposures in adults. Infants have less developed brain, respiratory, gastrointestinal, immune, reproductive and metabolic systems than older children and adults (Bearer, 1995; Wigle, 2003). Their gastrointestinal tract is more permeable making it easier for toxins to be absorbed. Common exposures to toxins include pesticides, heavy metals, persistent organic pollutants and phthalates. Common pesticides are organophosphates, pyrethroids, organochlorides and DDT.

Social Factors

Most infants are delivered in hospitals where they are exposed to chemicals used the nursery and hospital settings, particularly Polyvinyl chloride (PVC), di 2-ethylhexyl phthalate (DEHP) and Bisphenol A (BPA). PVC is used in medical products as a plasticizer for tubing and other devices. Most PVC medical devices are from 20-40% DEHP and are common in hospital nurseries. Neonatal intensive care units often use PVC medical products for IV solutions, enteral feedings and other necessary treatments. These chemicals are known to leach out of the medical device into fluids containing lipids. As reproductive and developmental toxins these chemicals can expose infants at the time when they are adjusting to extrauterine life and have immature organ systems. Due to their small size and variety of exposures, newborns in NICUs can be exposed at far greater levels comparative to adult exposures (Schettler, 2002). While nursing initiatives such as Green Birthdays by the American College of Nurse Midwives seek to improve health care settings, infants continue to be exposed to environmental hazards from the moment of their birth. For many newborns that require NICU care, the length of time spent in the NICU can be weeks or months, thus increasing their exposure to these hazards.

Additionally infants spend most of their time in a single environment for prolonged periods, such as a crib, where the exposures do not vary. However, if hazardous materials are present, they become more concentrated in this single environment (Bearer, 1995). Infants attending day care are confined to the same environment all day where they may be susceptible to indoor air contaminants. Indoor air quality in homes is often 10-50 times more hazardous than outdoor air where infants are exposed to carcinogens, neurotoxins and pesticides. While breastfeeding is recommended as the best nutrition for infants, chemicals such as polybrominated diphenyl ethers (PBDEs), PCBs, organochloride pesticides and dioxins that accumulate in human fat tissue in the breast have been

shown to be transmitted to the infant during breastfeeding. These chemicals can also be found in formulas made from cow's milk. Further, the skin of a newborn is a highly absorptive surface and infants are exposed to a number of toxic chemicals in the personal care products that are applied to their skin (Bearer, 1995).

CHILDREN

Biophysical Factors

Children are more susceptible to environmental toxins because their ongoing physical development and physiology put them at greater risk. Tickner and Hoppin (2000) note that children are more susceptible to environmental toxins for 4 important reasons:

- they undergo periods of rapid growth and development (window of vulnerability);
- they have age-related differences in absorption, metabolism, detoxification and excretion of substances;
- they incur greater exposure to environmental toxins; and
- they incur exposure from the fetal period throughout life so that the cumulative effects of toxic exposures lead to greater risk.

The actual specific period of vulnerability for adverse effects of the toxic chemical exposures depends upon the toxin itself and its mechanism for action, the dose of that toxin, the actual target tissue for the toxicant and the timetable for development in the child (Wigle, 2003). Other factors that affect exposure and risk are location of toxin and child, breathing zones, oxygen consumption, food consumption, water consumption and behavioral development (Bearer, 1995).

Children's developmental changes from infancy to adolescence affect the toxicokinetics of their exposures. For example, their body composition has greater water content and less lipid content that can affect chemicals that bind to lipids. While that may offer protection in the early months, the body lipids rise rapidly after birth for the first nine months. This rise in lipids increases the child's sensitivity to lipid binding chemicals such as dioxin. Children have a larger sized liver per body weight which can allow for hepatic metabolic clearance. But the larger liver can also allow for activation of toxic metabolites. Immature enzyme function in the liver reduces the body's ability to clear/remove environmental chemicals while immature renal function slows the elimination of chemicals and metabolites. There is a long postnatal period of development for the lungs and brain. Limited serum protein binding capacity in the birth to 3 month period of infancy creates the potential for more toxicants and chemicals in the body when pharmaceuticals and environmental chemicals are not bound to the serum and freely circulate in the infant's body (Ginsberg, Hattis, Miller, & Sonawane, 2004). Such physiological processes of normal development create critical periods where toxic exposures can be most harmful.

Children breathe more rapidly than adults and take in more air than adults. Toddlers generally breathe twice as fast as adults while school age children under the age of 12 years breathe about 1 ½ times as fast as adults. Children consume 3-4 times more food per body weight than adults, and drink more than 2 and ½ times more water per body weight than adults. As a result, they experience greater exposures to environmental health hazards of 2 to 5 times that of an adult.

Human development continues through childhood and the digestive, excretory and reproductive systems have not reached full development during childhood. As a result the protective mechanisms of a fully developed adult gastrointestinal tract may reduce exposures while mature kidneys and liver are better able to detoxify and eliminate toxins that affect children in greater concentrations. Additionally, toxins continue to pose risk for healthy reproductive system development and can result in decreased fertility and damage to reproductive structures and function (Silbergeld & Patrick, 2005).

Behavioral Factors

Children are more vulnerable to toxins due to behavioral factors as well due to oral, dermal and inhalation exposures specific to developmental stage behaviors (Moya, Bearer & Etzel, 2004). Children play at ground level both inside on the floor and outside in grass and other play spaces. Consequently they are exposed to materials that are tracked inside onto floors, and settle from the air. Common hazards on floors are pesticides and fertilizers, cleaning supplies, lead dust in older homes, and other household chemicals (Sattler, Afzal, Condon, Belka & McKee, 2010). Outdoor hazards include the chemicals used in lawn and garden care but also chemicals transported by water runoff that include petroleum products, automotive additives, paints, and other industrial products.

Children also use hand to mouth behavior to learn and explore which makes them more vulnerable to toxins on household items as well as toxins within products such as toys. Harmful chemicals such as lead, cadmium and phthalates have been found in products commonly used by children including sleep accessories such as positioners and wedges, teethers and other plastic toys. Research

indicates that on average a child's hands contact contaminated surfaces up to 32 times during eating, with even more contact to food before the food enters the mouth. Approximately 20-80% of dietary exposures come from such hand to mouth behavior (Akland et al, 2000).

While infants may spend more time in cribs and indoors, as children age they are more likely to be at play both indoors and out of doors. Indoors they are likely to sit and lay on floors while outside they are likely to play in grass or soil, which can contain harmful pesticides. These can also be tracked into the home on human and animal feet. Wood playground equipment often has been treated with creosote and arsenic, which are toxic.

Other location factors include the time a school age child spends in the school setting. Indoor air in schools has been identified as a source of carcinogens, neurotoxicants and endocrine disruptors (EDCs). These include chemicals such as lead, radon, pesticides, asbestos, and volatile organic compounds (VOCs) such as solvents and formaldehyde. Further, schools can be a source of environmental hazards such as cleaning products as well.

In addition, children live in families where they can be exposed to "take home toxins". This refers to toxins that their family members are exposed to in the work setting and carry home on their clothing and personal belongings. A commonly recognized take home toxin is asbestos, which is linked to the development of lung conditions, particularly mesothelioma. Decades later, children who have been exposed to chemicals in their home or from take home toxins are at risk of developing conditions such as mesothelioma, Parkinson's Disease, and various forms of cancer.

Nurses can aid families to anticipate childhood risks during various stages of development through the tools provided in the PSR (Physicians for Social Responsibility) Pediatric Environmental Health Tool Kit.

ADOLESCENTS

Biophysical factors

During puberty the adolescent experiences changes in hormones and the metabolic interactions of neurochemicals for development. This poses a "window of vulnerability" for the adolescent whose endocrine, immune, musculoskeletal and reproductive systems are undergoing maturation and can be heavily exposed to chemicals known to affect many systems. According to the Environmental Working Group report, Teen Girls' Body Burden of Hormone-Altering Cosmetics Chemicals, an array of sex hormones present at minute levels in the body are responsible for the transition from childhood to adulthood and current research suggests that adolescents may be at particular risk for exposure to even trace levels of hormone disrupting chemicals.

Behavioral Factors

Adolescent girls are likely to increase their use of personal care products and cosmetics increasing their exposure to toxic chemicals in such products. Studies indicate that, on average, girls have up to 13 hormone altering chemicals from 4 chemical families - phthalates, triclosan, parabens, and musks - in their bodies. In addition to posing serious health effects as hormone disruptors, these chemicals have the potential to cause cancer as well. Results suggest that young women are being exposed to a wide variety of cosmetic preservatives that puts them at serious risk during this important period of development (EWG, 2016).

Adolescents also are at risk due to their occupational exposures. During this phase of life they are most likely to begin employment in a variety of settings and more than 80% do work during some part of the year (Etzl & Balk, 2003). Frequently, adolescent boys go to work in the summer in lawn care services, painting and sealing driveways. At times they begin to work as entrepreneurs creating their own summer employment in such positions that are not monitored by Occupational Safety and Health Administration (OSHA). They may be unaware of the hazardous materials to which they are exposed. Adolescents employed in a variety of settings can be exposed to environmental tobacco smoke, solvents, and other cleaning agents (Etzl & Baklk, 2003). A report by OSHA noted that more than 2 million youth are exposed to farm related hazards. Beyond the dangers of heavy equipment injuries are adolescents' exposures to the fertilizers and pesticides used in agricultural settings. These include chemicals known to be carcinogenic, neurotoxicants and hormone disruptors.

PREGNANT MOTHERS

Biophysical Factors

While most scientists are concerned about prenatal exposures for the fetus, there is evidence that pregnant women are also at more risk themselves for exposure to environmental toxins due to their changing physiology during pregnancy. For example, decreased motility of the gastrointestinal tract increases intestinal transit. This delay can lead to greater absorption of toxins. Due to decreased plasma albumin concentration during pregnancy, compounds that are normally bound to albumin are altered kinetically (Brent, 2004). Increased extracellular fluid volumes affect the transfer of compounds dependent upon fluid concentration. Therefore, many toxins can actually move more readily into the pregnant mother. In

addition, there are changes in renal elimination, changes in maternal liver metabolism, and variations in uterine blood flow that affect her ability to detoxify and clear toxins from her body. Elevated blood lead levels in the pregnant mother may lead to pregnancy induced hypertension, a most serious and potentially life threatening complication of pregnancy (Yazbeck et al, 2009).

ADULTS

The average weight Caucasian man is the norm to which all standards for chemical safety have been applied. As a result, the discussion of vulnerability compares the various populations across the lifespan to the healthy adult. In addition, factors that affect the overall health of an adult such as chronic illness, affect the adult's susceptibility to environmental toxins.

Social Factors

Where a person lives, works, attends school, worships and plays can increase the risk of toxic exposures. These are considered to be the social determinants of health and greatly impact health outcomes. These exposures can have a serious impact upon their health. Beyond the individual level issues or household residence, school and workplace, there are neighborhood effects that impact the health of poor and minority populations at much higher levels of exposure. These increased exposures and negative health outcomes are commonly termed issues of *environmental justice*. However those who live in more hazardous areas suffer injustice from their greater exposure to toxins.

In addition, the various hobbies and recreational activities that a person pursues can impact the amount of toxins they are exposed to in their lifetime. If the hobby includes paint and paint thinners, for example, an individual would be placed at a similar risk to those who are exposed occupationally. Home gardeners can be exposed to pesticides used.

Further, various traditional remedies include toxins such as mercury, lead and other heavy metals. Folk remedies that contain lead, such as "greta" and "azarcon" are used to treat an upset stomach. In many Latino communities a form of mercury *azogue* is ingested to relieve empacho, a form of gastrointestinal malaise (for more information: HIDDEN DANGER Environmental Health Threats in the Latino Community). In a study of traditional Asian herbal remedies, levels of arsenic, lead and mercury were found to be at toxic levels in 49% of the products and 74% of them exceeded public health guidelines for prevention of disease (Garvey, Hahn, Lee & Harbison, 2001).

Behavioral Factors

Workplace exposures to hazards affect almost all categories of workers globally. The Occupational Health and Safety Administration (OSHA) reports that in 2008 more than 5,000 workers in the United States alone lost their lives in work related events. Early concerns for occupational health and safety began with identification of the hazards of coal miners and the development of pneumoconiosis or black lung disease. Common examples of occupations known for serious health effects from environmental toxins are agricultural workers who are exposed to pesticides, workers in dry cleaning establishments who are exposed to solvents such as tetracholoroethylene (PERC), shipyard workers, and those who work with insulation who are exposed to asbestos. (McDermott et al, 2005).

Workers exposed to chemicals such as vinyl chloride, benzene, copper sulfate, plastics and asbestos have higher rates of cancers such as lung cancer, kidney cancer and leukemia and other blood related conditions. Workers exposed to environmental tobacco smoke, carbon monoxide, or solvents are at increased risk for heart disease including arrhythmias. Since the early recognition of the link between occupation and health with coal miners, a variety of other lung conditions have been linked to workplace exposures including byssinosis (Brown lung) and those who work with cotton; silicosis and those who work in sandblasting and with ceramic and cement materials; and asthma from chemicals such as chromium, aluminum, nickel and exposure to dust. Those who work in smelters or foundries and those in the pharmaceutical industry are at greater risk of neurological disorders through workplace exposure to toluene, mercury, lead, arsenic, pesticides, plastics, and carbon monoxide. (See Table 2).

Various federal agencies such as the Occupational Safety and Health Administration (OSHA) and National Institute of Environmental Safety and Health (NIOSH) study, monitor, enforce standards and provide important research and education to improve worker health. The American Association of Occupational Health Nurses supports nursing efforts in occupational and environmental health. They provide links to their text, Essentials of Occupational and Environmental Health Nursing. Nurses are exposed to many hazardous chemicals in their work in the hospital and other health care settings. It is known that various medical products that nurses are exposed to contain toxic substances. However, there has been little confirmation of the health burden this places upon a nurse's body. In a bio-monitoring study conducted by the organization,

Table 2: Chemical Exposure and Health Outcomes

Chemical Exposure	Adverse Health Outcome
Vinyl chloride	Liver cancer Cardiovascular disease
Benzene	Leukemia Aplastic anemia Neutropenia
Benzidine (various chemical formulas)	Bladder cancer
Copper sulphate	Anemia and blood disorders
Plastics	Neurological effects
Asbestos	Asbestosis Lung cancer Mesothelioma
Particulate matter	Asthma Cardiovascular disease Pulmonary disease Lung cancer
Sulphur dioxide	Asthma
Environmental Tobacco Smoke	Cardiovascular effects Pulmonary disease Asthma
Carbon Monoxide	Cardiovascular disease including angina
Solvents	Arrhythmias Liver damage
Cotton fibers	Byssinosis
Dust from cement; sandblasting; ceramics	Pneumoconiosis Bronchitis
Pesticides	Skin cancer

Hazardous chemicals exist in health care. (Wilding, Curtis, & Welker-Hood, 2009).

Physicians for Social Responsibility, nurses and physicians in 10 states were found to have levels of chemicals with known or suspected negative health outcomes. In those tested, bisphenol A (BPA), mercury, phthalates, polybrominated diphenyl ethers (PBDEs), triclosan, and perflorinated compounds (PFCs) were among the chemicals found. All persons in the study had at least five of the six kinds of chemicals tested and all had BPA and some form of phthalates in their bodies (Wilding, B.C., Curtis, K., & Welker-Hood, K. (2009). Hazardous chemicals exist in health care.

Further, evidence suggests that previous ethnic and racial disparities in workplace exposures to toxins persist today. Historically, black workers were shown to be disproportionately exposed to silicosis, chromate, and carcinogens from coke ovens. Latinos are shown to face disproportionate risks from pesticide, lead and mercury exposure (NRDC, 2004). More recent reports of disproportionate exposures show that Latino agricultural workers, Native American mine workers and newly immigrated Asians are among those whose workplace exposures exceed that of whites (Murray, 2003).

OLDER ADULTS

Biophysical factors

The Environmental Protection Agency created an Environmental Public Health Framework to address concerns for older adults. It is important to note than persons older than age 65 demonstrate great variability in physical changes that affect vulnerability. Frailty of the very old, the presence of serious health conditions and residential, behavioral, and lifestyle factors contribute to differences in susceptibility (Geller & Zenick, 2005).

Older adults are at greater risk for harmful health effects from toxic exposure for two reasons. First, they experience physiological changes related to aging. The effectiveness of their respiratory system to clear inhaled toxins is diminished due to decreased lung volume, elasticity and lowered ventilation rate. Weakened skin integrity reduces their capacity to resist dermal exposures. Liver metabolism and renal function is less effective due to reduced blood flow, effects of aging and the effect of specific age related diseases. Reduced capacity to metabolize and excrete toxins absorbed through respiratory, gastrointestinal, and dermal pathways increases the harmful effects of toxic exposures. Polypharmacy is frequent in older adults and the interaction of a large number of pharmaceutical chemicals and environmentally adsorbed chemicals puts added stress on metabolic processes. In addition, changes in immunity and other processes of aging combine with exposures earlier in their lifetime to contribute to the development of illnesses. For example, Parkinson's disease has been shown to be related to exposure to neurotoxins earlier in life.

Second, the older population experiences a greater number of chronic illnesses that can be adversely affected by exposures to environmental hazards. Conditions such as Chronic Obstructive Pulmonary Disease (COPD), asthma and other chronic lung conditions are made worse by exposure to environmental tobacco smoke, particulate matter, tobacco smoke and other criteria air pollutants. Studies indicate that air pollution and climate can have significant adverse effects on those who have cardiac disease (Gold & Samet, 2013).

Behavioral factors

Older adults spend up to 90% of their time indoors exposing them to indoor air pollution, which is comprised of outdoor air contaminants as well as specific contamination in indoor settings (Davis, 2009). Outdoor air pollution includes pollutants such as sulfur dioxide, nitrogen dioxide, ozone, and particulate matter.

Most of the literature that addresses environmental risk among of people with developmental disabilities or cognitive delays examines the relationship of toxic exposures and neurodevelopment effects. More research is needed to explore the effects of toxic exposures to an individual who has some type of cognitive or developmental difference. Researchers question whether physiological factors such as alterations to the nervous system make an individual more vulnerable to added exposures.

Persons with Alterations in Cognitive and Physical Abilities

Environmental exposures are associated with a number of neurodevelopmental effects (EPA, 2013). Organizations such as the American Association on Intellectual and Developmental Disabilities note that the potential for cumulative effects of hazardous chemical exposure for the population with intellectual and developmental disabilities should be addressed through ongoing research (AAIDD, 2012). People with developmental differences who are able to work can be exposed to toxins in their work setting. Those living with physical and cognitive disabilities are more likely to live in community based residential homes where they are likely to be exposed to a variety of household environmental health toxins from poor indoor air quality. These pollutants include carbon monoxide, lead, mercury, radon, pesticides and household cleaning products (Davis, 2009). The American Association on Intellectual and Developmental Disabilities addresses the risks for environmental exposures in their position statement (AAIDD, 2012).

GLOBAL HEALTH

Across the globe, all humans are at greater risk from climate change in terms of changes in temperature and humidity, drought, plant life, wildfires, and changes in air quality. However, some regions of the world are experiencing the harmful effects of climate change at a greater rate. Water is becoming scarcer in many regions and the melting of the ice cap and glaciers is putting some poorer, heavily populated regions into crisis.

Researchers estimated that 25-53% of the burden of illness worldwide can be attributed to environmental health risk factors when they considered nutritional factors in food, pesticides and environmental tobacco smoke but excluded known genetic causes and behavioral factors such as smoking and diet (Smith, Corvalan & Kjellstrom, 1999). While the researchers were unable to confirm these estimates, their findings indicate that environmental hazards contribute to disease and financial burdens worldwide (Smith, Corvalan & Kjellstrom, 1999). The World Health Organization (2015) has methodology to quantify the disease burden attributable to environmental health risks including indoor and outdoor air pollution, lead, mercury, occupational exposures to carcinogens, environmental tobacco smoke and solar radiation. Toxins such as lead in gasoline, arsenic and high levels of fluoride in water, and DDT are exposures found in the developing world that do not occur in the United States.

Additionally, the policies of the richer countries contribute to global health disparities. Currently many pesticides banned for use in the United States and Europe are sold for use in poor tropical regions. Many developed countries have been disposing of pharmaceuticals by dumping these and electronic hazards in poorer countries (Ahsanuddin, 2012; Bradley, 2014). Currently, for example, Kenya has large electronic-waste dumps near large population centers (Schluep, Rochat,Munyea, Laissaoui, Wone, Kane, Hieronymi, 2008).

Finally, protection is more limited in many regions of the world. As developing countries adopt many of the less environmentally friendly products such as plastic bottling and bags, they are more likely to dispose of these non-recyclables by dumping and burning. Such practices increase the human risks, particularly carcinogens from air, water and soil pollution.

This overview of the vulnerability to environmental health risks by a variety of populations highlights the biophysical, behavioral and social factors that increase risk for many people. Advocacy to reduce risk of exposure to toxins and to protect health in ways that the Precautionary Principle advises must be evident for all people globally. The particular needs of the vulnerable populations

discussed here add evidence to the need for policy change.

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VULNERABLE POPULATIONS - ANTICIPATORY GUIDANCE

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INTRODUCTION

Anticipatory guidance is education provided to parents and child caregivers on a variety of health topics related to the child's development. This guidance should focus on the development the child will experience in the next 3 months to 1 year. Anticipatory guidance related to environmental health is an important component of this education to protect the child's health today and in the future. Each developmental age brings about different environmental health concerns that need to be addressed with parents and caregivers. Many of these topics should be revisited often as they build upon one another. It is important to remember that when a child moves out of a particular developmental category, the environmental health topics discussed in previous stages should be reviewed as a majority of the health concerns are still present in the child's life.

INFANTS

Infant developmental stages are broken into four different categories to address the rapid growth and development that occurs in the first year. These categories are 0-3 months, 3-6 months, 6-9 months, and 9-12 months. As the child progresses through each stage they become more curious about their surroundings and the world, potentially putting them in contact with more dangerous things.

0-3 MONTHS

Infants 0-3 months spend 15-18 hours sleeping each day. It is important that sleeping surfaces be free of toxic chemicals that could affect the child's growth and development. Major infant mattress manufacturers have laden their products with dangerous flame retardants, volatile organic compounds, toxic waterproofers, and unknown antibacterial chemicals. The good news is that not all manufacturers are using these toxic chemicals in their mattresses (Clean and Healthy New York, 2011). Healthcare providers can access the 2011 Mattress Matters report and 2013 update from the following websites to provide parents with information on mattress companies that do not use toxic chemicals. Then parents can make an informed decision when purchasing this essential item for their infant.

Mothers who are breastfeeding need to be cautious about their seafood intake because of the mercury levels present in seafood. Mercury exposure is a concern for infants due to its negative effects on brain development and the nervous system. When foods contaminated with mercury are eaten by a breastfeeding mother, the toxins are passed into the breastmilk. Seafood is a nutritious food that breastfeeding mothers should include in their diet as it provides B-vitamins, omega-3 fatty acids, and is a lean protein. However, consumption needs to be monitored.

Table 1: Mercury Levels In Seafood

HIGHEST LEVELS OF MERCURY • Marlin • Orange roughy • Tilefish • Swordfish • Shark • King Mackerel • Tuna (bigeye, Ahi)	• Snapper • Sea Trout (Weakfish) • Tuna (canned, chunk light) • Tuna (Skipjack)
HIGH LEVELS OF MERCURY • Chilean Sea Bass • Bluefish • Grouper • Mackeral (Spanish, Gulf) • Tuna (canned, white albacore) • Tuna (Yellowfin)	**LOW LEVELS OF MERCURY** • Anchovies • Butterfish • Catfish • Clam • Crab (Domestic) • Crawfish/crayfish • Croaker • Flounder • Haddock • Hake • Herring • Mackeral (N Atlantic, Chub) • Mullet • Oysters • Perch (ocean) • Plaice • Salmon (Canned, Fresh) • Sardines • Scallops • Shad (American) • Shrimp • Sole • Squid (Calamari) • Tilapia
MODERATE LEVELS OF MERCURY • Bass (Striped, Black) • Carp • Cod (Alaskan) • Croaker (White Pacific) • Halibut (Pacific and Atlantic) • Jacksmelt (Silverside) • Lobster • Mahi Mahi • Monkfish • Perch (freshwater) • Sablefish • Skate	

Table 1 lists mercury levels for different types of seafood. Fish that are classified as having the highest levels of mercury in them should be avoided altogether. Breastfeeding mothers should eat no more than three 6-oz servings per month of fish that have high levels of mercury. Fish that have moderate levels of mercury in them should be eaten no more than six times a month in a 6 oz. serving. Fish that have the lowest levels of mercury

in them can be eaten in 6 oz. servings up to two times per week (American Pregnancy Association, 2013). The National Resources Defense Council has a seafood mercury calculator available on their website. Users can put in their weight, type of fish, and serving size and the results will provide information on how much mercury you have consumed and what your safe levels are.

3-6 MONTHS

What baby does not enjoy the jangling of car keys? How many parents have used this object as a diversional activity for their infant or allowed their infant to hold and mouth car keys? The answer is most parents and infants. What many parents don't know is why car keys are a dangerous object for the infant to play with. Car keys contain lead, a toxic chemical. Young children absorb lead at a greater rate than adults and elevated blood lead levels can cause anemia, hearing damage, learning disabilities, speech difficulties, behavioral problems, and other neurologic effects. Parents should be educated to not let their child play with car keys due to the potential for lead exposure. In addition, education needs to be provided on the importance of washing their hands after they handle car keys, and especially before any food preparation or breastfeeding.

Infants can get their first tooth as early as 3 months of age. To help soothe the pain for cutting teeth, caregivers can give infants teethers. It is important that parents pick teethers that are Bisphenol-A (BPA), polyvinyl chloride (PVC), and phthalate free. Parents should read the packaging to see if the product states that they are free of these toxins. While this can be a daunting experience for parents, healthcare providers can provide parents with information on safe products. Some manufacturers that have products that meet these standards are MAM, Vulli, and Zoli. In addition, Safe Mama has compiled a list of BPA, PVC, & phthalate free teethers.

The majority of infant toys are made of plastic material. Infants will inherently put these toys in their mouth, whether they belong there or not, as this is their natural way of exploring an object. A large number of toys contain harmful chemicals such as PVC, BPA, lead (a stabilizer in PVC products), cadmium, phthalates, and flame retardants. These chemicals are associated with a number of negative health impacts such as cancer, endocrine disruption, altered growth and development, and reproductive health impacts. (Uding & Schreder, 2014). Products that do not contain these harmful chemicals are available, but may not be labeled or sold in major toy stores. Healthcare providers have the unique opportunity to provide parents with the appropriate resources to purchase healthy toys for their child during health care visits or post the information to their office website/Facebook page. Box 1 lists a variety of healthy toy resources that healthcare providers can share with parents and child caregivers.

Box 1: Safe toy resources (Moms Rising, 2014)

http://www.healthystuff.org/ search over 1,500 toys by name or manufacture to see toy health rating

http://www.momsrising.org/

text healthytoys (toy name) to 41411
will receive an instant message back on whether the toy is toxic

6-9 MONTHS

Around 6 months of age, infants may start to crawl and expand their exploration of the world. Crawling brings on a new set of safety concerns for parents and childcare providers. Through crawling, infants are exposing themselves to more dirt, dust, germs, and chemicals that they pick up on their hands, clothes, mouths, and face. The infant is closer to the ground and therefore breathes in more toxins that are present in dust and dirt. It is imperative that healthcare providers provide the following health tips to parents of a soon to be crawler to help protect the child from toxic exposures:

11. Remove shoes at the door
    a. Decreases dirt, organisms, chemicals (such as lead, mercury, pesticides) on the floor
12. Wet mop hard floor surfaces weekly
    a. Decreases toxic chemicals found in dust (i.e. flame retardants)
3. Avoid toxic cleaning chemicals during mopping
    a. Make your own cleaner:
        i. 67 Homemade All-Natural Cleaning Recipes
        ii. Do It Yourself Recipes for Eco-Friendly Cleaning
        iii. Green Cleaning Recipes
    b. Examples of companies that produce non-toxic floor cleaners
        i. Bona
        ii. Method
4. Vacuum carpets weekly
    a. Decreases exposure to toxic chemicals

In addition, parents need to be vigilant about how they store any chemicals, cleaners, and medications when they have a child who is mobile (crawler or walker). These products should be stored up high and in a locked cabinet that only an adult can open. Products should also be stored in their original container. If a child accidentally ingests the product, healthcare providers can utilize the

information on the container to provide timely and safe care. Healthcare providers should provide parents with the national poison control number (1-800-222-1222) and instruct them on when to call.

At 6 months of age, children begin eating solid foods. Fruits and vegetables are some of the first foods that are introduced to infants and hold important nutritional value. Children can be exposed to pesticides through fruits and vegetables that they eat. Children's top favorite foods include strawberries and apples which have been found to contain high levels of more than one pesticide. To reduce a child's exposure to toxic pesticides, healthcare providers can provide parents and caregivers a list of foods that they should try to buy organic (dirty dozen plus) and those foods that are less contaminated or non-organic (clean fifteen). See Table 2 for the fruits and vegetables that fall into the dirty dozen and clean fifteen categories.

Table 2: Fruits and Vegetables and Pesticides

Dirty Dozen Fruits & Vegetables	Clean Fifteen Fruits & Vegetables
Apples	Asparagus
Celery	Avocados
Cherry tomatoes	Cabbage
Cherries	Cantaloupe
Cucumbers	Cauliflower
Grapes	Sweet Corn
Nectarines	Eggplant
Peaches	Grapefruit
Spinach	Honeydew
Strawberries	Kiwi
Sweet bell peppers	Mangos
Tomatoes	Onions
	Papayas
	Pineapples
	Sweet peas
	Sweet potatoes

(Environmental Working Group, 2016)

At 6 months when infants start eating more solid foods their meals become messier. At this time parents may opt to replace cloth bibs with plastic bibs that are more resistant to messier meals. Healthcare providers can educate parents to look for bibs that are PVC, phthalate, and vinyl free. It is important to explain to parents that when a child uses a bib that has one of these toxins in them, the toxin is ingested into the child's body via inhalation and contact with food.

Sunscreen can be applied to an infant after 6 months of age. Infants have a greater risk of negative health effects from toxic chemicals found in sunscreens because their skin is immature and they have a greater ratio of surface area to body weight than adults. Given this information, healthcare providers should educate parents on which sunscreens are safe to use. Sunscreen should be free of parabens, phthalates, oxybenzone, polyethylene glycols (PEG's), and propylene glycol and protect against UVA & UVB rays. SafeMama has provided a great list of safe sunscreens to use that healthcare providers can share with their patients, but it is not inclusive.

9-12 MONTHS

As early as 9 months of age an infant can start to walk expanding their ability to come in contact with more toxins. With this new found mobility, infants have access to more objects that they can put in their mouths and consequently ingest toxins. For example, infants may now have access to electronic devices, such as TVs and computers, which contain toxic flame retardants that are harmful to the developing child. Parents need to be educated on the importance of keeping children away from everyday products that contain toxins.

Between 9 and 12 months, infants may start to use a dish for their food during meal time. It is important that parents do not use dishes that contain melamine, BPA, phthalate, formaldehyde, or PVC. These chemicals can adhere to food placed on these chemical containing dishes, which ultimately transfers the chemical to the child's body. These chemicals are hormone disruptors and have been found to cause negative health effects such as attention deficit hyperactivity disorder (ADHD), reproductive problems, and thyroid problems (National Institute of Environmental Health Sciences, 2013). In addition, when storing the child's foods, parents should avoid plastics with the numbers 3, 6, & 7 (Healthy Child Healthy World, 2013). Glass or stainless storage is best. Also, foods heated in the microwave should not be heated in plastic containers. Use glass or ceramic containers instead.

TODDLER

As children progress into toddlerhood they are exposed to new toxins outdoors, as they expand their range of exploration with their new found mobility. Toddlers love to play in dirt, especially as they are helping an adult with gardening or digging to find worms. Some of the toxic chemicals that can be found in dirt are lead, pesticides, arsenic, mercury, dioxins, and other heavy metals (Shayler, McBride, & Harrison, 2009). It is important to remind parents to diligently wash their child's hands after playing in dirt to rid their hands of toxic chemicals such as lead and pesticides.

The majority of U.S. households use pesticides and herbicides on their grass and garden plants to prevent or get rid of weeds, bugs, and disease. After application of these chemicals, children have an increased risk of coming in contact with these chemicals and the negative health effects from exposures. Children who are playing outside in the grass or by plants treated with pesticides have a higher exposure rate than adults. This is because toddlers will touch the treated area and are closer to the ground breathing in more of the toxin. In 2011, three studies found a decrease in IQ scores and behavioral tests in children age 6-7 years who were exposed to high levels of organophosphate pesticides in the womb or as infants (Bouchard et al., 2011; Engel et al., 2011; Rauh et al., 2011). Health care providers should educate parents and caregivers to use non-toxic pesticides and keep children away from areas that have been treated with pesticides. In addition, hand washing is always an important prevention measure to decrease continued chemical toxin exposure after playing outside.

During warm weather, children love to play in water and with garden hoses. Garden hoses have been found to contain lead, chlorine (due to PVC), bromine (a flame retardant chemical), tin, phthalates, arsenic, and bisphenol A (BPA). Education can be provided to parents on how to decrease their child's exposure to garden hose toxins which includes not drinking water from the hose, don't leave the hose in the sun, let the water run for a few minutes before filling a pool, buy a lead free hose, and wash your hands after handling a hose (Ecology Center, 2013). There are also drinking water safe garden hoses available that do not contain PVC or lead. If using a drinking water safe hose, water should be allowed to run for several minutes prior to drinking because contaminants can collect in standing water.

Children's plush furniture that has popular cartoon characters or other stimulating designs is highly desired by young children, yet they may be covered in harmful chemical flame retardants. Flame retardants have been shown to cause negative health effects and do not effectively work in decreasing fire risks to children. Parents and child caregivers need to be advised to not purchase products that contain polyurethane foam that is treated with flame retardants and be provided a list of alternative kid friendly furniture that does not contain toxic chemicals (Center for Environmental Health, 2013).

PRESCHOOLERS

Preschoolers are creative and love to work with a variety of art and craft materials. Preschoolers are also curious by nature and are more likely to sniff, taste, or "paint" their skin with art supplies increasing their exposure to potential toxins. Adults who purchase art and craft materials for children should supervise children to ensure they are using the product appropriately and take the following steps listed in Table 3 to ensure that the products are safe. The National Library of Medicine has an online Household Products Database that provides toxicity information on commonly used household products, including art supplies. Parents can also make homemade finger paint or play clay (see Table 4) that is 100% safe if accidentally ingested.

Table 3: Safer art supplies

Material to Avoid	Safer Alternatives
Aerosols, sprays	Liquid non-aerosol products, manual applicators
Cold water, commercial, & powder dyes	Plant based dyes (such as canned beets, cranberries, frozen blueberries, turmeric)
Instant papier-mâché	Papier-mâché made from newspaper and library paste or white paste (flour/water)
Powdered forms of clays, glazes, paints, pigments	Moist clay, liquid non-aerosol products
Products containing lead or heavy metal (some enamels, paints, glazes)	Similar products without chronic health hazard labels, water based markers and paints
Solvent based products (rubber cement, turpentine, permanent markers)	Water based glues, markers, paints

(California Environmental Protection Agency, 2013)

SCHOOL AGERS

Lunch Boxes

When children start attending primary school they will be eating lunch away from home and often times carrying a lunch box. Children's lunch boxes, especially those that have popular cartoon characters on them, have been found to contain phthalates which we know are harmful to developing children (Schade, 2012). Phthalates have been found to be a causative factor in ADHD and asthma (Bertelsen et al., 2013; Kim et al., 2009). Chemicals are released from these lunch boxes and can cling to food and hands allowing the chemical to be ingested into the child's

Table 4: Homemade art supplies

Homemade Finger Paints	Homemade Play Clay
Ingredients: • 1 cup flour • 4 cups cold water • plant based dyes	Ingredients: • 1 cup flour • 1 cup water • ¼ cup salt • 2 tbsp cream of tartar • 1 tbsp oil • plant based color dye
Directions: In medium pot combine flour and 1 cup of water. Stir until smooth. Add remaining 3 cups of water. Cook and stir over medium heat until thick and bubbly. Remove from heat and let cool. Divide into containers and tint with dyes. Plant Based Dyes • drain juice from canned beets or thawed frozen berries • simmer then drain coffee, tea, or crushed plant material such as purple grapes, red or yellow onion skins, walnut hulls, cranberries, or oak or apple tree bark	Directions: Mix flour, salt and cream of tartar in a medium pot. Add water and oil. Cook over medium heat for 3-5 minutes, stirring frequently. When dough forms remove from heat and knead. Divide and add dye. Store in an airtight container or baggie. See directions for finger paints for plant based color dye instructions

(California Environmental Protection Agency, 2013)

body. Healthcare providers can advise parents to purchase lunch boxes that state they are PVC and BPA free to protect their children from these harmful chemicals.

School supplies

In the fall, as students go back to school, new school supplies are purchased by thousands of families. School supplies, such as backpacks, 3-ring binders, vinyl rain boots, raincoats, lunchboxes, notebooks, and art supplies, have been found to contain a number of harmful chemicals, such as phthalates (Schade, 2012). Healthcare providers can recommend to parents of school agers that they avoid buying products that are made out of PVC or vinyl which has the recycling number 3 on it. The Center for Health, Environment, and Justice has created a Back to School Guide for PVC free school supplies that can be utilized by healthcare providers to educate families.

Gymnastics

Gymnastics is a popular sport for young children and is a sport many children stick with for years. While the physical activity gained from this sport is good for children's health, the toxic chemical flame retardants they are exposed to in the gym are not. Flame retardants have been found in the polyurethane blocks that gymnasts fall into for a soft landing. Flame retardants are known to be hormone disrupting chemicals (Carignan et al., 2013). While a safe alternative to the blocks does not exist, healthcare providers can recommend to their patients to wash their hands and shower immediately after practice to rid their skin of the toxic chemicals.

TEENAGERS

Cosmetics

As school-agers become teenagers the number of personal care products and cosmetics they use increases. They start to use deodorant, more hair care products, make-up, and perfume or cologne. The majority of personal care products being sold in the US contain toxic chemical ingredients that can have negative health effects. See Table 5 for a list of harmful chemicals and associated health effects. This increased usage exposes teenagers to more toxic chemicals while their bodies are still developing. Healthcare providers can encourage teenagers to find out if the products they use are harmful by utilizing a variety of online resources:

1. GoodGuide - has an app for phones to scan products and provides information on healthier alternatives
2. EWG's Skin Deep cosmetic database
3. Make your own non-toxic lip gloss recipe

Work Exposures

During the late teenage years children start to get jobs that can expose them to new toxins depending on the work environment. Some examples of unhealthy work environments include restaurants that allow smoking exposing teenagers to secondhand smoke, farms that use harmful pesticides, janitorial work which exposes teenagers to toxic chemicals, and cashier or retail salesperson which exposes teenagers to BPA from handling receipts (Ehrlich, Calafat, Humblet, Smith, & Hauser, 2014). Healthcare providers need to educate

Table 5: Harmful Chemicals and Associated Health Effects

Harmful Chemicals	Negative Health Effects
Triclosan	Interferes with thyroid hormone metabolism, interferes with estrogen and androgen receptors
Parabens	Cancer, reproductive problems
Fragrance	Unknown as "fragrance" could be anything, can trigger asthma and headaches
Phthalates	Cancer, reproductive problems

(Beyond Pesticides, n.d.; Darbre & Harvey, 2008)

teenagers on safe and healthy work environments and provide them with examples of jobs that they can do but would not have a negative effect on their health. In addition, they can also educate teenagers on some simple steps to decrease their exposure to toxins in the work environment, such as frequent hand washing after handling receipts or opening windows for fresh air when using cleaning products.

ONLINE RESOURCES/TOOL KITS

For Healthcare Providers

- Pediatric Environmental Health Specialty Unit
  - Physician guide to safer plastics
- U.S. PIRG Education Fund
  - 2013 Annual Survey of Toy Safety
- Physicians for Social Responsibility
  - Pediatric Environmental Health Toolkit
  - Environmental Health Reference Card
- Clean and Healthy New York
  - Pocket size card information sheet on common chemicals and how to protect yourself

For Parents/Child Caregiver

- Safer Chemicals Safer Families
  - Safer rain gear
- Toxic Free Future
  - Toxic Chemicals Remain In Children's Products
- Safe Mama
  - A large volume of product information sheets to help the consumer purchase healthier products
- healthystuff.org
  - provides information on the health and safety of products based on research findings
- Healthy Child Healthy World
  - Variety of resources on healthy daycares and schools, safer foods, and healthy nursery
  - Healthy apps, books, e-books, webinars, videos, and reports
- Children's Environmental Health Network
  - Eco-Friendly Child Care

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IMMIGRANTS AND REFUGEES AS A VULNERABLE POPULATION

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INTRODUCTION

In the U.S., the number of immigrants have increased from 5% of population in 1970 to 12% in 2004, with projections of the immigrant population making up 15% of the U.S. census by 2025 (Martin & Midgely, 2006). According to the 2010 U.S. Census, there are 40 million people living in the U.S. who are foreign-born; representing 12.9% of the U.S. population (U.S. Census Bureau, n.d.). Although immigrants to the U.S. represent many nations, the foreign-born U.S. residents that comprise the largest segment of the population were born in Mexico (11.7 %), China (2.2), India (1.8), Philippines (1.8 %), and Vietnam (1.2 %) (U.S. Census Bureau, n.d.). Furthermore, the U.S. also has a history of welcoming refugees; in 2012 alone, the U.S. received 58,238 people as refugees. More than half the refugees to the U.S. in 2012 were from the Near East and South Asia (30,057) (U.S. Department of State, 2013).

Those immigrating to and seeking refuge in the U.S. have primarily resided in California, Florida, Illinois, New York and Texas. There has been a recent trend, however, in which immigrants and refugees are settling throughout the country (U.S. Census Bureau, n.d.). This trend leads to greater diversity within our communities and requires the nurse to have an understanding of the needs of foreign-born populations related to their past environmental exposures and their unique environmental risks with resettlement in the U.S.

ENVIRONMENTAL EXPOSURES FROM COUNTRY OF ORIGIN

Like everyone else, we are influenced by our environments. Body burden studies have found that people living in the U.S. their entire lives have a legacy of chemical exposures. Immigrants and refugees arrive in the U.S. with past environmental exposures from their native land. Depending on the circumstances of the immigrating person those environmental exposures can place an immigrant or refugee at greater health risk.

OCCUPATIONAL EXPOSURES

Workplace environmental exposures in the country of origin influence the health of people immigrating to the U.S. The World Health Organization (n.d.) has identified that people from developing countries are more likely to be exposed to airborne particulates, carcinogens, and risks of workplace injury. Those employed in agricultural jobs are at risk for pesticide exposures and depending on the climate of the country of origin heat related illnesses such as skin cancer and renal disease (Wesseling, Crowe, Hogstedt, Jakobsson, Lucas & Wegman, 2013). Outdoor workers are particularly vulnerable to greater risk of heat related illnesses as a result of climate change. Climate change also is expected to exacerbate existing chronic diseases such as pulmonary and cardiac disease (Intergovernmental Panel on Climate Change, 2014).

It is helpful to remember that not all resettled immigrants and refugees were employed in countries with strict occupational health requirements for worker protections. Assessment of past employment actives and exposures is an important first step to determine environmental risks. In addition to the risk described for agricultural workers in the previous paragraph, workers in manufacturing may be at risk for musculoskeletal injury from repetitive activities or chemical and noise exposures from working with industrial equipment and lubricants. Those who were employed in the health care sector may have risk of biological exposures, while the extraction (mining) industry presents the risk of radiation, poor air quality, and chemical exposures (Frumkin, 2010). For more information regarding global occupational health risk see WHO Occupational Health web site.

The role of many women from developing countries remains traditional and their work is in the home. This makes immigrating women from some developing countries vulnerable to household indoor smoke from indoor cook stoves that use wood or other biomass fuel. Poor indoor air quality is associated with pulmonary conditions such as acute respiratory infections, tuberculosis, and lung cancer, as well as heart disease and poor pregnancy outcomes such as low birth weight (World Health Organization, 2006). Nursing assessments should include identifying chronic diseases and previous exposures in the immigrating person's country of origin.

CULTURAL & FOLK PRACTICES

Cultural practices can put immigrants and refugees at risk for environmental hazards. For example, women from some parts of Africa, South Asia, and the Middle East may use traditional eye cosmetics known as kohl (Arabic: kuhl; Punjabi: sirma; Hindi: kajal; Telegu: katuka from: https://theurbanmuslimwomen.wordpress.com/2008/09/22/kohl-for-the-eyes/). Kohl can also be applied to infants' eyes at birth as it is believed to strengthen the eyes and protect the child from the evil eye. Kolh preparations may contain

lead and this practice can put women and infants at risk of lead toxicity.(See Unit III, pages 61-62 in e-text)

Furthermore, some traditional medicines that are used as part of Hispanic, Chinese, Middle Eastern, Indian and other Asian folk health practices have been noted to contain heavy metals including lead. The U.S. Center for Disease Control and Prevention offers detailed information about folk medications that may place immigrant and refugee families at risk for lead and other heavy metal exposures. The nurse should assess past use of traditional medicines and determine if the immigrating family continues to rely on these traditional medicines.

DISASTERS

Natural and manmade disasters have the capacity to disrupt the infrastructure that provides clean water and air as well as safe food and medicines. Consequently, immigrant and refugee families may present with health problems related to exposure to poor air and water quality as a result of disruptions of utilities. These disasters could be the reason for immigration to the U.S. Natural disasters such as volcanoes, earthquakes, tornadoes and hurricanes can create health problems for the people in the surrounding communities. For example, volcanic activity generates gases such as sulfur dioxide, carbon dioxide and hydrogen chloride as well as particulate matter that can affect human health. The U.S. Geological Survey web site describes air pollution related to volcanic activity.

With increasing development, natural disasters can influence the built environment and lead to a manmade disaster. This was the case with the 2011 earthquake and subsequent tsunami near Fukushima, Japan that ultimately led to the release of radiation from the nearby nuclear power plant. Following the Fukushima nuclear disaster, WHO (2013) conducted a health risk assessment and identified that those people living closest to the nuclear reactors at the time of the accident had an increased risk of solid cancers (4%), breast cancer (6% increase for infant females), leukemia (7% increase for infant males) and thyroid cancer (70% increase for infant females). It is important that the nurse takes the time to learn the history of the country of origin and reason for immigration so that health screening can be targeted to the patient's environmental health risks. For more information regarding environmental health impacts of disasters please go to.

WAR AND AREAS OF CONFLICT

Disputes of our world's limited natural resources such as water rights can be an antecedent to war. War itself, a manmade disaster, presents additional environmental risks to immigrant and refugee families. Psychological trauma and physical disability as consequence of military conflict can be complicated by environmental exposures of warfare including chemical weapons that affect military and civilian populations (Dworkin, Prescott, Jamal, Hardawan, Aras, & Sandro, 2008). Iraqi refugee families attributed congenital anomalies of children that were born following maternal exposure to chemicals used during the Iraqi war (McDermott-Levy & Al Balushi, 2015).

IMMIGRANTS & REFUGEES LIVING IN THE U.S.

Immigrants to the U.S. are less likely to have health insurance and are less likely to seek care from a health care professional. Furthermore, citizenship influences access to U.S. sponsored health insurance programs such as Medicaid and Medicare. Consequently, 44% of non-citizen immigrants do not have health insurance (George Washington University, 2012). Access to health care is further limited by language barriers, cultural differences, perception of health needs, and immigrant status (Ku & Jewers, 2013). These factors influence how an immigrant patient or family would respond to or understand the risks or impacts of environmental exposures.

LANGUAGE

Language and access to interpreters also creates barriers to health information for refugees (Morris et al., 2009) who may come to the U.S. with a variety of physical and mental health problems (Jamil, Farrag, Hakim-Larson, Kafaji, Adbulkhaleqm & Hammad, 2007; Ramos, Orozovich, Moser, Phares, Stauffer, & Mitchell, 2010). One problem for those new to the country is the ability to access environmental health information related to the area of resettlement and to read instructions on chemical labels such as pesticides and cleaning agents. The National Service Center for Environmental Publications of the EPA has environmental health resources in 23 languages and dialects to support the immigrant and refugee family. Safe and proper use of household pesticides and cleaning agents can be a problem for recent immigrants who may not be able to read instructions in English. One thing that may assist those new to the U.S. is that in 2003 the member countries of the United Nations published a harmonized chemical hazard communication system called the "Globally Harmonized System of Classification and Labeling of Chemicals" (OSHA, n.d.). As a result of harmonization, most countries rely on standardized warning symbols and standardized safety data sheets (formally MDS). While this will not completely overcome some language barriers for recent immigrant or refugee families, standardization does provide common warning pictographs from country to country. For more information regarding international chemical labeling

standardization see Occupational Safety & Health Administration web site regarding global harmonization. An another important role for the nurse is to not only teach safe use of household chemicals but to offer safer, nontoxic alternatives.

CULTURAL IMPLICATIONS IN THE U.S.

Adding to barriers of access to a health professional regarding environmental health information is the perceptions of the role of the nurse. In some cultures it is not acceptable to ask questions of the providers and nurses do not have a role other than following the physician's orders. Also the U.S. health care system is very complex and can be confusing to a newly arriving immigrant; therefore, someone with an environmentally related problem may not know how to access a health care provider for assistance. Nurses need to make themselves available to immigrant and refugee communities in order to educate those new to the U.S. in the role of the nurse and environmental risks and safe practices. Social organizations and the faith community are groups in which the nurse can access immigrant and refugee communities. For example, Villanova University nursing students partnered with a senior center that serviced elderly Asian immigrants to teach healthy gardening practices that did not rely on pesticides. See How does your garden grow?

ECONOMICS & HOUSING

Many immigrants and refugees arrive in the U.S. and find themselves living at a lower standard of living than they had in their home country (Morris et al., 2009). In the U.S. they may find themselves living in substandard housing, older homes in disrepair, or be victim of unscrupulous landlords. Home environmental risks that may be a problem for this population are lead based paint, carbon dioxide from poorly maintained furnaces, or pests such as roaches or rodents. The nurse should assess the age of homes, the availability and policies related to carbon monoxide detectors, and if pests are a problem for the immigrating family. If an environmental risk is identified the nurse should make appropriate referrals and educate the family in mitigation methods.

CONCLUSIONS

Immigrants and refugees may come to the U.S. with previous environmental health exposures that require assessment and management if there are health consequences. Additionally, once in the U.S., immigrants and refugees are at risk as a result of language and cultural barriers as well as potential challenges accessing the health care system. Nursing assessments should focus on the unique previous exposures and potential risks in the resettled immigrant. Once risks and health problems are identified the nurse can make appropriate referrals and participate in interventions that promote health of this vulnerable population.

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Unit III:
Environmental Health Sciences

INTRODUCTION

Three science areas from biology and public health are essential to understanding environmental health. These are ecology, toxicology and epidemiology. In this unit ecology refers to the study of any living thing in relationship to its environment and toxicology is defined as the study of poisons, or toxins, and the treatment of toxic exposures. Epidemiology is the study of the distribution and determinants of health-related states or events in specified populations, and the application of this study to the control of health problems (Last, 2001). Unit 3 includes an introduction and resources related to disciplines of science relevant to environmental health. In addition, the scientific process of risk assessment, often considered a part of toxicology, is included in this chapter. The first discussion looks at ecology and ecosystems to highlight the relationship between humans and environment. Second is a look at toxicology with sections relevant to nursing practice such as carcinogens, criteria air pollutants, flame-retardants, and heavy metals. Although there is no section that includes a comprehensive discussion of epidemiology, in this edition, there is an example of environmental surveillance relevant to epidemiology. According to the World Health Organization (WHO), " Public health surveillance is the continuous, systematic collection, analysis and interpretation of health-related data needed for the planning, implementation, and evaluation of public health practice. Such surveillance can….monitor and clarify the epidemiology of health problems" (WHO, 2016). In this unit the discussion of the CDC surveillance program, the National Environmental Public Health Tracking Network (CDC, 2016) is an application of environmental surveillance.

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ECOLOGY, ECOSYSTEMS AND WATERSHEDS

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The word Ecology originated in the late 19th century and was first called oecology from the Greek oikos that meant 'house' + –logy. The Oxford English Dictionary defines ecology as the branch of biology that deals with the relations of organisms to one another and to their physical surroundings. An additional definition is the political movement that seeks to protect the environment, especially from pollution (OED, 2015).

Ecology refers to the study of any living thing in relationship to its environment. Darwin, around the year 1859, classified the "web of life" and acknowledged the immense complex set of interrelationships that existed between organisms and their environment (Sattler, 2009). Similarly, ecosystem describes the active communities of microorganisms, plants, and animals, along with the lifeless environment in which they live (Allender, 2014). Rainforests are Earth's oldest living ecosystems that cover only 6% of the earth's surface but end up housing more than ½ of the earth's plant and animal life (SRL, 2014). According to the Environmental Protection Agency (EPA, n.d.), watersheds are areas of land where the water that is found under it, ends up draining to the same spot. The well-known scientist geographer, John Wesley Powell described a watershed as "that area of land, a bounded hydrologic system, within which all living things are inextricably linked by their common water course and where, as humans settled, simple logic demanded that they become part of a community."

There is a simplified version of the several different levels of ecologic systems. This simplified version is broken down into two levels, the microsystem and the macrosystem. The microsystem can be thought of as the environment that is directly surrounding the individual, for instance their family and household. On the other hand, the macrosystem is the broader framework, in which the microsystem is embedded. The macrosystem consists of one's culture, their traditions, customs, societal norms, governmental agencies, schools, organizations, economic policies and the physical environment (Sattler, 2009). The relationship between Commoner's Law and these ecologic systems can be compared as "everything is connected to everything else and everything must go somewhere." Ecosystems help regulate water, gases, waste recycling, nutrient cycling, and biology as well as provide recreational and cultural opportunities for human use. The scientific analysis of ecosystems is critical to the understanding of environmental health impacts on human health; this synergistic relationship among human beings and the environment has impacts along the human development continuum.

According to the EPA (n.d.), a watershed can provide several ecosystem services like "nutrient cycling, carbon storage, erosion/sedimentation control, increased biodiversity, soil formation, wildlife movement corridors, water storage, water filtration, flood control, food, timber, recreation, and reduced vulnerability to invasive species, the effects of climate change, and other natural disasters". Rainforests provide food, water, and oxygen to the rest of the world. Temperate and tropical rainforests have a dramatic relationship with climate change because they help regulate earth's temperature and its weather patterns (The Nature Conservancy, 2015).

Increases in human demands, like home heating and cooling, cause an increase in the use of fossil fuels (such as coal) which in turn, because of their burning, releases those toxic chemicals that cause increases in air pollution. This air pollution contributes to global warming (Allender, 2014). Global warming then has impacts on ecosystems throughout the world and the delicate balance within ecosystems with the resultant weather and environmental impacts that are related to the increase in global warming.

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NTRODUCTION TO TOXICOLOGY

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Toxicology is an important science in understanding environmental health. But, for most nurses the name toxicology itself sounds a bit overwhelming. Toxicology is the study of poisons, or toxins, and the treatment of toxic exposures. As nurses we do not typically study about toxic exposures and their treatment; but we do study other chemical exposures meant to improve human health when we study pharmacology. We can use our understanding of pharmacology to develop and understand toxicology. In both areas the method of exposure (injection, topical, inhaled, or ingested) influences the amount of chemical (or drug) absorbed and then in toxicology, just as pharmacology, we further examine the human biochemical response to the substance in question. Both toxic chemicals and drugs are metabolized or biotransformed and create a biochemical interaction in the human body that can be therapeutic in the case of medicines or could be toxic in the case to too much medication or a toxicant.

It is important, however, to understand that there are unique differences between toxicology and pharmacology that makes the study of toxicology and the determination of toxic exposures a bit more challenging than the study of pharmacology. In pharmacology, drugs have been tested in human populations and are given in prescribed dosages – we know how much medication and the route it is being administered. When giving medications, for the most part, conditions are controlled; vital signs and therapeutic levels are monitored. Whereas, in the case of a toxicant often we have not controlled the route of exposure and we may not have knowledge of the exact amount of exposure (how much was ingested or breathed in). Also frequently, for ethical reasons, the toxic chemical has not been tested on human beings. Therefore, when we examine toxicological data we frequently rely on animal studies and accidental human exposures where we are approximating the amount of exposure to make an informed decision regarding human health. Consequently, many times we make the best decision we can with the available scientific evidence while recognizing that there may be limitations in the data (not the same species for testing, or an unknown amount of exposure). Pharmacology and toxicology share some similar concepts; but, toxicology is much more complex and frequently we must make inferences from the data that we have to determine toxicity of a particular chemical. Therefore, we rely on the best evidence that we have within the context of the Precautionary Principle when making decisions regarding toxic environmental exposures and human health.

As with medications, individuals may be exposed to multiple toxins at the same time. Little research has been conducted regarding human exposure to multiple toxins which can occur at the same time or sequentially. Sometimes we do not even know what toxicant(s) the individual was exposed to. For more comparing toxicology to pharmacology please see EnviRN Evidence - Toxicology.

CARCINOGENS

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A carcinogen is any substance that causes cancer or helps cancer grow. Carcinogens can either be physical, biological or chemical. Physical carcinogens include ultraviolet light and ionizing radiation. A biological example would be the Human papilliomavirus (HPV) which is known to cause cervical cancer in women. Lastly, chemicals used to make many of the products we use daily in our personal and professional lives are carcinogens. Chemicals we encounter in our daily lives can include but are not limited to the following:

- Pesticides are used in agriculture to help feed over 300 million Americans. Individually people use them to maintain a beautiful landscape, keeping insects and animals from ruining their flowers and produce. There are long term ramifications to our ecosystem that results from using these chemicals. Pesticides have been shown to be carcinogenic as well as causing problems with our nervous system, endocrine system and lungs when inhaled. Pesticides infiltrate our groundwater supply polluting our water. To learn more about pesticides and safe handling please refer to the following EPA page epa.gov/pesticides/health/cancerfs.htm. An innovative approach to farming without chemicals is vertical farming. Vertical farming is done indoors free of external factors related to weather, bugs and drought. It is our duty as nurses to advocate and support healthy innovation http://www.verticalfarm.com
- Bisphenol A (BPA) is one of the most common chemicals to which we are exposed in everyday life. It is found in our food and plastic beverage containers. BPA is a synthetic estrogen that can disrupt the hormone system causing reproductive and developmental disorders, particularly when exposures occur while babies are still in the womb or in early life. Elevated estrogen levels generally increase a woman's risk of breast cancer. In 2008, there was a public outpouring for a change amongst reports of "toxic baby bottles" which was revolutionary. Companies had to produce BPA free bottles due to consumer demand. http://www.cansa.org.za/federal-report-looks-at-risks-from-plastics-chemical/; http://ntp.niehs.nih.gov/ntp/ohat/bisphenol/bisphenol.pdf
- Trichloroethylene, is an organic solvent used in industry as a degreaser. According to the Department of Veterans Affairs, between 1957 and 1987, an estimated 750,000 people living and working at Camp Lejeune may have been exposed to drinking water contaminated with trichloroethylene. Some 71 Camp Lejeune veterans have been diagnosed with male breast cancer, and many others suffer rare forms of cancer, leukemia and other debilitating diseases. Children conceived, born and raised on the base are reported to have experienced high incidences of birth defects and developmental and childhood illnesses. In 2011, the EPA ruled that trichloroethylene was a carcinogenic and harmful to humans. The Camp Lejeune case shows us how chemicals can pose health risk for future generations. http://www.epa.gov/ttn/atw/hlthef/tri-ethy.html

A carcinogen has the ability to damage the DNA directly or indirectly cause a disruption of a cellular metabolic process. For example, they may cause cells to divide at a faster rate, which could increase the chances that DNA changes will occur. Cancer is caused by a change in a person's DNA. However, carcinogens do not cause cancer in every case, all the time. A variety of factors such as a person's genetic makeup, the length and intensity of the exposure can determine the level of the cancer causing potential. The damaging effects of carcinogens can be insidious because the effects are often not immediate and lay dormant for many years. Nurses are exposed to numerous toxic chemicals on a shift such as disinfectants, sterilants, cleaners, and maybe some hazardous drugs such as chemotherapy. It is important for nurses to be vigilant at work to decrease the risk of exposure especially when pregnant.

HOW DO WE FIND OUT IF SOMETHING IS A CARCINOGEN?

Scientist get much of their data about whether something might cause cancer from lab studies in cell cultures and animals. Another important way to identify carcinogens is through epidemiologic studies, which look at human populations to determine which factors might be linked to cancer. However, humans do not live in a controlled environment so the studies have their limits. People are exposed to many substances at any given time, including those they encounter at work, school, or home; in the food they eat; and in the air they breathe. By combining data from both types of studies, scientists do their best to make an educated assessment of a substance's cancer-causing ability. When the evidence is conclusive, the substance is labeled as a carcinogen. When the available evidence is compelling but not felt to be conclusive, the substance may be considered to be a probable carcinogen. But in some cases there simply isn't enough information to be certain one way or the other.

WHO DETERMINES HOW A CARCINOGEN IS CLASSIFIED?

Several agencies (national and international) are responsible for determining the cancer-causing potential of different substances. Each agency has its own classification standards. These agencies tend to focus on substances and exposures most likely to cause cancer, but there are many others that have not been studied fully yet.

- International Agency for Research on Cancer - The International Agency for Research on Cancer (IARC) is part of the World Health Organization (WHO). Its major goal is to identify causes of cancer.
    - Group 1: Carcinogenic to humans
    - Group 2A: Probably carcinogenic to humans
    - Group 2B: Possibly carcinogenic to humans
    - Group 3: Unclassifiable as to carcinogenicity in humans
    - Group 4: Probably not carcinogenic to humans
- National Toxicology Program - This program was started in 1978 in response to the concerns from people within the United States regarding the relationship between the environment and cancer. The National Toxicology Program (NTP) is formed from parts of several different US government agencies, including the National Institutes of Health (NIH), the Centers for Disease Control and Prevention (CDC), and the Food and Drug Administration (FDA). The NTP updates its Report on Carcinogens (RoC) every few years.

  The Report on Carcinogens identifies 2 groups of agents:
  1. "Known to be human carcinogens"
  2. "Reasonably anticipated to be human carcinogens"
- Environmental Protection Agency- The US Environmental Protection Agency (EPA) maintains the Integrated Risk Information System (IRIS), an electronic database that contains information on human health effects from exposure to certain substances in the environment. EPA has published the revised Guidelines for Carcinogen Risk Assessment 2005. The Guidelines provide a framework to EPA scientists for assessing possible cancer risks from exposures to pollutants or other agents in the environment.
    - Group A: Carcinogenic to humans
    - Group B: Likely to be carcinogenic to humans
    - Group C: Suggestive evidence of carcinogenic potential
    - Group D: Inadequate information to assess carcinogenic potential
    - Group E: Not likely to be carcinogenic to humans
- Other agencies and groups - Other federal agencies, such as the CDC's National Institute for Occupational Safety and Health (NIOSH), the Food and Drug Administration (FDA), and the National Cancer Institute may comment on whether a substance or exposure may cause cancer and/or what levels of exposure to a particular substance might be considered acceptable.

MY PERSONAL ACCOUNT OF CANCER AS A PRACTICING BEDSIDE NURSE:

I graduated from nursing school in 1997 and worked at a local ER. Initially, I had limited exposure and experience with the oncology patient because there were always rooms available on the oncology floor for them to be directly admitted. The ER was just considered "too dirty" of a place for these immunocompromised patients. Fast forward to current practice, oncology patients are sitting in waiting rooms for hours waiting to get a gurney in the emergency department. Now, some shift's have a whole section with active oncology patients or patients with a history of cancer. My journey to environmental nursing started when I started to get "burnt out" and realized I suffered from moral distress. To witness the physical decline and pain and emotional upheaval cancer has on a patient and family made me question my role as a nurse. I realized that I needed to get more involved in advocacy, working up stream, and having the moral courage to speak out on behalf of my patients. I needed to become more active in reducing the likelihood of cancer.

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CRITERIA AIR POLLUTANTS

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Air pollution is the largest environmental risk to human health (World Health Organization, 2014). Globally, outdoor air pollution contributes to 3.7 million annual deaths and is among the top 9 risk factors for disability adjusted life years lost (Lim et al., 2013; World Health Organization, n.d.). Major health conditions impacted by outdoor air pollution include acute lower respiratory diseases (e.g. pneumonia), obstructive lung diseases, ischemic heart disease, stroke, and lung cancer – all conditions commonly seen by nurses in a variety of settings (Lim et al., 2013; World Health Organization, 2014). The sources of most outdoor pollutants are emissions from industry, transportation, processes to create energy, and waste management (World Health Organization, 2014).

Nearly 130 million Americans live in communities where air quality does not meet healthy standards, posing an ongoing source of health risk (U.S. Department of Health and Human Services, n.d.). People with pre-existing lung or cardiovascular disease, children, and the elderly are more susceptible to the health effects of air pollution exposure (Lim et al., 2013; World Health Organization, 2014).

NURSES' ROLE IN REDUCING EXPOSURE TO AIR POLLUTANTS

Nurses equipped with knowledge about common air pollutants are in key positions to educate patients and families on strategies to reduce exposures and risks. Nurses also can contribute to community advocacy and building coalitions that reduce community levels of exposure. Additionally, nurses can inform ongoing policy by sharing their clinical experiences in caring for affected patients and communities (American Nurses Association, 2007).

OUTDOOR AIR POLLUTANTS

The most common and pervasive harmful outdoor air pollutants in the United States are called "criteria" air pollutants (EPA, 2014, 2016a, 2016b). The six criteria pollutants are sulfur dioxide, nitrogen oxides, particulate matter (identified by a mean diameter of less than 10 or 2.5 μm), ozone, lead, and carbon monoxide (EPA, 2014, 2016a, 2016b). Improved regulation and innovations in pollution sources (such as industrial processes and automobiles) have continually improved levels of criteria air pollutants in the United States, as can be seen on http://www.epa.gov/air-trends/. However, climate change predictions indicate the potential for future increased levels of these pollutants, especially ozone and particulate matter (EPA, 2012). More information on the individual criteria air pollutants can be found at the Environmental Protection Agency's website. Table 1 summarizes each pollutant and their health effects.

Table 1: Health effects of criteria air pollutants

Pollutant	Common health effects linked to Increased ambient levels
Sulfur Dioxide	General irritation of the eyes, nose, throat, and lungs. Worsening asthma and chronic obstructive pulmonary disease (COPD), respiratory infections, heart attack, cardiac dysrhythmia, hypertension, abdominal pain, depression, headache, lung cancer
Nitrogen Oxides	General irritation of the eyes, nose, throat, and lungs. Worsening asthma and chronic obstructive pulmonary disease (COPD), respiratory infections, heart attack, cardiac dysrhythmia, hypertension, abdominal pain, depression, headache, lung cancer
Particulate Matter[a]	Heart attack and stroke, cardiac arrest, clots, chest pain, cardiac dysrhythmia, shortness of breath, respiratory infection, fatigue, headache
Ozone	General irritation of the eyes, nose, and throat. Worsened lung function and asthma. Cardiac arrest, dysrhythmia, depression, and skin irritations
Carbon Monoxide	Heart attack, cardiac dysrhythmia, asthma, pneumonia, depression, headache, and ear infection
Lead[b]	Anemia, hypertension, decrease in kidney function, cardiovascular events, altered childhood neurological development (behavioral and intelligence)

[a] Assembled impacts of various sizes of particulate matter

[b] Ingestion of paint, dust, and soil is the most frequent route of exposure. Ambient levels add to the accumulation in the environment.

TEACHING TOOLS

Several teaching tools for healthcare providers' continuing education and communication with patients about common air pollutants are available at http://www.airnow.gov/index.cfm?action=health_providers.index. Examples from this Environmental Protection Agency site include patient education posters on how common air pollutants impact respiratory and cardiac health. Posters are in English and Spanish versions.

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CHEMICALS OF CONCERN: FLAME RETARDANTS

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Flame retardants are chemicals marketed to the public as a mechanism of protection from fires; yet products containing flame retardants provide no more protection against fires than other safety barriers (Babrauskas, Blum, Daley, & Birnbaum, 2011). Moreover, research shows that these chemicals are disruptive to a person's health. Vulnerable populations are especially susceptible to the health impacts from exposure to flame retardants. The continued use of flame retardants is misleading to the public as one assumes that domestic products, especially children's products, are safe to use.

WHAT ARE CHEMICAL FLAME RETARDANTS?

Flame retardants are chemicals that are added to materials for the purpose of making those materials more resistant to fire or reducing the speed that a flame spreads. Consumer products, such as upholstered furniture and electronics, contain flame retardants.

The use of flame retardants in the manufacturing of upholstered furniture began about 1975 when California adopted the Furniture Flammability Standard, Technical Bulletin 117 (Babrauskas et al., 2011). This standard requires polyurethane foam to resist an open flame for 12 seconds. In a short video, The Chicago Tribune tells how the tobacco industry was successful in shifting the focus from cigarette companies producing cigarettes that easily started fires to furniture manufacturers making upholstered furniture that would easily ignite and once ignited the fire would spread quickly. This led to the widespread use of chemical flame retardants in upholstered furniture.

Some of the leading chemical flame retardants on the market today are polybrominated diphenyl ethers (PBDEs), Firemaster 550, Tris (1-chloro-2-propyl) phosphate (TCPP), Tris (1,3-dichloro-2-propyl) phosphate or chlorinated tris (TDCPP), and Tris (2-chloroethyl phosphate) (TCEP). PBDEs are a group of flame retardants that contain bromine. Over the past decade, several PBDEs have been phased out of production because they were found to be linked to health problems, such as hyperactivity and learning disabilities in children and thyroid dysfunction (American Academy of Pediatrics [AAP], 2013). PBDEs are not bound to the products that contain them, thus they can be dispersed into the environment. Since PBDEs are lipophilic, meaning they adhere to fat cells in the body, and have a long half-life, they continue to present a health risk (National Resources Defense Council, 2005). The majority of the public have PBDEs in their system because of past exposure or current exposure to products purchased before the phase out. The Environmental Working Group has created an information sheet on PBDEs that nurses can use with clients and health professionals to describe the health impact of PBDEs and ways to limit exposures.

Today, Firemaster 550 is being used instead of PBDEs and is frequently found in upholstered furniture and other foam products. Firenmaster 550 consists of four major chemicals: triphenyl phosphate, Triaryl phosphate isopropylated, Bis (2-ethylhexyl) tetrabromophthalate, and 2-ethylhexyl-2,3,4,5-tetrabromobenzoate (2). There is evidence that this chemical flame retardant is associated with endocrine system disruption, including thyroid function (Center for Environmental Health [CEH], 2013b; Patisaul et al., 2013). Similar to other flame retardants, Firemaster 550 has lipophilic and non-adherent properties. It can be found in dust, sewage sludge, and marine animals (Babrauskas et al., 2011), and presents risk of inhalation and ingestion for humans and pets. .

Flame retardants TCPP, TDCPP, and TCEP are from the "Tris" family, and all have similar properties and health risks. These chemical flame retardants can be found in products made of polyurethane foam, such as couches and automotive seats; baby products such as strollers and nursing pillows; electronics; adhesives; the back-coating of carpets; plastics; vinyl products made out of PVC; and paints (CEH, 2013b; Ecology Center, 2013; National Resource Defense Council [NRDC], 2010). Researchers found that TCPP is linked to genetic alterations and menstrual changes (Center for Environmental Health [CEH], 2013a), and that TDCPP is associated with cancer of multiple systems. TDCPP was banned from children's clothing in 1977 due to causing significant health problems, but it is still being used in other children's products. Current research on TCEP shows that it is associated with fertility problems in males and females, thyroid and kidney cancers, and hyperactivity (NRDC, 2010). This flame retardant has been found in infant changing pads and car seats (CEH, 2013b).

WHERE ARE CHEMICAL FLAME RETARDANTS FOUND?

Table 1: Sources of chemical flame retardants

Everyday Consumer Products:	Baby and Children's Products	Hospital Setting
- Upholstered furniture (items made out of polyurethane foam) - Automotive seating - Backing of carpets - Insulation - Car dashboards **Electronic Devices:** - Televisions - Remotes - Cell Phones - Computers - Cables **Food** - 20% of exposure to flame retardants is from diet - Butter - Seafood - Meat - Dairy	- Crib mattresses - Changing pads - Bassinet pads - Car seats - Strollers - Furniture/ plush chairs - Electronic tablets (Fuhu Nabi Jr., Kurio Touch 4's, VTech InnoTab 3, LeapFrog, LeapPad 2 explorer) - Nursing pillows - Baby carriers - Rocking chairs/gliders - Foam cubes and mats for gymnasts	- IV pumps - TV's - Mattresses - Infant bassinet pads - Furniture cushions - Privacy curtains - Pulse oximeters - Ventilators - Electronics

Babrauskas et al., 2011; Bradman et al., 2012; Carignan et al., 2013; CEH, 2013a; Clean and Healthy New York, 2011; Ecology Center, 2013; Health Care Without Harm, n.d; Stapleton et al., 2011; Stromberg, 2012

ENVIRONMENTAL HEALTH CONCERNS OF FLAME RETARDANTS

Chemical flame retardants are released into the environment during production. When they are in products, there is also continuous release of these chemicals into consumer homes and businesses. As consumers interact with these products, a greater percentage of the chemical is released. For example, when a person sits on a couch the friction created from movement increases the amount of chemical that is released into the environment. When chemical flame retardants are released into the environment, they adhere to dust, which has been found to be a major source of exposure of flame retardants (Stapleton et al., 2009). Children's behaviors put them at a greater risk of exposure. For example, children often have their hands on furniture and other items that may be covered with this chemical-bound dust. They then put their hands in their mouth and ingest the chemical. Since their bodies are small, children are more susceptible to health risks because of exposure.

According to a study from the University of California Berkeley's Center for Environmental Research and Children's Health (CEH, 2013a), children were found to have flame retardant levels in their bodies that are three times higher than the levels found in their mothers. Children of color and low socioeconomic status were found to have higher levels of flame retardants in their bodies (CEH, 2013a). Contributing factors include more time spent indoors due to poor play conditions outside, and generally homes might have lower cost products and older furniture that might contain flame retardants previously phased out, such as PentPBDE (CEH, 2013a).

Exposure can also occur prenatally as flame retardants readily pass through the placenta. Newborns and infants can be exposed to these chemicals through breastmilk (Laboratory Equipment, 2012). However, even though breastmilk is a mode of transfer of flame retardants to children, the benefits of breastfeeding still outweigh the risks of exposure. Children have an increased vulnerability to these chemicals because their bodies go through rapid growth and development during early childhood (CEH, 2013a).

Flame retardants can also invade the human body or other living organisms through the air and skin. When a person is sitting in a room that has a product containing chemical flame retardants, they are breathing in the chemical that is free floating in the air. Researchers found that 97% of Americans tested have flame retardant chemicals present in their bodies (CEH, 2013a). Wildlife animals, including fish, birds, and marine mammals, also have increasing levels of these chemicals in their systems (Babrauskas et al., 2011).

Firefighters are another vulnerable group because of how these chemicals react during fires. When the chemicals burn, they produce high levels of toxic gases, such as carbon monoxide, dioxins, furans, hydrogen cyanide, soot

and smoke (Babrauskas et al., 2011; CEH, 2013a; Laboratory Equipment, 2012). Inhalation of these gases cause more fire injuries and fire deaths then the fire itself (Laboratory Equipment, 2012). Studies found that firefighters have higher rates of multiple myeloma, non-Hodgkins lymphoma, prostate, and testicular cancer than the average person (CEH, 2013b).

Chemical flame retardants can cause a variety of health problems. Table 2 lists health problems that are associated with chemical flame retardants. The systems that can be affected by toxic chemical flame retardants include neurologic, reproductive, endocrine, development, thyroid, and immune systems.

Table 2: Health Problems flame retardants cause

Cancer - Multiple systems **Altered thyroid hormone levels** **Neurologic impairments** - Memory - Learning **Developmental** - Adverse effects on motor, cognition, and behavioral outcomes - Lower IQ - Hyperactivity	**Reproductive** - Infertility - Cryptorchidism - Adverse birth outcomes including decreased weight, length, and chest circumference **Endocrine** - Type-2 diabetes - Insulin resistance - Obesity

AAP, 2013; Babrauskas et al., 2011; CEH, 2013a; Gascon et al., 2012; Stapleton et al., 2011

Watch this short Youtube video on why dust bunnies can make you ill.

Chemical flame retardants are not only a concern because they are harmful to our health and environmental systems, but recent research found that they are not effective at reducing fires. These chemicals are applied to polyurethane foam that is then covered by fabric or another covering. During fires, the fabric is ignited first. By the time flames reach the foam, the fire is no longer a small open flame, but a larger fire; thus the flame retardants are no longer effective (Babrauskas et al., 2011; CEH, 2013a) The United States Consumer Product Safety Commission (CPSC) conducted burn tests of upholstered chairs and concluded that the standards in California's TB 117 do not provide a significant fire safety benefit (Babrauskas et al., 2011).

Lastly, one of the dangers of chemical flame retardants is that they do not leave the human body, homes, and the environment once they are banned or phased out. People don't throw out their upholstered furniture when a chemical flame retardant stops being produced. In addition, if a product containing flame retardants ends-up in a landfill, the chemicals leak into the environment. These chemicals linger for years in the environment and build up in the human body because of their long half-lives (CEH, 2013a).

Watch this CNN 9 minute clip on why the safety and effectiveness of flame retardants is being questioned.

WHAT HAS BEEN DONE TO PROTECT OUR HEALTH?

In 1977, the chemical flame retardant chlorinated Tris (TDCPP) was removed from children's pajamas because it was found to cause cancer in test animals. At the time of removal, cancer in humans and flame retardants were not linked, but the perceived risk to a child's health was high (United States Consumer Product Safety Commission, 1977). Even though this chemical was banned in children's pajamas in 1977, it has remained in production and is in other children's products. Two other chemical flame retardants, PentaBDE and OctaBDE, have been phased out of production in the past decade due to scientific evidence that they are accumulating in our environment and in humans and may present a health risk (United States Environmental Protection Agency, 2013).

Through legal action in 2013 by the Center for Environmental Health, flame retardant chemicals were successfully removed from children's nap mats. Nap mats are often used in daycare settings, exposing young children and teachers to these unhealthy chemicals (CEH, 2013a).

In 2013, California passed a new fire safety law, TB 117-2013, that went into effect January 1, 2014. This new fire safety standard allows companies to make fire retardant-free products, but does not ban the use of flame retardant chemicals. The new standard states that a product must not smolder for more than 45 minutes after a lit cigarette is placed on it. Fire barriers or use of less flammable fabrics are ways manufacturers can avoid chemical flame retardants (CEH, 2013a).

TB 117-2013

Effective January 14, 2014

- Companies don't need to use chemical flame retardants to adhere to the new standard
- Products must pass a 45 minute smolder test
- Does not make chemical flame retardants illegal
- Details of ruling: http://www.bearhfti.ca.gov/about_us/tb117_faqs.pdf

WHAT CAN WE DO TO PROTECT OUR HEALTH NOW?

To reduce our exposure to flame retardants, consumers can send a strong message to manufactures by not purchasing products treated with chemical flame retardants. For example, when purchasing furniture, look for products that are polyester, wool, cotton, or down filled; made out of wood or canvas; or that attest to meeting the flammability standards without using chemicals. In addition, do not purchase products that contain polyurethane foam (CEH, 2013a). In the online resource section of this chapter, a list of known manufacturers who do not use toxic flame retardant chemicals is included. When remodeling or building a new home limit the use of carpeting and draperies as these products are known to contain flame retardants (CEH, 2013b).

Frequent hand washing is one of the most important prevention strategies to ingesting toxic flame retardants, especially for young children who are crawling or playing on the floor where more dust is found. Dryer lint and vacuum cleaner bags have high levels of flame retardants in them, so make sure to wash your hands after handling these. Vacuuming, especially with a HEPA vacuum cleaner, or wet mopping weekly to remove dust, can help decrease home levels of toxic flame retardants (CEH, 2013a; CEH, 2013b).

Due to the prevalent use of flame retardants in furniture and baby products, consumers need to execute certain precautions with these products to reduce their exposure:

- Inspect foam products for rips or product breakdown, and replace the product if possible.
- Don't reupholster foam furniture
- Execute caution when removing old carpet by isolating the work area, wet-mop to pick up small particles left behind, and carefully handle the padding.

Eliminating your exposure to toxic chemical flame retardants from electronics can be a little more difficult. Consumers can utilize the Center for Environmental Health's electronics shopping guide to help them purchase products that are free of brominated and chlorinated flame retardants (CEH, 2013b). In addition, don't let children play with or mouth electronic devices that are known to have flame retardants in them such as remotes and cell phones. If they do touch these objects, wash their hands as soon as possible and before eating.

When purchasing new products, look for the new TB 117-2013 label to see if chemical flame retardants have been added. Consumers should be cautious of discounted furniture as manufactures are able to sell their inventory that meets the old TB 117 standard until it is sold out. Consumers can ask manufactures if they use flame retardants in their products to determine product safety (CEH, 2013a).

In addition, consumers need to continue to support legislation that will change chemical policy regulations to create a toxic free environment. Encouraging and supporting companies to use better fire prevention strategies that do not use toxic chemicals can help reduce the environmental exposure to these toxins. Product design, use of physical barriers, and type of material used are ways companies can change their fire retardant strategies.

ONLINE RESOURCES/TOOL KITS

For Healthcare providers

The Center for Environmental Health has a variety of resources available to the public, which include:

- A great educational pocket size card to give patients providing them with tips on how to reduce their exposures to chemical flame retardants. http://www.ceh.org/wp-content/uploads/2013/08/Tips-to-Reduce-Exposure-to-Flame-Retardants-WEB.pdf
- A report on flame retardants found in children's furniture http://www.ceh.org/wp-content/uploads/2013/11/Kids-Furniture-Report-Press.pdf
- A list of products that contain harmful chemical flame retardants http://www.ceh.org/campaigns/flame-retardants/health-impacts/list-of-products-in-violation-of-california-law/

The National Resources Defense Council has a 2 page pamphlet that highlights TDCP and TCEP flame retardants focusing on the vulnerability of children.

The Environmental Working Group has a 1 page guide on PBDEs on what they are, where they are found, why their harmful, and how to avoid them.

For Parents and Child Caregivers

- The Center for Environmental Health offers testing of foam for flame retardants. Results take 2-3 weeks to get back and is free.
- Companies that advertise that they produce flame retardant-free furniture

If you live in California:

- Cisco Home (www.ciscohome.net)
- Eco-Terric (www.ecoterric.com)
- EcoBalanza (www.greenerlifestyles.com)
- Ekla Home (www.eklahome.com)
- Furnature, (www.furnature.com)
- Green Sofas (www.greensofas.com)
- Viesso (www.viesso.com)
- The Futon Shop (www.thefutonshop.com)
- LEE Industries (www.leeindustries.com)

If you live outside of California

- Corinthian (www.corinthianfurn.com)
- Drexel Heritage (www.drexelheritage.com)
- EcoSelect (www.ecoselectfurniture.com)
- Endicott Home (www.condosofa.com)
- LEE Industries (www.leeindustries.com) (CEH, 2013a)

Baby products

- Baby Luxe Organic: Polyester-filled and cotton-covered pads and mattresses
- Baby Bjorn: Polyester-filled and cotton-covered baby carriers
- Orbit Baby: Strollers and car seats with Expanded Polypropylene foam that meets TB 117 without halogenated chemicals
- Boppy: Nursing pillows filled with polyester and no added flame retardant chemicals (CEH, 2013b)

Children's Pajamas

- Sleepwear for children less than 9 months usually don't contain flame retardant chemicals because they don't have to meet flammability standards.
- Sleepwear for children older than 9 months may contain flame retardants
- look for snug-fitting sleepwear, tag will say "not flame resistant"
- avoid 100% cotton sleepwear
- avoid products that are treated with Proban or Securest
- News and reports on flame retardants in children's products including kids furniture and mattresses
- Handout on flame retardants in baby products and healthy tips
- Alliance for Toxic Free Fire Safety website has up to date information on chemical flame retardants. Sections include products, home, people, fire, and policy. They have a variety of resources and how to take action again chemical policy.

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HEALTH EFFECTS OF HEAVY METALS

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Metals are natural elements found in the earth and they have been mingling in the waters of the earth for ages and eons. They are also another emerging and growing category of global pollutants. As human industry extracts them from the earth, they are harnessed to industrial production, weapons, and the production of power, and then released again into the environment. We breathe, eat, and drink them more and more.

Metals are widely dispersed in our daily activities, in our occupations, our neighborhoods, our bridges, paints, and soils. People willingly have tattoo dyes containing metals injected into their skin (U.S. Food & Drug Admin., 2009). Metals are known to accumulate in select body tissues, especially the brain and kidneys, and many are toxic.

Surprisingly, the definition of what a heavy metal is varies, and it is loosely defined. Some definitions are based on the atomic weight of the metal, while others are based on its toxicity (Duffus, 2002). To further confuse the issue, some heavy metals are essential to body functions in certain quantities (like vanadium, manganese, iron, cobalt, nickel, copper, zinc and molybdenum), but those same metals may be toxic at sufficiently excessive amounts (Burger & Waishwell, 2001).

Toxicity varies, too, according to the metal involved and the specific form of that metal, the dose, the chronicity of the exposure, the age and size of the individual exposed to it, and the route of exposure. People may be exposed to heavy metals in many ways, such as through their diet, medications they take, their environment, and their occupational and recreational activities (Adal, A., 2013).

For instance, according to the Environmental Protection Agency's statistics, fish consumption advisories have been issued for over 16% of U.S. freshwater lakes and 7% of rivers due to chemical pollution, much of which is due to heavy metals (Burger & Waishwell, 2001).

Welders may exhibit Parkinson-like symptoms from occupational manganese exposure (Perl, Olanow, & Warren, 2007), and some medications, such as some imported Chinese and Ayurvedic medicines, have been found to contain dangerous levels of arsenic, mercury, and lead (Medicines and Healthcare Products Regulatory Agency, 2013; 2014).

In another example, acute renal failure secondary to ingestion of Ayurvedic medicine containing mercury in a 2 year old is discussed in this article (Sathe, Ali, & Ohri, 2013).

However, aluminum, bismuth, gold, gallium, lithium, and silver are also being used therapeutically in medicine (Adal, 2013), and mercury, silver, gold, and other metals have long been used in dental amalgams. According to Dr. Mark Houston, in his presentation to the 13th International Symposium of The Institute for Functional Medicine, "The Environmental Protection Agency has determined the safe daily intake of mercury to be less than 0.1 µg/kg/day (about 7 µg/day for a 154 lb person). It is estimated that 1 dental amalgam filling releases about 3-17 µgs of mercury vapor per day. The typical amalgam is composed of 50% mercury, 25% silver, 25% tin, copper, and nickel" (2007).

The chief heavy metals of interest in the environmental science literature in discussions about occupational exposures are lead, mercury, cadmium, chromium, copper, manganese, nickel, zinc, and silver (Hogan, 2010), but regulations of waste incinerator emissions may also include arsenic, cobalt, tin, and thallium.

The high temperatures of waste incineration tends to convert heavy metals into their oxide and chloride forms, which are then released as fine particulate matter into the surrounding atmosphere (Donnelly, 1991). Industrial effluent continues to pollute water worldwide, too.

In Life Support: The Environment and Human Health, McCalley (2002, p. 77) writes "Prescriptions to Reduce Human Exposure to Heavy Metals". He advises:

- Prescription 1: Accelerate and complete the global phaseout of leaded gasoline.
- Prescription 2: Begin an effort to monitor levels and trends in metals pollution worldwide.
- Prescription 3: Establish population-based biomonitoring for selected metals.
- Prescription 4: Educate government, scientists, and the general public about the toxicity of metals.
- Prescription 5: Declare a moratorium on the production, distribution, and use of products likely to significantly increase global exposure to toxic metals.
- Prescription 6: Continue basic research into the impact of metals on human health.

There is much to be done!

A table named Typical Presentation of the Most Commonly Encountered Metals and Their Treatment from an article entitled Heavy Metal Toxicity may be accessed by clicking here (Adal, 2013). It lists acute and

chronic symptoms of exposure, pertinent lab values and concentrations, as well as recommended treatment regimes.

The following is a listing of some of the more common heavy metals of concern, with a brief introduction to each, and useful web links for further investigation.

ARSENIC

Arsenic is a known toxin and carcinogen, and it is also known that human exposures to arsenic are common. Safe levels of exposure are still being debated by scientists and government regulators. It is found naturally in rock, many water supplies, and crops that are grown in arsenic-tainted waters, like rice, or apples from orchards with a history of being doused with lead arsenate or copper arsenate. It is also found in pressure-treated wood products that have been treated with chromium arsenate.

Arsenic Web links:

- Agency for Toxic Substances & Disease Registry (ATSDR, 2012): Toxic Substances Portal
- Agency for Toxic Substances & Disease Registry: ToxFAQs
- ATSDR: Patient education and instruction sheet
- Centers for Disease Control and Prevention (CDC) Health Hazard Evaluation Table

CADMIUM

Cadmium exposure is not especially common, though it tends to be associated with occupations dealing with pigments, metal plating, batteries, and some plastics. However, exposure to cadmium may also be through emissions from a cadmium smelter into the air or into sewage sludge later used as fertilizer for food crops. People have a hard time excreting cadmium, and it has been found to damage the lungs, testicles, and kidneys (McCally, 2002).

Cadmium web sites:

- Agency for Toxic Substances & Disease Registry: Toxic Substances Portal
- Agency for Toxic Substances & Disease Registry: ToxFAQs

CHROMIUM (HEXAVALENT)

Chromium may be found in various forms. The hexavalent form is thought to be the most toxic and carcinogenic, and is used extensively in some industries like leather tanning. Factory runoff from those industries has become a major problem. It is highly corrosive and allergenic and lung cancer is associated with its inhalation.

Chromium web sites:

- OSHA Fact Sheet: Health Effects of Hexavalent Chromium
- U.S. EPA fact sheet on Chromium Compounds

COBALT

For most people, cobalt exposure may occur through consuming foods and beverages (like cobalt-fortified beer). For others, exposure to cobalt occurs occupationally as cobalt powders are used industrially in enamels, and in the creation of metal alloys. It is mainly absorbed through the pulmonary and the gastrointestinal tracts, and the main target organs are the skin and the respiratory tract.

Cobalt web links:

- Agency for Toxic Substances & Disease Registry: Toxic Substances Portal
- Agency for Toxic Substances & Disease Registry: ToxFAQs

COPPER

Interestingly enough, levels of copper and iron which may be normal during the reproductive years, may be later found to contribute to diseases of aging such as atherosclerosis, Parkinson's Disease, and inflammatory diseases, or to contribute to aging itself via free radicals of oxidation (Brewer, 2007).

Copper websites:

- Agency for Toxic Substances & Disease Registry: Toxic Substances Portal
- Agency for Toxic Substances & Disease Registry: ToxFAQs

LEAD

Lead has been mined and used by people for centuries, and exposure is common. It is the most widely used of the metals, and the worrisome health effects of lead have likely been the most studied of all the heavy metals. In the 20th century, when lead was used in plumbing, gasoline, solder in food cans, paint, and ceramic ware, lead levels in the human population rose to dangerous levels. Now, in the 21st century, we have made great strides in reversing the trend, but there is still a lot of lead around.

There is lead in city water supplies like Washington, DC (EPA, 2014). There is lead in the paint in bridges, buildings, and infrastructure across the world. There is lead in cheap plastics like lunch bags (Daluga & Miller, 2007), diaper bags,

purses, Christmas lights, and vinyl window blinds. People willingly have tattoo dyes containing metals injected into their skin (U.S. Food & Drug Admin., 2009), and there is even lead in many brands of lipstick, though the EPA reports state that studies have not shown that enough lead is ingested for there to be a proven health risk.

Lead is associated with a wide variety of health problems, ranging from convulsions, coma, renal failure, anemia, hypertension, metabolic and neurological disorders. The EPA states that, " Studies continue to show that elevated Blood Lead Levels (BLL) are associated with neurological effects, including reduced intelligence, changes in brain function, fatigue, impotence, and reductions in nerve conductivity. There are also systemic effects from lead exposures, such as changes in the level of circulating thyroid hormones and changes in immune system parameters."

Furthermore, maternal bone stores of lead are mobilized during pregnancy and passed on to the next generation during pregnancy and lactation.

Public health education regarding minimization of exposures through housekeeping and dust control, the use of personal protection during renovation projects, and reduction in the use of lead in everyday products is important. For a lecture regarding lead exposure and regulations please see: http://lecture.envirnevidence.org/lead/

Lead websites:

- Agency for Toxic Substances & Disease Registry: Toxic Substances Portal
- Agency for Toxic Substances & Disease Registry: ToxFAQs
- Environmental Protection Agency: Lead in DC Drinking Water

LITHIUM

According to Hsing Po Kang and his fellow researchers (2013, April), "Rechargeable lithium-ion (Li-ion) and lithium-polymer (Li-poly) batteries have recently become dominant in consumer electronic products because of advantages associated with energy density and product longevity. However, the small size of these batteries, the high rate of disposal of consumer products in which they are used, and the lack of uniform regulatory policy on their disposal mean that lithium batteries may contribute substantially to environmental pollution and adverse human health impacts due to potentially toxic materials."

Lithium web links:

- Centers of Disease Control & Prevention: NIOSH guide to chemical exposures
- Centers of Disease Control & Prevention: Lithium Hydride Immediately Dangerous to Life or Health Concentrations (IDLH)

MANGANESE

Manganese is considered a "trace element", and small amounts are necessary to be healthy. People consume manganese in food and water. However the higher level of exposure in occupational settings, like those observed in the welding and steel production industries, have been associated with the development of symptoms similar to Parkinson's Disease (Perl & Olanow, 2007). At high levels, manganese can cause brain damage.

Manganese exposure is increasing and has become of global concern since the addition of a manganese-based additive to gasoline called methycyclopentaldienyl manganese tricarbonyl, or MMT.

Manganese links:

- Agency for Toxic Substances & Disease Registry: Toxic Substances Portal
- Agency for Toxic Substances & Disease Registry: ToxFAQs
- CT Dept. of Public Health: Drinking Water Fact Sheet on Manganese
- U.S. EPA Fact Sheet About Manganese

MERCURY

Mercury may be found in various forms (and as inorganic and organic compounds). It is released into the air when coal is burned or when trash, especially medical waste is incinerated. It is used in various chemical, metal-processing, automotive, and electrical-equipment manufacturing, and in dental amalgams, batteries, and thermometers. The form and variety of mercury highly influences its level of toxicity.

The organic form of methylmercury bioconcentrates up the food chain, so that many species of larger fish carry worrisome levels, levels that are potentially dangerous to the unborn and to little children. National advisories are in place to limit the consumption of the fish species with the highest levels.

Health effects include developmental problems (effects during periods when organs are developing), gastrointestinal (digestive) problems, neurological

disorders, ocular difficulties (eyes), and renal/urinary problems (Agency for Toxic Substance & Disease Registry, 2011).

Mercury websites:

- Agency for Toxic Substances & Disease Registry: Toxic Substances Portal
- Agency for Toxic Substances & Disease Registry: ToxFAQs

NICKEL

Nickel is a very abundant metal and is found in many metal alloys, batteries, industrial compounds, metal-plating, and chemical reactions. It may be released into the environment from the chimney stacks of power plants and waste incinerators. The ATSDR states that,

> "Food is the major source of exposure to nickel. You may also be exposed to nickel by breathing air, drinking water, or smoking tobacco containing nickel. Skin contact with soil, bath or shower water, or metals containing nickel, as well as, metals plated with nickel can also result in exposure. Stainless steel and coins contain nickel. Some jewelry is plated with nickel or made from nickel alloys. Patients may be exposed to nickel in artificial body parts made from nickel-containing alloys. Exposure of an unborn child to nickel is through the transfer of nickel from the mother's blood to fetal blood. Likewise, nursing infants are exposed to nickel through the transfer of nickel from the mother to breast milk."

The most common health effect of nickel is an allergic reaction to the nickel-coating on jewelry (ATSDR, 2011).

Nickel websites:

- Agency for Toxic Substances & Disease Registry: Toxic Substances Portal
- Agency for Toxic Substances & Disease Registry: ToxFAQs
- NJ Dept. of Health: Right to Know Fact Sheet on Nickel
- U.S. EPA: Nickel Compounds

SILVER

Silver is a natural element most often found as a compound with sulfur, chlorine, and nitrogen. It is used in jewelry, dental amalgams, electronic equipment, pool sanitation, and is being used recently in nanoparticle-form as an antibacterial agent.

High levels of silver exposure in the air have been associated with breathing problems, lung and throat irritation, and stomach pains. Skin contact with silver can cause mild allergic reactions such as rash, swelling, and inflammation in some people. Chronic high level exposure can cause a blue-grey skin discoloration called arygria.

Silver web links:

- Agency for Toxic Substances & Disease Registry: ToxFAQS
- Agency for Toxic Substances & Disease Registry: Toxic Substances Portal

THALLIUM

In a review of public health and environmental concerns, Peter and Viraraghavan (2005) state that, "Thallium (Tl) is a rare but widely dispersed element. All forms of thallium are soluble enough to be toxic to living organisms. Thallium is more toxic to humans than mercury, cadmium, lead, copper or zinc and has been responsible for many accidental, occupational, deliberate, and therapeutic poisonings since its discovery in 1861".

Thallium is used in the manufacture of electronic devices and switches, special glasses, and in medical procedures to evaluate heart disease (ATSDR, 1992).

People can be exposed to thallium through food (the largest exposure), air, and water, cigarette smoke.

Thallium can cause neurological, respiratory, cardiac, liver, and kidney problems if large amounts are consumed for short periods of time. Vomiting and diarrhea, temporary hair loss can also occur, and death may result after exposure to large amounts of thallium for short periods of time.

Thallium web sites:

- Agency for Toxic Substances & Disease Registry: Public Health Statement
- Thallium: a review of public health and environmental concerns

VANADIUM

Vanadium is a metal that everyone is exposed to, mostly from food, but also from air and water. High levels of exposure tend to occur within occupational settings. It has been found that vanadium compounds may damage the male reproductive tract in animal studies.

Vanadium has been found to irritate the lungs, causing asthma-like symptoms and bronchitis, anemia, and also kidney damage (ATSDR, 2012).

Vanadium web sites:

- New Jersey Department of Health and Senior Services: Hazardous Substance Fact Sheet
- Agency for Toxic Substances & Disease Registry: ToxFAQs

ZINC

Zinc is one of the most common elements on earth and is found in air, water, and virtually all foods. It is essential to our health, but either too little or too much can be problematic. It has many commercial uses in batteries, metal coatings to prevent rust, and in the production of metal alloys. It is used to make paint, rubber, dyes, wood preservatives, and ointments.

Too high levels can cause stomach cramps, nausea and vomiting, or a short-term condition called metal fume fever, which causes flu-like symptoms such as fever, chills, nausea, fatigue, joint pains and muscle aches, shortness of breath, cough and chest pains (Malaguernera, et al., 2013).

Zinc web sites:

- Agency for Toxic Substances & Disease Registry: Toxic Substances Portal
- Agency for Toxic Substances & Disease Registry: ToxFAQs

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ENVIRONMENTAL PUBLIC HEALTH TRACKING

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In 2000, the Pew Environmental Health Commission was charged with developing a blueprint to rebuild the nation's public health defenses against environmental threats. At the time a survey to registered voters found that the majority (87%) were seriously concerned about risks to their health from pollutants in the environment. Most said that taking a national approach to tracking environmental health should be a priority of government at all levels (America's Environmental Health Gap: Why the Country Needs a Nationwide Health Tracking Network, Pew Environmental Health Commission 2000). In response, the Centers for Disease Control and Prevention (CDC) developed a national tracking program to integrate existing health and environmental information systems and build state-based tracking networks.

The Environmental Public Health Tracking (EPHT) network or "Tracking" is the ongoing collection, integration, analysis and interpretation of data about environmental hazards, exposure to environmental hazards, and human health effects potentially related to exposure to environmental hazards. The overall mission of EPHT is to improve the health of communities. With enhanced surveillance, data is more readily available to determine prevalence and trends of certain diseases associated with environmental exposure.

Unlike research, the EPHT program tracks certain acute and chronic diseases suspected of having an environmental connection with key environmental data (i.e., asthma and air pollution). While associations between environmental exposures and health effects have been documented, much more research is this area is needed.

The tracking network is designed to assist health professionals in exploring trends in their communities and to generate hypotheses for future study. Using the network, nurses can view maps, tables and charts with data about chemicals found in the environment, along with chronic diseases. Nurses can view this by areas of geographic interest. With EPHT, nurses have access to quality, nationally consistent data measures, in order to conduct community assessments, plan environmental health investigations, including health impact assessments (HIAs), and respond to questions from patients and peers.

The National EPHT network allows health care providers to explore health and environmental data in one easy to find location. For example, users can examine possible health risks from contaminants such as air pollution and explore the relationship to myocardial infarction within specific geographic regions of a state. Or nurses can observe the amount of lead in drinking water and the relationship to premature births at the county level.

Currently 25 states and the city of New York participate in the EPHT program. Readily available health data from the tracking network allows national, state and local health officials to respond and develop effective public health actions to prevent or control certain diseases that may have environmental etiologies. In addition, the public is provided with a better understanding of what is occurring in their communities and what actions they may take to protect or improve their health (*EPHT Program: Closing America's Environmental Public Health Gap* 2004, CDC). For further information and to view the current EPHT states, visit the CDC National EPHT website.

INTRODUCTION TO RISK ASSESSMENT IN ENVIRONMENTAL HEALTH

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WHAT IS RISK?

The Environmental Protection Agency defines risk as "the chance of harmful effects to human health or to ecological systems resulting from exposure to an environmental stressor" (EPA, 2012a).

The EPA defines a stressor as "any physical, chemical, or biological entity that can induce an adverse response. Stressors may adversely affect specific natural resources or entire ecosystems, including plants and animals, as well as the environment with which they interact" (EPA, 2012a).

It is important to keep in mind that risk can be actual (based on empirical data) or perceived (based on cultural and/or personal beliefs). For a noteworthy view on the difference between the two read Perceived vs. Actual Risk (Schneier, 2006).

Remember, risk is also a matter of perception. For example, every time you work with paper, you are at risk of getting a paper cut. One could say that the risk of a paper cut has minimal perceived risks to human health and therefore people continue to work with this material without warning labels.

Changing perception is a matter of gathering relevant and accurate data and balancing this against beliefs and values.

If the negative outcomes of a paper cut were perceived as significant, one could demand that all reams of paper include a warning label informing the end user of the impending dangers. Sound a little extreme? That's because we don't perceive paper cuts as a major threat to human health. On the other hand, warning labels are found on cigarette packages, medication bottles, household cleaning agents, plastic bags and thousands of other products that are perceived and proven to negatively impact health.

WHY IS RISK ASSESSMENT IMPORTANT TO NURSES?

Nurses perform risk assessments on a daily basis. For example, an acute care nurse must assess a patient's risk of developing pressure ulcers in the hospital. Alternatively, a discharge coordinator will assess a client's risk of falls based on their home environment. In doing so, nurses seek to reduce and prevent harmful effects to human health, including disease, disability, and premature death. One way of achieving this is to limit human exposure to environmental stressors and promote healthy, sustainable environments. Nurses need to know how to identify environmental hazards and assess human risk related to these hazards. Thus, risk assessments can be done for individuals, families, communities or larger cohorts.

HOW DOES ONE ASSESS A RISK?

The first step in risk assessment is to define a problem. What is the problem, how big is it, how does it impact humans or the environment and which stakeholders are salient enough to help solve the problem? The methodology used in this section combines two excellent risk assessment frameworks:

1. Health Canada's Decision-Making Framework for Identifying, Assessing and Managing Health Risks (Health Canada, 2000)
2. EPA's Human Health Risk Assessment (EPA, 2012b).

Problem solvers beware! New risk managers make the mistake of skipping over risk assessment and jumping straight to a solution. Do not make this mistake. The assessment process is what tells you whether or not you even have a risk.

Step One: Identify and Characterize a Problem

For all things risk related, identifying a problem is the starting point. A problem could be a hunch, an observation, or the product of existing information. Below is a list of questions to ask in order to fully understand the problem.

Who is impacted by the problem?

Whenever possible provide a quantitative value.

- Individual/ group
- General population
- Life stages such as children, teenagers, pregnant/ nursing women
- Population subgroups - highly susceptible (for example, due to asthma, genetics, etc.) and/or highly exposed (for example, based on geographic area, gender, racial or ethnic group, or economic status) (EPA, 2012b).

Example: "75% of South Asian men and women aged 45 and up, living in Surrey, have diabetes."

What type of problem/hazard is in question?

- Chemicals (single or multiple/cumulative risk)
- Radiation
- Physical (dust, heat)

- Microbiological or biological
- Nutritional (for example, diet, fitness, or metabolic state)
- Socio-Economic (for example, access to health care) (EPA, 2012b).

Example: "Children aged 0-10 are experiencing increased heat exhaustion due to the recent record breaking temperatures."

How is the problem reaching humans?

- Point sources (for example, smoke or water discharge from a factory; contamination from a Superfund site)
- Non-point sources (for example, automobile exhaust; agricultural runoff)
- Natural sources (EPA, 2012b).

Example: "There is an increase in reports of asthma attacks downwind of the power plant."

How does this problem enter the human body?

- Pathways (recognizing that one or more may be involved)
    - Air
    - Surface Water
    - Groundwater
    - Soil
    - Solid Waste
    - Food
    - Non-food consumer products, pharmaceuticals
- Routes (and related human activities that lead to exposure)
    - Ingestion (both food and water)
    - Contact with skin
    - Inhalation
    - Non-dietary ingestion (for example, "hand-to-mouth" behavior)

Example: "Residents of the Kingston neighborhood are complaining of a change in the taste of their water and an increase in unusual skin rashes."

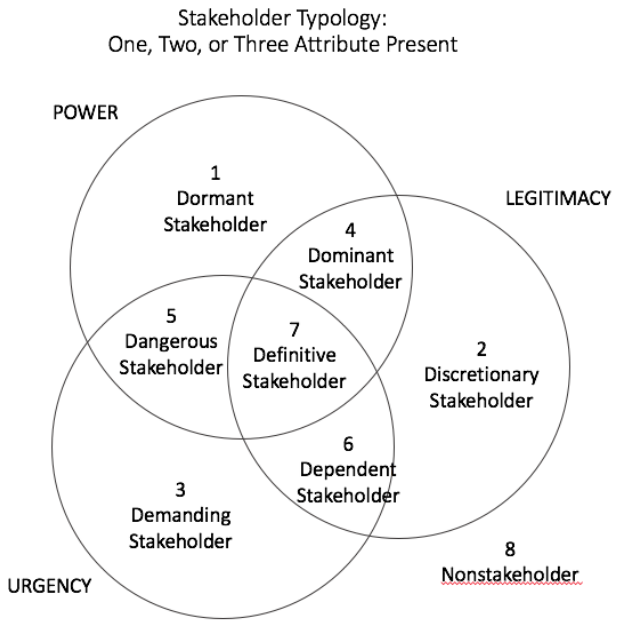
Lastly, it is important to define whether the problem is acute or chronic; what the severity of the adverse effects are; what time frame the problem occurs in; and if the risk is only to humans or to other species as well (EPA, 2012c).

Health Canada (2000) suggests drawing from one or more of the following sources to characterize a risk:

- Toxicology studies (e.g. on laboratory animals, cultured cells, or tissues);
- Epidemiology studies (e.g. of occupationally exposed workers);
- Environmental monitoring (e.g. levels of chemical contaminants in air);
- Biological monitoring (e.g. lead levels in blood);
- Product surveillance (e.g. adverse reactions to specific therapeutic products);
- Disease surveillance (e.g. distribution of cases of a disease over time);
- Investigations of disease outbreaks;
- Targeted risk assessment programs;
- Targeted public health research;
- Information supplied by industry as required by legislation;
- Lack of compliance with legislative requirements;
- Consultation with experts (e.g. advisory committees);
- Literature review;
- Monitoring of the news media;
- Communications from interested and affected parties (e.g. health care professionals, consumers, industry);
- Focus groups
- Examination of public perceptions and concerns.

Step Two: Identify and Characterize the Salient Stakeholders

In this step, identify and characterize the key stakeholders. You will discover that certain stakeholders exhibit power, urgency and/or legitimacy or a combination thereof. Mitchel et al. (1997) categorized stakeholders using these three main attributes as depicted in the Venn diagram below (Figure 1). For more information on how to characterize stakeholders read Mitchel et al. (1997).



Step Three: Formulate a Problem Statement

If the nurse has done a good job collecting the data above, then this step will be easy. Take your "hunch" from step one and make it more specific.

For example, the problem, "Sudden Infant Death Syndrome occurs more often in babies than before" can be transformed to a thorough problem statement.

Problem Statement: (data is fictitious) "Sudden Infant Death Syndrome (SIDS) impacts 1 in 10 infants aged 0-5 months old in North America. This number is equitably distributed across socioeconomic status, ethnicity and geographic regions. Sleeping position is a strong precursor of SIDS; infants sleeping prone (face down) have a 30% increased risk of SIDS as compared to infants that sleep face up."

Resources about Risk Assessment

- EPA Risk Assessment
- Healthy People 2020. Environmental Health
- National Research Defense Council. (2012). Strengthening Toxic Chemical Risk Assessments to Protect Human Health
- World Health Organization. Children's Environmental Health: Environmental Risks

CONCLUSION

This section presented the steps of identifying a problem and gathering pertinent information to assess whether or not a problem poses a health risk. In addition to assessing actual risks it is important to identify the perceived risks through your most salient stakeholders. Selected resources about risk assessment are provided. Finally, this is an iterative process which allows one to truly assess, is this problem really putting the target population at risk?

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Unit IV:
Practice Settings

INTRODUCTION

As of 2014, 2.8 million Registered Nurses were actively working in the United States, with 61% employed in hospitals (Bureau of Labor Statistics, 2015). Many work in other clinical settings, such as community health, clinics or public health departments. Whether nurses practice in clinical care specialties, education, research, or advocacy, all nurses are to practice in an environmentally safe and healthy manner.

Our professional *Scope and Standards of Practice* (ANA, 2015) outlines what nurses are obligated to address. Standard 17 states that "The registered nurse practices in an environmentally safe and healthy manner" (p. 84). This particular professional obligation reminds us that as nurses we need to address both upstream and downstream impacts when considering environmentally safe and healthy practice. First, we want to look upstream to address environmental determinants of health or illness, in our assessment, care planning, education and evaluation. Second, we want to decrease downstream environmental impacts of our own practice--the pollution we add to the world because of our professional choices. No matter where we practice--hospitals, clinics, universities, agencies, or communities--we can choose processes, practices and products that are less environmentally harmful. And nurses everywhere need to be alert to our occupational hazards.

Unit IV introduces nurse exposures to hazardous materials in hospital practice settings, pharmaceutical waste disposal, and "green teams" that address environmental health and sustainability in hospitals. Last, is a list of who's in charge of various aspects of the hospital environment.

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NURSE EXPOSURE IN WORK

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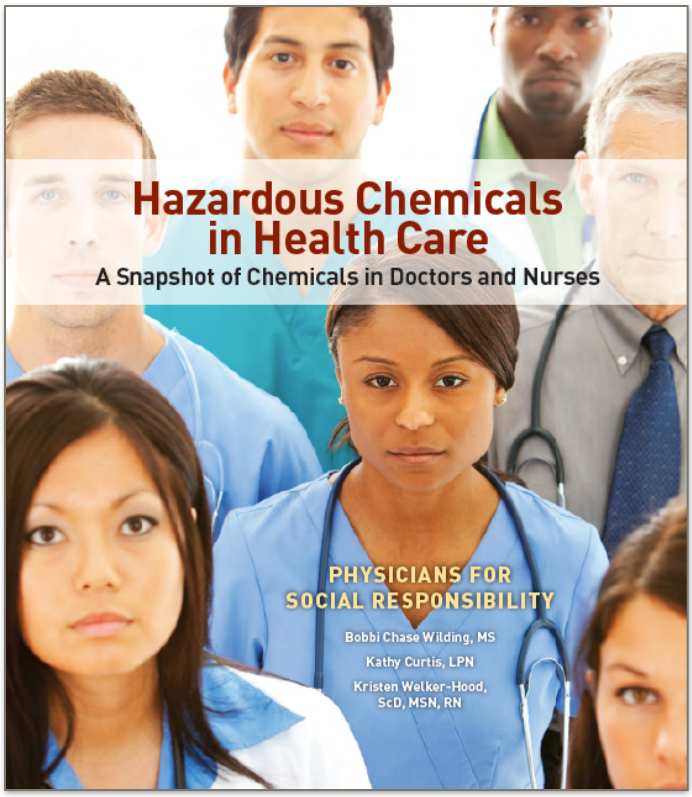
Over 60% of nurses in the US work in a hospital setting. While our mission in hospitals is to provide healing environments, the methods of healing often result in chemical, biological, and radiological exposures to the patients and hospital employees. This section will review some of the potential exposures that nurses experience and ways in which nurses are engaging in environmental health changes that are not just decreasing exposures but actually promoting health.

In the past few years, there have been a couple of studies that have helped us to understand the importance of addressing our own workplace environments.

The Nurses' Exposure Study showed us that there are a number of increased risks for disease (asthma, infertility, cancer, and others) that may be associated with chemical and radiological exposures in hospitals.



The Nurse and Physician Body Burden Studies found measurable amounts of toxic chemicals that are commonly found in hospitals, in the blood and urine of doctors and nurses.

In a 2011 study, using the National Health Study II, Lawson et al found an increased risk of miscarriage in nurses who were exposed to chemotherapeutic agents, sterilants, or X-Rays. Read the abstract here.

These studies help us to understand that the chemicals and processes that we use in health care create clear and present risks to our health.

WORKING THE GREEN SHIFT

Occupational and environmental health has not received much attention in nursing curriculum and therefore nurses have lacked the skills to both assess occupational/environmental risks and to reduce or eliminate them. In the last decade or more, some nurses from around the country have begun to look at their hospitals through a new occupational and environmental lens. They have seen unnecessary exposures to toxic cleaning products, batteries that are being tossed in the trash, and product-selection based on lowest cost with little attention paid to potentially harmful exposures to patients and employees. They noted that hospital waste was not segregated, not recycled (nor composted) – practices that they did at home. And they started to question these old practices and bring new and sustainable practices to their hospitals – occupationally and environmentally healthy practices.

This section of the text will guide the reader through a range of issues associated with environmental health and sustainability in health care. It will also help the reader to understand how positive changes are being made – how Green Teams are being created, new collaborators are being found in Housekeeping and Dietary Services, and how changes in purchasing decisions can have a huge impact on health.

(Note: it will not cover needle stick injuries, lifting policies, workplace violence, nor bloodborne pathogen exposures – all of which are critical occupational health issues in nursing. For more information on these issues, we refer you to the American Nurses Association's Center for Occupational and Environmental Health site).

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HAZARDOUS EXPOSURES IN HEALTHCARE

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While hospitals and other healthcare facilities are meant to be places of healing, many of the chemicals and products used in healthcare can have negative impacts on the health of patients, visitors, nurses, and staff.

MERCURY

Most hospitals have replaced their mercury thermometers with digital, mercury-free ones. This process occurred because nurses and others discovered the dangers posed by mercury. A conscious effort was made to substitute and healthier choice for one that posed a hazard. Mercury-containing products are particularly problematic if they are incinerated. When the mercury that is released into the air from incinerator emissions lands on bodies of water a set of processes occur that result in mercury-contaminated fish. Below is an illustration of the "fate and transport" of mercury (Figure 1).

Mercury is a powerful neurotoxicant, linked to health effects in humans and animals. Long-term exposure to mercury can cause effects which develop gradually. It may cause shaking of the hands, eyelids, lips, tongue, or jaw. It may cause headaches, trouble sleeping, personality change, memory loss, irritability, indecisiveness and loss of intelligence. It can also cause skin rash, sores in the mouth, or sore and swollen gums. Many of these symptoms go away when the exposure to mercury stops. Mercury is excreted in urine.

KEY RESOURCES

- EWG's Fish List page on website of Environmental Working Group lists mercury levels in fish and other seafood
- Global Movement for Mercury-Free Health Care Report (pdf)
- Making Medicine Mercury Free (pdf)
- The Mercury Problem: Fast Facts (pdf)
- Mercury-Free Health Care website, a WHO-HCWH Global Initiative
- Mercury Policy Project website
- Mercury Thermometers and Your Family's Health (pdf)
- Toward the Tipping Point (pdf) WHO-HCWH Global Initiative to Substitute Mercury-Based Medical Devices in Health Care and Two-Year Progress Report

MERCURY ON THE MOVE: RISKS TO YOU AND YOUR FAMILY

A poster explaining the methylmercury exposure pathway, which answers the question: How does mercury travel from the health care setting to the dinner plate? Please download, print, and distribute this poster. Download: Mercury Poster

Tabletop Display

Using the mercury pathway poster and materials found here, you can design your own freestanding educational display that can be used to educate audiences on the hazards associated with mercury. The components of the display include the mercury pathway poster as a focal point and a selection of supporting materials to choose from. Download: Mercury Display

PLASTICS

We use a lot of plastics in health care – IV tubing and bags, respiratory therapy tubing, dialysis tubes, etc. There are two major problems with plastics. First, is the problem with polyvinyl chloride which is the component chemical in polyvinyl chloride (PVC) plastics. This particular plastic is toxic during its manufacture when both workers and the environment can be exposed to dioxins (a family of highly toxic chemicals) whose unintentional exposures are the consequence of PVC manufacture. Dioxin contamination also results when PVC products are incinerated, either in medical waste incinerators or municipal incinerators. It's important for nurses to know how and where the waste from their hospital is disposed. When PVC waste products are sent to landfills, there is no real concern regarding exposures. However, if PVC waste is sent to an incinerator, very unhealthy air contaminants can result. Dioxins are some of the most carcinogenic chemicals known.

Hard plastics are made more malleable (for use in IV bags, tubes and so on) by the addition of phthalates. Phthalates are a group of chemicals that come with a range of health effects, including endocrine disruption. The particular phthalate that is commonly found in hospital equipment is Diethylhexyl Phthalate (DEHP). Studies indicate that there is a risk of testicular problems in baby boys who are exposed to DEHP and it is further recommended that DEHP-free tubing be used in neonatal intensive care units.

Some hospitals have made the shift to DEHP-free NICUs and others are even DEHP-free throughout the hospitals. DEHP-free products are now readily available and price competitive.

Health Care Without Harm has created a set of resources on Plastics and DEHP.

KEY RESOURCES

- Alternatives to PVC and DEHP
- Aggregate Exposures to Phthalates in Humans: HCWH 2002 Report (pdf)
- DEHP Exposures During the Medical Care of Infants (pdf)
- Find out more about PVC-Free Building Materials (pdf)
- Neonatal Exposure to DEHP and Opportunities for Prevention (pdf)
- Weight of the Evidence on DEHP (pdf)
- Why Health Care is Moving Away from PVC (pdf)

GREEN CLEANING IN HOSPITALS

Hospitals have to have high standards for cleaning and disinfecting. However, they can select products that are both effective AND green, as a way of decreasing exposures to patients, staff and visitors. Green cleaning refers to using cleaning products that do not contain toxic chemicals (including fragrances), some of which are associated with respiratory and other health problems. Some hospitals are also addressing the paper and equipment used in cleaning processes, requiring paper products used for cleaning to contain recycled material and requiring the use of microfiber mops, which decrease water consumption.

In other hospitals, green cleaning policies have gone so far as to include specifications for cleaning versus disinfecting. It is important to understand the difference between cleaning and disinfecting. Disinfectants pose the highest risk, as they are formulated to kill bacteria. New, safer disinfectants are coming to market in the United States that are hydrogen peroxide based. Because these disinfectants break down into hydrogen and water, there is essentially no risk of adverse health effects. Some of the hydrogen peroxide based cleaners also boast a shorter contact time that contributes to better infection prevention (Perez et al 2005).

When disinfectants or sterilants are warranted, such as cleaning a NICU warmer or incubator in-between patients, or cleaning equipment in the cath lab operating room, it is critical for nurses and others to know how to protect themselves when using the products. Reading the safety data sheet (formerly MSDS), the chemical information sheet associated with the product, can be

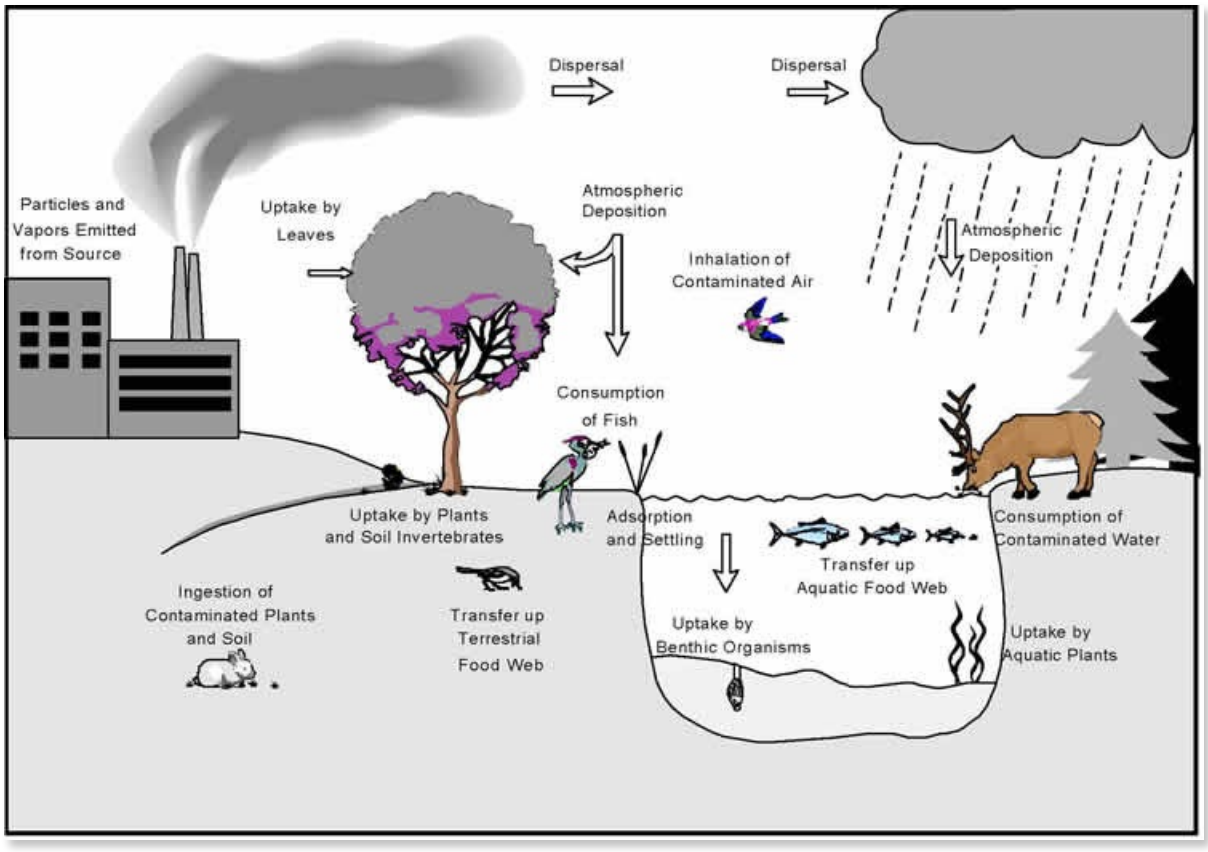

Figure 1: https://www.epa.gov/fera/multimedia-fate-and-transport-modeling-general

helpful but sometimes it is too vague. The statement "wear gloves" or "use respiratory protection when using this product" is not sufficient guidance. If that is all that is suggested on the safety data sheet, then the manufacturer needs to be called and queried about the precise type glove and/or respirator (mask).

Some manufacturers provide substantial guidance and it is then incumbent on nurses and others to make sure they are following the manufacturer's recommendations. For example, on a safety data sheet for gluteraldehyde, the manufacture has this to say about skin protection:

"To protect hands and forearm wear gloves of appropriate type and length. MICRO TOUCH latex gloves are acceptable, if changed frequently (i.e. every 5 – 10 minutes) and/or double gloved. Before using other latex gloves contact the manufacturer for permeation information to determine if their gloves are suitable for use with gluteraldehyde solutions. Nitrile rubber, butyl rubber, and similar synthetic rubber gloves (i.e., ALLERGARD Synthetic Surgical Gloves, are acceptable glove materials. Do not use neoprene rubber, or polyvinyl chloride (vinyl) gloves, as gluteraldehyde may rapidly absorb by these materials."

If sterilants and disinfectants are potentially hazardous to adults then we can assume that the very susceptible neonate will be considerably more responsive. For neonates that are not on independent respiratory support it is important to consider their potential exposures to cleaning chemicals, antimicrobial soaps, and disinfectants. Many hospitals use flooring materials that require extensive maintenance by stripping, waxing, etc and many of these products have been linked to respiratory problems (Rosenman et al 2003, Medina-Ramon et al 2005). In addition to looking for safer cleaning chemicals, it is important to also consider changing the surfaces to make them easier to clean. For example, the University of Maryland Medical Center is transitioning to rubber flooring, which does not require the use of wax, and hence, floor strippers. The companies producing these no-wax products are boasting less slips, trips and falls because the floor is less slippery.

Many health care facilities are adopting "fragrance free" policies and these policies can extend to cleaning products. Educating housekeeping staff and others in the hospital about the true smell of clean – which is NO smell – will help them to rethink the need for pine or lemon-smelling products. Real pine and/or lemons are rarely part of the fragrances' ingredients.

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PHARMACEUTICAL WASTE

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Nursing practice is closely connected to the use of pharmaceuticals, both in inpatient and community settings. Many nurses recall when the common practice was to flush out-of-date or unused medications down the toilet to prevent accidental poisonings or misuse. Due to studies that show the presence of pharmaceuticals in drinking water, there has been increased regulatory oversight and scrutiny of medication disposal. Pharmaceutical waste has serious implications for the environment. Additionally, there are operational and financial concerns posed by regulatory agencies. Such federal agencies include the Department of Justice Drug Enforcement Administration (DEA), Environmental Protection Agency (EPA), Centers for Medicare and Medicaid Services (CMS), and U.S. Food and Drug Administration (FDA) (Knutsen, 2013).

PHARMACEUTICAL CONTAMINATION OF THE ENVIRONMENT

The work of the United States Geological Survey (USGS) indicates categories and amounts of pharmaceuticals that find their way to waterways. A USGS study in 2002 found that "one or more chemicals were detected in 80 percent of the streams sampled, and 82 of the 95 chemicals [tested for] were detected at least once. Generally, these chemicals were found at very low concentrations (in most cases, less than 1 part per billion). Mixtures of the chemicals were common; 75 percent of the streams had more than one, 50 percent had 7 or more, and 34 percent had 10 or more" (USGS, 2002). Since that time, the USGS has conducted more studies to better understand the scope and degree to which pharmaceuticals are present in water. Their work on Emerging Contaminants in Environment provides evidence of this growing concern for health. Further, soil can be contaminated with pharmaceuticals through the use of reclaimed water. The USGS studies of pharmaceuticals in soil indicate how ubiquitous pharmaceutical waste is in the environment.

Pharmaceuticals enter the environment in several ways. First, human consumption of medications leads to excretion of chemicals into sewage that can release into aquifers or surface water. While this is unintentional contamination, there is also the purposeful flushing of unused or expired medications. Contamination also occurs as part of pharmaceutical manufacture and waste disposal. There is also the excretion of pharmaceuticals by animal sources, due to use of medications (generally steroids and antibiotics) in livestock production (Becker, Mendez-Quigley & Phillips, 2010).

Due to the aging of the population and increase in prescription medication use, there is an increase in the likelihood of pharmaceutical waste in the environment. It is estimated that hospitals and long term care facilities contribute up to 65% of the unused pharmaceuticals into wastewater facilities (Becker, Mendez-Quigley & Phillips, 2010). The article Managing Pharmaceutical Waste: What Pharmacists Should Know is very helpful to understand the following: what pharmaceutical waste is, who is generating it, common waste streams, characterization of hazardous waste streams, and how it should be managed.

SAFE MEDICATION DISPOSAL EFFORTS

Some efforts to safely dispose of medications are proactive and work at the source of pharmaceutical use. Two organizations, Practice Greenhealth and the American Nurses Association (ANA), promote safe medication disposal efforts.

Practice Greenhealth is an organization for the health care community dedicated to environmental stewardship, and sustainable and eco-friendly practices. Through their work and outreach to health care institutions, they provide guidance and educational resources for pharmaceutical waste management.

The ANA promotes the safe disposal of pharmaceuticals and offers guidance on the Nursing World website. ANA adopted a policy to describe nurses' role in pharmaceutical waste generation and disposal (Stanton, 2011). The types of medications found in waterways include medical waste, hazardous waste, and controlled substances. Among these are antibacterials, antibiotics, endocrine disruptors, plasticizers, steroids and other metabolites. Nurses are leaders in this effort in many locations. Nurses must address pharmaceutical waste in their practice because they administer and dispose of medications. Also, nurses must educate and supervise others in the proper use and disposal in the community. Nurses can serve an advocacy role in policy formation for the development, production and distribution of medications as well as health care polices for safe disposal. In addition, nurses can work with organizations such as Health Care without Harm to address this problem.

The Association of periOperative Registered Nurses (AORN) has demonstrated leadership in the area and published useful information in the AORN journal. For example, the Summary of Recommended Pharmaceutical Waste Streams identifies the variety of proper disposal strategies (Stanton, 2011).

Many hospitals and health care agencies promote Take Back Programs that are sponsored by the DEA. These programs are designed for members of the public to dispose of unwanted, unused, or outdated medications. The programs are not for use by businesses or health care facilities.

Nurses work across in-patient and community practice settings where medications are stored, monitored, distributed and disposed of. Universal management guidelines are not available however in some areas health care professionals are working to provide proper guidance. Such settings include home care, school health (Taras, Haste, Berry, Tran & Singh, 2014) and long term care.

RESOURCES REGARDING PHARMACEUTICAL WASTE DISPOSAL

The concern for pharmaceutical waste management is not a new issue. In 1976, the federal Resource and Recovery Act (RCRA) was enacted to protect human health and the environment from the potential hazards of waste disposal. However, pharmaceuticals were not included until about 2004. Since that time enforcement efforts have become stricter and efforts to achieve compliance have strengthened. The act is administered by the EPA.

Both the EPA and Food and Drug Administration (FDA) provide guidance for medication disposal. The following resources offer information for home and hospital use of medications.

- EPA: Collecting and Disposing of Unwanted Medicines
- FDA: Disposal of unused medications: What you should know
- Medication Disposal: Questions and Answers
- FDA: Safe Disposal of Medications
- FDA: Information about those medications to flush if absolutely necessary
- DEA: Controlled Substances
- Hospitals for a Healthy Environment (H2E): Managing Pharmaceutical Waste: A 10-step Blueprint for HealthCare Facilities in the U.S. (2006)

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GREEN TEAMS

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There are a number of names that have been given the committees/groups that have been convened at hospitals to address environmental health and sustainability. One of the most common names is the Green Team. These teams are convened by nurses, administrators, and others. Their make-up can vary, but the most successful ones have representatives from the departments noted below. They can help to raise concerns, do assessments and audits, compare alternative solutions, make recommendations, and help to implement changes.

Watch Denise Choiniere, who was the first Sustainability Manager at the University of Maryland Medical Center, describe how nurses are working on "greening" their hospitals. A great introduction to incorporating environmental health into nursing practice.

Here's the website for the University of Maryland Medical Center's Green Team

It's just one example of many, many green team programs. If you google "hospital green teams", you'll see lots of other examples. (Note, the medical center is conveniently located on Greene Street.)

WHO'S IN CHARGE IN HOSPITALS?

Really, everyone has a part, but there are several offices/departments/individuals/committees that can be particularly important:

- Environmental Services / Housekeeping / Maintenance – often where the decisions are made about the cleaning processes and products
- Purchasing Department or Committee – make important product selection decisions
- Architects/Planners – often take the lead when rehab, expansions, and new hospital buildings are being planned and developed
- Infection Control – should be consulted when making decisions are being made about cleaners/sterilants/disinfection products
- Occupational Health and Safety – can help provide additional support for decisions
- Food Services – can be instrumental in helping to bring local, sustainably-grown foods to the hospital and when planning/implementing a Farmers' Market
- Public Relations – important to keep in the loop
- Nursing and Professional Development – a good place to help to bring speakers into the hospital to talk about environmental health and sustainability related to health care. Nursing "grand rounds", lunch-time talks, and other venues can provide great opportunities to have compelling speakers.
- GREEN TEAMS – critical organizational structures in which sustainability and environmental health can be discussed and addressed.

Some hospitals have made institutional commitments to environmental health and sustainability, even including it in their core values statement.

Unit V:
Sustainable Communities

WHAT ARE SUSTAINABLE COMMUNITIES?

The term "sustainable communities" refers to a goal to ensure survivable communities globally. Sustainable communities use resources to meet current needs while considering the needs of future generations. Elements of sustainability include safe and healthy housing, transportation that reduces harmful exposures to the environment and provides opportunities for all citizens to engage in community life, access to healthy and affordable foods, smart growth, and social and economic opportunities all supported by involved community members.

For more than 25 years, civic groups, local communities and non-governmental organizations have worked to advance sustainable living. The Institute for Sustainable Communities has partners in the United States, China, Vietnam, Thailand, Bangladesh and India. There are videos online that show the work of sustainable cities, towns and neighborhoods.

Since 2009, the US Federal Government has a program entitled the Partnership for Sustainable Communities that is comprised of three federal agencies: the U.S. Department of Housing and Urban Development (HUD), U.S. Department of Transportation (DOT), and the U.S. Environmental Protection Agency (EPA). The goal of the partnership is to protect the environment while improving access to affordable housing, increasing transportation options and lowering transportation costs. According to their website, the "Partnership for Sustainable Communities (PSC) works to coordinate federal housing, transportation, water, and other infrastructure investments to make neighborhoods more prosperous, allow people to live closer to jobs, save households time and money, and reduce pollution. The partnership agencies incorporate six principles of livability into federal funding programs, policies, and future legislative proposals" (PSC, 2016).

Successful projects sponsored by the partnership include Bridgeport, CT, Greenville, SC and Milwaukee, WI. In addition, other examples of communities that have developed programs for sustainable communities include those supported by the Making a Visible Difference in Communities program of the EPA, as well as Smart Growth initiatives.

INTRODUCTION

Unit V offers a variety of topics that relate to healthy and sustainable communities. The beginning chapter introduces the National Library of Medicine's ToxTown resource. This is an interactive and engaging resource for children and adults to learn about environmental health impacts in communities. Learning about communities such as cities, towns, farms and ports prepares nurses to understand concepts that relate to healthy and sustainable communities. Unit 5 next includes a discussion about Green Buildings, which is a topic that many nurses are likely to know about as a result of the current efforts to build environmentally responsible workplaces. The Green Cleaning in Homes chapter provides information and resources to inform nurses about healthier choices for cleaning products. Unit 5 also addresses transportation concerns, Brownfields in communities, and antibiotic use in agriculture. These topics impact the health and well being of community residents. The chapter, Environmental Justice, builds upon the issue of health disparities related to the social determinants of health. While communities work to foster social and economic health and well-being, hazardous exposures impact community citizens differently. This chapter addresses both the development of the environmental justice movement, the federal and state mandates developed in response to this movement and efforts by community members to address injustice and work toward healthy sustainable communities.

INTRODUCTION TO TOX TOWN

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Tox Town is an interactive teaching tool from the National Library of Medicine. The information presented in Tox Town was created to teach middle school students about the health impacts of the environments in which we live, work, and play. These lessons and activities may be useful to faculty and nursing students who are new to environmental health. The Tox Town program offers six separate communities to learn about the chemical risks to human health that are relevant to the specific community that is being assessed. The communities or neighborhoods are:

1. Town
2. City
3. US Border Region
4. Farm
5. Port
6. US Southwest.

Tox Town City

Within each community the learner can click on a variety of natural (streams, ocean, air) and built environments to discover environmental risks related to the area. Additionally, within Tox Town there are links to the Centers for Disease Control (CDC), Environmental Protection Agency (EPA), and Toxicology Data Network (TOXNET) to learn more information about specific environmental toxicants, including toxicological information and methods to reduce risk.

Although Tox Town was created for middle school students, many of the concepts covered in the program are new to most nursing students. Furthermore, the program provides the foundation for a nursing student to visualize assessing a community from an environmental perspective. Environmental health in nursing can be further developed by examining the evidence based literature and other scientifically-based web sites, and using faculty developed case studies. Tox Town is also offered in Spanish. This could be valuable for nurses when teaching members of a Spanish-speaking community about environmental risk and prevention. Go ahead check out Tox Town for yourself.

Tox Town Farm

GREEN BUILDINGS

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Florence Nightingale identified the environment as a primary area of concern for professional nursing. Nursing's focus on the environment encompasses many levels. Levels range from the immediate patient environment and the in utero environment of the newborn to the local community environment where people live and ultimately the global environment.

WHAT IS THE BUILT ENVIRONMENT?

At the community and global levels, professional nursing has evolved to focus on assessment and interventions that address both the natural environment and the built environment. This focus includes advocating for changes to enhance the built environment (DeGuzman & Kulbok, 2012). The U.S. Environmental Protection Agency (U.S. EPA) defines the built environment as including patterns of land use, transport infrastructure, building orientation and design, and the natural environment. The natural environment includes ecosystems, endangered species, habitats, and water quality (U.S. EPA, 2001).

WHAT ARE GREEN BUILDINGS?

Green buildings have been defined as those structures that are created, maintained, and deconstructed using environmentally responsible and resource-efficient processes (U.S. EPA, 2014). Green buildings are intended to minimize the impact of the built environment on human health and on the natural environment by incorporating specific design features and processes that

- enhance energy and resource efficiency,
- protect human health,
- improve human productivity, and
- reduce waste, pollution, and degradation of the environment (U.S. EPA, 2014).

Building green in the U.S. grew largely out of two movements that emerged in the 1960s and 1970s, namely 1) the environmental movement and 2) the increasing focus on energy efficiency and sustainability following the oil shortage crisis of the 1970s (U.S. EPA, 2014). One year after the first local green building program was introduced in 1992 in Austin, Texas, the U.S. Green Building Council (USGBC) was founded (US EPA, 2014). The vision of the USGBC is to promote healthy, efficient, and equitable buildings and communities for all (USGBC, 2012-2015a). As of February 2015, the USGBC directory listed 73 local chapters across 37 states, as well as a chapter in Washington DC and one in Puerto Rico (USGBC, 2012-2015b). The USGBC administers a green building certification program titled Leadership in Energy & Environmental Design (LEED). Building projects can receive LEED certification at a specific level based on meeting specific prerequisites and points for the desired certification level. The USGBC implemented the first LEED pilot program (version 1.0) in 1998; as of February 2015, Version 4.0 of LEED was in place (USGBC, 2012-2015c).

The World Green Building Council [WGBC] (n.d.a) identifies various features of green building design and processes that span the sequential phases of

- planning (e.g., location, design),
- construction (e.g., materials, methods), and
- functioning(e.g., access, transportation/commuting, maintenance, operating procedures and policies).

More specifically, indoor environmental factors are addressed. Factors include indoor air quality, energy and resource use, temperature, lighting, noise, functionality of layout, and 'active" design features that include opportunities for exercise as well as exercise services such as gym facilities (WGBC, n.d.a).

HOW IS THE GREEN BUILDING MOVEMENT BEING EVALUATED?

The green building movement has begun to focus increasingly on documenting the effectiveness of green buildings in meeting their intended purposes of protecting and promoting human health and the natural environment. The WGBC's 2013 report identified a framework to measure the effectiveness of green office buildings by examining:

- financial outcomes (e.g., worker absenteeism, turnover, medical costs)
- workers' perception of outcomes (self report of health and wellbeing, productivity)
- physical outcomes (e.g., temperature, ventilation, humidity, lighting, noise, pollution).

The WGBC's (n.d.b) 2013 report The Business Case for Green Building discusses reports of cost savings and other positive outcomes from green buildings. Different outcomes have been identified to evaluate the effectiveness of green buildings constructed for different purposes, e.g., green schools and green hospitals. The

state of Ohio required that all publicly-funded construction of kindergarten through 12th grade schools be LEED certified at the level of Silver or better; Ohio has the greatest number of green schools in the U.S. (130 as of 2015). The Battelle Memorial Institute was hired by the Central Ohio Chapter of the USGBC to study whether LEED-certified K-12 schools in Ohio make a difference in educational outcomes such as test scores, attendance, and discipline (Battelle Memorial Institute, 2014 April.)

NURSING AND ADVOCACY FOR GREEN BUILDINGS

Nurses must recognize that the mechanisms through which the environment can affect human health exist in both the natural environment and the built environment. This recognition has implications for the scope of assessment of the environment beyond the immediate locale to the broader built environment. Nursing interventions to enhance the environment include advocacy for responsive local and regional policies. Such policies capitalize on the increasing knowledge of how green buildings promote and protect human health. In addition, nurses can add to the knowledge regarding green building effectiveness through studies that provide insight into pathways that link green building to health outcomes of individuals, families, and communities (DeGuzman & Kulbok, 2012). As the green building movement continues to grow, nurses in different specialty areas (e.g., acute care, school nursing, public health, occupational health) can incorporate knowledge of the interaction between the specific built environment and health into the care they provide to the individuals, families, and/or populations who spend time in those buildings.

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GREEN CLEANING IN HOMES

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WHY GREEN CLEANING IS RECOMMENDED IN HOMES

Exposure to potentially toxic substances is often a result of common household activities. The Environmental Protection Agency (EPA) found levels of common pollutants to be 2 to 5 times higher inside homes than outside, regardless of the home's location (EPA, n.d.). Health effects from chemical exposures include eye, nose and throat irritation, headaches, nausea, contact dermatitis, and central nervous system dysfunction. Inhalation of respiratory irritants is a common trigger of asthma symptoms. Many toxic chemical cleaning products are not only more expensive than more natural methods, they also end up in the water systems after rinsing, and in landfills after disposal of unused products. Some cleaning chemicals are known or suspected to cause cancer in humans (EPA, 2012).

One way to avoid the exposures to potentially toxic chemicals is to read labels carefully. Non-toxic commercial products are available to the consumer who is willing to do some research. The market is full of products that claim to be "all natural", "safe for the environment" or "biodegradable", but these terms are not subject to guidelines for their use. When looking for environmentally safe products, look for certified green products with the Green Seal or EcoLogo mark on the label whenever possible (Environmental Working Group, 2011). Manufacturers are not required to list the content of cleaning products; however, household products should carry the following warnings if applicable:

- Caution – slightly toxic
- Warning – moderately toxic
- Danger – highly toxic
- Poison–use precautions to avoid exposure (Findley & Formicelli, 2009).

Sprays, especially aerosols, can linger in the air for hours or days. If used on a regular basis, the result is chronic inhalation of chemical substances. This is important to consider in light of the increasing popularity and frequent (often continuous) use of air "freshening" and scenting candles, sprays, plug-ins, etc. A clean home will be odorless; however, many American consumers have become fond of scenting their home. There are effective ways to ensure that your home has a pleasant scent without using expensive commercial scenting products, for example using flowers or essential oils.

SAFER CLEANING PRACTICES IN HOMES

To reduce exposure of family members to chemicals in the home, greener cleaning products can easily be made from common household ingredients. Many of these cleaning substances have been used effectively for years, but have fallen out of favor due to the successful marketing of "new and improved" methods.

This chapter will explore safer practices for effective home cleaning, inexpensive common household items that can be used for house cleaning, home scenting ideas, and some basic pest management. References for more detailed information are provided at the end of the chapter.

CLEANING BASICS

One strategy for keeping the home clean is to reduce clutter, which in turn reduces dust. In addition, some houseplants are effective at removing toxins from the air. Through photosynthesis, houseplants use carbon dioxide and emit oxygen and can remove a significant amount of toxic chemicals from the air. Recommended plants include English Ivy, ferns, and rubber plants (Leader, 2013).

Avoid using "antibacterial" soaps and cleaners as they are unnecessary for cleanliness and can be harmful. Many antibacterial products contain triclosan, which has been associated with endocrine system disruption, environmental pollution, and the increasing emergence of drug-resistant strains of bacteria. In addition, antibacterial soaps offer no additional health benefits over washing with soap and water (U.S. Food and Drug Administration, 2013).

Basic cleaning ingredients include the following:

- Distilled water (for mixing ingredients – works better than tap water)
- Baking soda (abrasive)
- Liquid dish soap (non-toxic formula)
- White vinegar (deodorizer, disinfectant)
- Hydrogen peroxide (disinfectant, whitener)
- Lemons (disinfectant, deodorizer, degreaser)
- Spray bottle
- Essential oils (optional, for scenting). Suggestions: lavender, lemongrass, lemon, lime, orange, cinnamon, clove, pine, rose, tea tree.

- Cotton rags (recommended over commercial products that are often made from plastics)
  (Dadd, 2011; Findley & Formichelli, 2009)

Other helpful items for specific purposes include the following: activated charcoal (deodorant), raw potatoes, (to remove rust from cookware), isopropyl "rubbing" alcohol (disinfectant), and newspapers (use for window washing instead of paper towels).

RECIPES FOR HOME-MADE CLEANING PRODUCTS (adapted from Dadd, 2011 and Findley & Formicelli, 2009)

All-purpose Cleaner:

1 part white vinegar
2 parts liquid soap
4 parts water
2-3 drops of essential oil (optional) for scenting

Mix ingredients in a spray bottle. This mixture can be used as a basic cleaner for kitchen and bath surfaces, as well as a window cleaner.

Disinfectant:

White vinegar **or**
Hydrogen peroxide
(do not mix)

Wipe with straight white vinegar, followed by hydrogen peroxide for particularly messy clean-ups, for example after handling raw meat. For best results, use hydrogen peroxide from a bottle that has been open for less than six months.

Abrasive Scrub:

Baking soda
Liquid soap

Place baking soda in a dish. Add soap until it makes a paste; dilute with a small amount of water if desired for a looser mixture. Apply to a sponge or brush and scrub.

CLEANING A HOME, SPECIAL TOPICS (adapted from Dadd, 2011 and Findley & Formicelli, 2009)

KITCHEN

Oven:

2 cups hot water
1 tablespoon liquid soap
1 teaspoon baking soda

First, remove as much soil as possible by scrubbing with crumpled aluminum foil or newspaper. Mix ingredients, apply to soiled areas, let stand for 20 minutes and wipe off. Repeat a needed.

Drain (with garbage disposal) Opener:

1 quart hot water
1 tablespoon of liquid soap

Boil water, then add soap. Pour directly into the drain.

Grill Cleaner:

Crumple aluminum foil into a ball and use as a scrub.

Rusty Cookware:

Cut a raw potato in half. Dip the cut end in salt or baking soda and use as a scrub.

BATHROOM

Toilet Bowl Cleaner:

1 cup vinegar
¼ cup baking soda

Mix ingredients and let sit for 15 minutes to a few hours in the toilet bowl (Overnight is another suggested method). Scrub and flush.

Drain Opener:

1 cup vinegar
½ cup baking soda

Combine the ingredients and pour into the drain. Let sit for 15-20 minutes. Rinse with hot water. Repeat if necessary or leave the mixture to sit overnight.

Mold/Mildew Remover:

2 parts water
1 part hydrogen peroxide

Mix ingredients and spray affected area. Let stand for 10-15 minutes and wipe clean. (Note: hydrogen peroxide may bleach surfaces such as wallpaper, linens or clothing.)

Mirror cleaner:

Use all-purpose cleaner, above. Or half vinegar and half water.

Tub and tile cleaner:

Use abrasive scrub, above.

LIVING AREAS

Dusting/Furniture Polish:

Lemon or pine essential oil
Liquid beeswax

Mix the ingredients and apply a small amount to a lint-free cotton cloth and wipe surfaces.

Windows:

Use the all-purpose cleaner, above. Wipe with newspapers.

Air Freshening:

Baking soda is a traditional and effective odor eliminator. Place an open box in areas where odors accumulate. Some ideas for home scenting include:

- Add essential oils to an aromatherapy infuser. Alternately, mix an essential oil with water in a spray bottle and spritz the air or surfaces. (Try a small amount first to make sure the oils do not stain fabrics.)
- Decorate with fresh or dried flowers, herbs, or citrus
- Simmer aromatics (e.g., citrus fruits or cinnamon) to combat cooking odors.
- Soy candles with essential oils are available commercially.
- Remember to bring in some fresh air from time to time. Even in winter, on milder days briefly open a window a few inches.

CLEANING CLOTHING

Washing:

In general, washing machines clean clothing in cold water as effectively as in hot or warm water. Hot water is needed only for heavily soiled items (such as diapers) or greasy items.

1 bar natural soap, shaved
1 cup borax* or baking soda
1 cup washing soda

Combine the ingredients and store. If a liquid detergent is desired, use liquid (e.g., castile) soap and heat the ingredients in enough water to cover and mix.

*Note: While borax is commonly recommended as a laundry booster, and is safe for the environment, the Environmental Working Group (EGW) rates borax as "high concern" for developmental and reproductive toxicity and is best avoided, particularly by women and children (EWG, 2011; EGW, 2014).

Fabric softener:

Add distilled white vinegar or baking soda to the rinse cycle.

Drying:

Clothes dryers are the second-largest users of home appliance energy, after refrigerators (Steingraber, 2011). They are also a leading cause of home fires. Keep in mind that the purpose of a clothes dryer is to evaporate water; wet clothing would dry anyway if exposed to air. The sun has been the traditional "solar dryer" since humans began wearing clothing. A brief time spent outdoors can save energy and money and leave your clothing smelling fresh. (Be careful of pollens if allergies are a problem for your family members.) Indoor drying systems can be used in inclement or cold weather. Heavy clothing, such as jeans and towels, can be dried in the drier for 10-15 minutes to remove wrinkles, and then air dried.

DRY CLEANING

The standard cleaning solvent used in commercial dry cleaning facilities is tetrachlorethylene (perchloroethylene), or "perc". The Environmental Protection Agency (EPA) classifies perc as "likely to be carcinogenic" (EPA, 2012). While the EPA does not recommend that consumers avoid wearing clothing that has been dry cleaned with perc, the solvent is a highly toxic environmental contaminant. Consumers can look for dry cleaner facilities that use less toxic methods, such as liquid silicone ("D5"), liquid CO2, or Professional Wet Cleaning (PWC). If clothing is dry cleaned with perc, remove the plastic and air out the clothing prior to bringing it into the home. When purchasing clothing, consider buying garments that can be machine or hand washed.

INTEGRATED PEST MANAGEMENT

Integrated Pest Management (IPM) is an environmentally sensitive approach to pest control. IPM uses knowledge of the behavior and life cycles of pests to achieve the least possible hazard to people, property, and the environment (EPA, 2014). Pests need a place to live, food, and water. The first step in the home setting is to avoid keeping food in open containers and to keep surfaces free of food and soil. In addition, cracks and holes where pests enter the home should be repaired. Fix areas where there are water leaks, such as pipes and faucets.

Avoid using insect sprays and foggers; in general, enclosed traps expose family member to fewer chemicals. Be sure to handle any traps according to the directions and keep out of the reach of children. For crawling insects, food-grade diatomaceous earth, a non-toxic fine powder, can be applied to surfaces where these pests are found, such as in cracks and crevices, in garbage cans, or in drains. But keep this powder away from pets, children, and food. When seeking a pest management company, select a company that uses integrated pest management.

RESOURCES

- Guides to product safety: Environmental Working Group
- Toxic substances information: Agency for Toxic Substances and Disease Registry

- Pediatric environmental hazards: Children's Environmental Health Network
- Green Seal of Approval
- Health indoor living information: Healthy House Institute
- Alternatives to pesticides: Pesticide Action Network
- Information/advocacy on cold-washing and air-drying laundry: Project Laundry List
- Information/advocacy on protecting families from toxic chemicals: Safer Chemicals, Healthy Families
- Information/advocacy for safer products for women: Women's Voices for the Earth

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TRANSPORTATION AND HEALTH IMPLICATIONS

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In addressing health issues, transportation is almost always part of the problem or part of the solution. That is so whether improving air quality, getting children immunized, providing early prenatal care, utilizing appropriate preventive and primary care services, or responding to an emergency. Transportation can be defined broadly as the means of moving people and goods to desired destinations. Transportation includes public transit options of rail and bus; individual automobile use and shared rides; bicycling and walking.

The health benefits of biking and walking as part of a pattern of regular exercise are well known in preventing obesity and numerous chronic diseases, and in promoting health and quality of life. Public transit carries with it exercise benefits because transit riders walk or bike to transit stops. In addition, public transit lessens the health effects of air and water pollution, the risk of injury and deaths from automobile accidents, the stresses of driving in congested traffic and driver road rage. An often overlooked benefit of transit is its role in developing a sense of community among regular riders, reducing social isolation as a risk to health.

Adequate, available, affordable public transit provides access to health care, to jobs, to education, to grocery stores, to religious and social gatherings, all of which are essential components of healthy living. Without alternatives to driving individual cars, some of the most vulnerable segments of the population—the poor, persons with disabilities, the elderly—are even more likely to be unable to meet basic requirements for daily living, much less to have productive roles in society. Not having to own a car or reduced use of an automobile lessens stress on family budgets.

Public transportation helps alleviate environmental, energy, and economic problems. As documented in the American Public Transportation Association's 2014 Fact Book: "Public transportation plays an important role in reducing the nation's energy use and greenhouse gas emissions. Due to the combined reduction in private passenger vehicle miles, reduced automobile congestion and reduced travel distances due to the proximity created by public transportation, more than 4 billion gallons of gasoline are saved and 37 million metric tons of carbon dioxide emissions are avoided" (APTA, 2014, p.21).

"According to the US Environmental Protection Agency's Greenhouse Gas Calculator, it would require 7.2 million acres of new pine or fir forests per year to match the annual carbon dioxide reductions provided by public transportation. Priced at $3.60 per gallon, the 4 billion gallons of gasoline saved annually saves the US consumer $14.4 billion per year" (APTA, 2014, p.21).

"Transit's impact on reducing congestion has also resulted in significant savings for drivers and their communities. Without transit, drivers would have used 450 million more gallons of gasoline because of added roadway congestion during 2011. Drivers would have been stuck in traffic an additional 865 million hours if there were no transit. Overall, the costs of congestion to drivers would have been an additional $20.8 billion if there had been no transit service" (APTA 2014 Fact Book, p. 21-22).

Opportunities for improving health through transportation include:

3. Policies that support adequate funding for public transit as well as safe roads.
4. Built community design/modification that includes:
    - cross streets,
    - eliminating single entrance/exit neighborhoods,
    - safe spaces for walking and biking for children and adults, i.e. bike lanes/paths, sidewalks,
    - mixed used neighborhoods to increase ease of access to shopping and services
5. Applying proven strategies for rural transit, e.g., van pools, park and rides, flexible routes.
6. Use of existing and additional rail lines for passenger as well as freight service.
7. Programs that assist first time riders, especially the elderly.
8. Collaborative efforts with schools and employers to encourage, facilitate and provide incentives for transit use.

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BROWNFIELDS AND NURSING IMPLICATIONS

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In this chapter we will learn what brownfields are and what the nursing implications should be related to them. This will include nursing education, practice, policy/ advocacy, and research.

DEFINITION OF A BROWNFIELD

Brownfields can be defined in a variety of ways, but the term typically refers to urban industrial or commercial facilities that are abandoned or underutilized due, in part, to environmental contamination or fear of contamination. There have been special efforts in recent years to target brownfields for cleanup and reuse for several reasons, including the potential to revitalize distressed communities, increase tax dollars, and provide new jobs.

AUTHORIZING LEGISLATION AND ENVIRONMENTAL PROTECTION AGENCY (EPA) MISSION

In January, 2002, Public Law 107-118 (H.R. 2869): "Small Business Liability Relief and Brownfields Revitalization Act" was enacted:

"To provide certain relief for small businesses from liability under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, and to amend such Act to promote the cleanup and reuse of brownfields, to provide financial assistance for brownfields revitalization, to enhance State response programs, and for other purposes" (GPO, 2002). EPA's Brownfields Initiative empowers States, communities, and other stakeholders in economic development to work together in a timely manner to prevent, assess, safely clean up, and sustainably reuse brownfields.

WHY IS THE BROWNFIELDS ISSUE IMPORTANT?

In recent years, many manufacturing plants and military bases have closed or relocated. Often, new development on these "brownfield" sites is made difficult by real or perceived environmental contamination. Through the Brownfields Cleanup and Redevelopment Program, EPA helps states, tribes, communities, and other organizations to:

- environmentally assess existing properties,
- prevent further contamination,
- safely clean up polluted properties, and
- design plans to re-use them.

EPA's investment in the Brownfields Program has resulted in many accomplishments, including leveraging more than $14.0 billion in brownfields cleanup and redevelopment funding from the private and public sectors and leveraging approximately 60,917 jobs. The momentum generated by the Program is leaving an enduring legacy. The Brownfields Program and its partners have provided guidance and incentives to support economic revitalization, and empower communities to address the brownfields in their midst. EPA's Brownfield Program continues to look to the future by expanding the types of properties it addresses, forming new partnerships, and undertaking new initiatives to help revitalize communities across the nation (EPA, 2015).

To view the brownfields and other related sites in your area, go to Clean-ups in my Community. You have a choice of mapping cleanups across the USA, mapping or listing cleanups for a ZIP code or city, or creating a table of cleanups or grants.

STATE EXAMPLE: MARYLAND

As indicated above, EPA does not regulate the Brownfields program alone, but delegate's authority to the States. States take a wide range of approaches and use an assortment of tools. Some States specifically address brownfields through their voluntary cleanup programs, others supplement their voluntary program activities, and still others have separate brownfields cleanup and redevelopment programs.

In Maryland, this program is called the Brownfields Redevelopment Initiative (MD Department of the Environment, 2015). Brownfields are included in Voluntary Cleanup Program and the goals are:

1. Encourage the investigation of eligible properties with known or perceived contamination;
2. Protect public health and the environment where cleanup projects are being performed or need to be performed;
3. Accelerate cleanup of eligible properties; and
4. Provide predictability and finality to the cleanup of eligible properties (MD Code, 1997).

WHY NURSES?

So what can nurses bring to the very technical world of hazardous waste cleanup, like brownfields? There are actually a lot of important roles that we are uniquely trained to do. We can:

- Enhance community connections / facilitate dialog
- Identify populations at risk

- Improve community education and risk communication
- Expand the multidisciplinary nature of your environmental health (EH) work
- Assist with translating science into policy
- Enlist undergraduate and graduate students for data collection.

CHALLENGES OF COMMUNITY INVOLVEMENT AT BROWNFIELD CLEANUPS

One of my former roles was providing community outreach and technical assistance to residents with hazardous waste sites in their midst. Through the six plus years I worked for the US EPA funded Hazardous Substances Research Center (the only regional center that had a school of nursing conducting the outreach), I learned some important lessons.

Including all stakeholders: It was often difficult to know who the stakeholders were, when first interacting with a community. I was often approached by a small group of concerned citizens or someone from the local government. This is not a comprehensive list, but you need to make sure to include:

- Community members
- Local businesses
- Representatives from local, state and federal government
- Local and state health department
- Department of Environment
- Health care providers
- Religious leaders
- Schools
- Financial institutions
- Developers
- Contractors
- Youth
- Responsible party(s)

Multiple agendas: I learned very early, there were often multiple agendas and they were not always obvious. Mostly citizens were concerned about health and then property values or effect on business. Then there would be other hidden agendas, like avoiding liability.

Who's in charge: One of my major tasks was trying to help the community understand the roadmap of who was in charge of the decision-making authority. Depending on the type of site and what city and state it is in, who is in charge can change. It is possible for EPA or State Department of Environment to have the lead. Also involved will be potentially responsible parties and their contractors, EPA's contractors, other consultants, Agency for Toxic Substances and Disease Registry (ATSDR), State Health Department, Local Health Department, and other local officials.

Agency responsibilities and limitations: Closely tied to who is in charge, is what each organization is allowed to do by the regulations that govern them. EPA and state departments are directed and limited by their legislative mandates. There are some things they have to do and some processes are set by the regulations. Some things they have no control over. For example, they cannot address property values or zoning; this is a local level issue. That is why it is important to have a large group of stakeholders at the table, so if an issue does not fall under one agency, it probably does fall under another.

POLICY GAPS

After introducing the brownfields definition, legislation, program and implementation, some policy gaps have been identified for future advocacy:

- Environmental justice in permitting process: Need to consider the cumulative impacts already in the community before siting new facilities.
- No program exists to address community-wide elevations of background contaminants
- No program exists to address multimedia problems
- No program exists to address school siting. Some sites do not have coverage under current regulations; schools are one of these. They often fall through the cracks and a school can build without any testing or cleanup.

ADDITIONAL RESOURCES

National Library of Medicine

- Toxicology and Environmental Health Information Program
- Tox Town
- MEDLINEplus
- TOXNET

Agency for Toxic Substances and Disease Registry

- ToxFAQs
- Toxicological Profiles

Environmental Protection Agency

- Envirofacts
- IRIS
- Tools and Technical Information
- Brownfield Training Conference Newsletter emails

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ANTIBIOTIC USE IN AGRICULTURE: PUBLIC AND ENVIRONMENTAL HEALTH IMPACT

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This section will discuss the use of antibiotics in agriculture and how this affects the development of antibiotic resistance and human health. An overview of the purposes for antibiotic use will be provided followed by a review of the evidence surrounding the link between antibiotic resistance in humans and antibiotic use in agriculture. The current state of federal regulations and government agency recommendations will be reviewed along with current research on potential alternatives to antibiotic use in food-producing animals. Finally, the role of nurses in reducing antibiotic use in agriculture will be discussed.

ANTIBIOTIC USE AND RESISTANCE IN HUMANS

The overuse and inappropriate use of antibiotics has resulted in the emergence of antibiotic resistance as a significant threat to public health. The Centers for Disease Control and Prevention (CDC) (2013) estimate that annually at least 2 million people in the United States acquire antibiotic-resistant infections, with approximately 23,000 deaths as a result of these infections, and even more deaths from resulting complications. Further, antibiotic resistance infections contribute a significant burden to the U.S. healthcare system and economy. The estimated economic cost associated with these infections in the health system ranges from $21 billion to $34 billion each year and accounts for over 8 million additional hospital days (Infectious Disease Society of America, 2014). The economic burden is increased when accounting for indirect costs associated with these infections, such as lost productivity as a result of absence from work due to illness. The emotional burden to patients and family members should also be considered as a significant adverse consequence of infections on individuals and society.

The rate at which new antibiotics are being produced is significantly less than the rate at which bacteria are developing resistance to the antibiotics used to treat clinical disease in humans. In a recent report by the British government, researchers found that unless action is taken to reduce antibiotic resistance, it would surpass cancer as the number one cause of death by 2050 and account for 10 million deaths annually worldwide (Review on Antimicrobial Resistance, 2014). Many invasive procedures, such as routine surgical procedures and chemotherapy, may no longer be done safely without effective antibiotics due to the risk of infection. Certain populations, such as immunocompromised patients, patients undergoing surgical procedures, including women giving birth by caesarean section, patients receiving cancer treatments, and the very young and elderly, are at the greatest risk of contracting resistance infections and experiencing associated complications.

Antimicrobial stewardship programs have been implemented across healthcare facilities to address the growing concern of antimicrobial resistance. These programs are coordinated interventions to limit the inappropriate use of antibiotics by determining optimal drug selection, dose, and duration of treatment, with the goal of promoting optimal patient outcomes (Dellit et al., 2007). Simultaneously such programs limit the development of antibiotic resistance and selective development of pathogenic bacteria. When antimicrobial stewardship programs are implemented with appropriate infection control guidelines, these programs are shown to limit the overuse of antibiotics in health care settings, ultimately decreasing the risk for development of antibiotic resistance pathogens and subsequent transmission of resistant bacteria among humans (Dellit et al., 2007).

USE OF ANTIBIOTICS IN AGRICULTURE

Efforts to decrease antibiotic use in hospitals and healthcare facilities have been widely adopted; however, little focus has been directed towards limiting inappropriate use in agriculture. Although the use of antimicrobials in the agriculture industry has become a mainstay of farming practice in the U.S., their use in food-producing animals is largely unregulated. To put this in perspective, it was estimated that in countries such as Sweden and Denmark, where limitations on antimicrobial use have been implemented, antibiotic use was less than 3 grams per pig slaughtered in comparison to 47 grams in the U.S. (Gilchrist et al., 2007). Estimates of the actual percentage of antibiotics used in the agriculture industry are unknown due to the lack of required regulation and tracking of usage. The U.S. Food and Drug Administration (FDA) currently only tracks sales of antimicrobials sold for farming purposes. It has been shown that these products are often used in a non-therapeutic manner. A 1995 U.S. Congressional Office of Technology assessment report identified that approximately 90% of antibiotics used in agriculture were for disease prophylaxis or growth promotion purposes rather than for therapeutic treatment of diseased animals (Ranke, Mitchell, St. George, & D'Adamo, 2014).

Antibiotics are used in food-producing animals for several purposes including prophylactically for disease prevention, therapeutically for disease treatment, and for animal growth promotion. To differentiate, therapeutic use of antibiotics is using short-term and high doses of antimicrobials to effectively treat clinical signs of disease. For the purposes of disease prevention and growth promotion, antibiotics are used routinely in low-doses at subtherapeutic levels, often times in large numbers of animals. In addition to the benefit of utilizing antimicrobials to reduce the risk of animals developing infections, using routine, low doses for disease prevention in turn decreases the energy needed by the animal to fight off infection, which is hypothesized to attribute to growth promotion (National Association of Local Boards of Health, 2010). Adding antibiotics to animal feed in water for purposes of growth promotion has become popular in farming practice due to the ability of these products to enhance feed efficiency, quality of animals produced, and decrease the time and amount of feed necessary to grow animals (Cheng et al., 2014). This means that animals grow larger at a faster rate creating a financial incentive for producers to add these agents as feed additives to increase production outputs.

While collectively, the FDA, United States Department of Agriculture (USDA), and CDC have called for judicious use of antimicrobial drugs in food-producing animals that are used to treat disease in humans, use in the industry remains largely unregulated. National agencies have identified use in agriculture as a concern in the emergence of resistance bacteria, however have failed to implement the necessary safeguards to address this issue. The FDA is the regulatory body that determines which antibiotics are approved for use in agriculture. To minimize non-therapeutic use, the FDA developed a report of guidance for industry (guidance #209 and guidance #213) outlining recommendations for the voluntary discontinuation of antimicrobials for inappropriate use in food-producing animals. Guidance #209 titled *The Judicious Use of Medically Important Antimicrobial Drugs in Food-Producing Animals* outlines the voluntary recommendations for limiting antimicrobials drugs in food-producing animals for growth promotion purposes (FDA, 2012). Guidance #213 titled *New Animal Drugs and New Animal Drug Combination Products Administered in or on Medicated Feed or Drinking Water of Food Producing Animals: Recommendations for Drug Sponsors Voluntarily Aligning Product Use Conditions with Guidance for Industry #209*, outlines voluntary recommendations for drug companies on the labeling of antimicrobial drugs use for animal production purposes (FDA, 2013).

While the FDA has identified the use of antibiotics for growth promotion purposes as an inappropriate use in food-producing animals, the recommendations developed under the guidelines fail to identify disease prevention as an inappropriate application in agriculture. With the FDA promoting the view that disease prevention is considered as a therapeutic use, even though this use involves utilization of routine and low doses of antibiotics, it creates the loophole in which industry can still use antimicrobials for growth promotion purposes, while labeling use for disease prevention. With this loophole and the voluntary nature of the recommendations, there have been conflicting reports of whether these guidelines will be effective in controlling the use of antibiotics in the animal industry. Further, the guidance lacks an adequate tracking system to monitor and regulate the amount and usage in food-producing animals. As previously mentioned, sales figure data on the total amount of antibiotics used in food animals are currently the only data collected in the U.S.

LINK BETWEEN ANTIBIOTIC RESISTANCE IN HUMANS AND ANTIBIOTIC USE IN AGRICULTURE

It is important to note that many of the antibiotics used in this industry are the same medications used to treat human disease, contributing to the threat of the development of resistant pathogens. Using antibiotics at subtherapeutic levels for disease prevention and growth promotion provides an environment for bacteria to thrive and develop resistance to medically important antibiotics. Cross resistance, when bacteria become resistant to an entire class or across different classes of antibiotics than the originally used antibiotic, is a significant concern that can also result from the overuse use and inappropriate use of these agents. For further information on how using subtherapeutic doses of antibiotics contributes to resistance, view these two short videos depicting the process: Natural Resources Defense Council's "Stop the Superbugs" video and FDA's Center for Veterinary Medicine "Animation of Antimicrobial Resistance".

Numerous peer-reviewed research articles have linked antibiotic use in food-producing animals to the development of antibiotic resistant bacteria. For example, research has shown the link between the use of antibiotic growth promoters to the development of antibiotic resistant pathogens, such as Campylobacter, Salmonella, Enterococcus and Escherichia coli (Graham, Boland, & Silbergeld, 2007). Antibiotic-resistance bacteria can then be transferred to humans through direct contact with animals, consumption of contaminated food, and environmental contamination (CDC, 2013). Health Care

Without Harm (2014) identified over 147 scientific studies demonstrating the transfer of resistant bacteria from agriculture to humans. Additionally, studies conducted in the Delmarva Peninsula region, one of the top five leaders in poultry production in the U.S., have shown transfer of antibiotic-resistant bacteria to farm workers from occupational exposure (Price et al., 2007) and environmental contamination from inadequate animal transport methods (Rule, Evans, & Silbergeld, 2008). Other environmental hazards include risks of soil and water contamination from agricultural runoff and animal waste practices, as 25-75% of antibiotics were shown to pass from animal feed to manure (Walker, Rhubart-Berg, McKenzie, Kelling, & Lawrence, 2005).

AGRICULTURAL INDUSTRY IN THE UNITED STATES AND RELATED ANTIBIOTIC RESISTANCE

The progression of the agriculture industry from small family farms to large-scale industrial farming practices has contributed to the need to use antimicrobials in farming animals. Concentrated Animal Feeding Operations (CAFOs) are large-scale industrial facilities that house large numbers of livestock and have become a mainstay in the agricultural industry as the demand for mass produced meats increases. These operations confine large numbers of animals in small spaces leading to unhygienic conditions in which disease can spread rapidly through concentration of manure, feed, and diseased animals in close quarters. The majority of food-producing animals are raised in these farm environments, with animal populations ranging from thousands to tens of thousands confined in small spaces (Silbergeld, Davis, Leibler, & Peterson, 2008). For example, in poultry farms one house of broiler chickens typically contains around 20,000 chickens. Overcrowding conditions, along with the hygiene, temperature, and ventilation of CAFOs greatly affects the health and the stress state of the animals (Gilchrist et al., 2007). With poor CAFOs conditions, animals are more likely to become diseased with the risk of rapid disease spread due to overcrowding conditions.

The increased risk of rapid disease spread as a consequence of confining such a large number of animals into this type of environment results in the need to use antibiotics as a disease prevention strategy. However, as previously discussed, use in this manner contributes to antibiotic resistance and a heightened risk of transferring resistant bacteria to humans through direct contact or environmental contamination. Research has shown that antibiotic resistant bacteria can spread via air, water, and direct contact with CAFO workers (Gilchrist et al., 2007). CAFO workers have an increased risk of becoming colonized with resistant bacteria that is abundant in industrial farm settings, which can then be spread to contacts in the community. A study of poultry workers in the U.S. showed an increased risk of colonization with gentamicin-resistant Escherichia coli compared to community referents (Price et al., 2007). Similarly, in a study evaluating workers at a hog slaughter processing plant, a larger percentage of workers carried strains of Staphylococcus aureus resistant to at least one antimicrobial class in comparison to residents in the community (Neyra et al., 2014). Workers are frequently provided little protective equipment, which further increases occupational exposure risk of colonization and subsequent transference to community contacts (Silbergeld et al., 2008).

Environmental contamination with resistant bacteria can occur as a result of the practices utilized on CAFOs in regards to waste management and housing conditions. Due to the high concentration of animals in such a small area, specific ventilation practices have to be utilized which contribute to the transfer of bacteria to the environment through contamination of air, soil, and ground and surface water (Silbergeld et al., 2008), with older and inadequate ventilation systems increasing this risk. Waste management and disposal practices become an issue from the large number of animals raised in a small space leading to large amounts of waste produced. Often times, animals poorly absorb antimicrobial products, with antimicrobials shown to be excreted in animal waste consisting of upper estimates of 90% in urine and 75% in feces (Silbergeld et al., 2008). The combination of resistant bacteria present in animal waste and the passage of antibiotic compounds in animal feces further contribute to environmental contamination with resistant pathogens. Another significant concern from CAFO conditions is soil, groundwater, and surface water contamination from agricultural runoff and animal management practices especially where animal waste is used as a fertilization method, with liquid waste sprayed across agricultural fields. Research has shown greater quantities of resistant bacteria in ground and surface water sources in close proximity to these mass producing swine facilities (Silbergeld et al., 2008).

ALTERNATIVES TO ANTIBIOTIC USE

The USDA has developed an action plan to address antimicrobial resistance outlining current activities including surveillance of antibiotic use and antimicrobial resistance (AMR), research and development of alternative management practices and strategies to limit antibiotic use, and education. All these activities are aimed at decreasing inappropriate use of antibiotics in food-producing animals. Currently, antibiotic use is supported

by large scale and intensive farming practices (Cheng et al., 2014), making the need to develop effective alternative solutions essential to ensure adoption of strategies to limit antimicrobial use. The USDA is presently in the process of researching alternative products or strategies to antibiotic use that limit the emergence of antibiotic resistance pathogens. Such strategies include vaccines, probiotics and prebiotics, organic acids, essential oils, immune enhancers and phytochemicals. Probiotics, combinations of live bacteria known to be beneficial to health, in animal feed has been identified as one of the most promising alternative solutions due it's selectivity of action. The use of probiotics as an alternative strategy to antibiotics derives from its ability to restore intestinal microflora balance, while specifically targeting harmful organisms (Seal, Lillehoj, Donovan, & Gay, 2013).

In addition to the above mentioned strategies, improved animal husbandry practices have been shown to supplement the removal of non-therapeutic antibiotics in agriculture. In a USDA survey, producers that eliminated the use of low and routine doses of antibiotics relied on stricter sanitation practices and improved housing ventilation systems, and were more likely to follow a consistent set of animal management practices compared to growers that used non-therapeutic doses of antibiotics (McDonald & Wang, 2011). A complete list of alternative interventions and further detail on mechanism of action can be found on the USDA's Alternative to Antibiotics Resource Center website, along with links to peer-reviewed articles and recent news/reports on the topic.

FEASIBILITY AND COST OF LIMITING ANTIMICROBIAL USE

Cost has been a concern within the agriculture industry in discussions of restricting the use of antibiotics in animals in terms of decreases in production and feed efficiency. However, research has demonstrated that bans may be successfully enacted with minimal effects on productions levels. For example, antibiotic bans placed on broiler chickens in countries in the European Union have shown minimal declines in production, which is compensated with cost-savings from a decrease in purchases of antibiotic growth promoters (Gilchrist et al., 2007). Specifically, in Demark after legislation was enacted that placed limitations on antimicrobial use in livestock, use in pigs decreased by over 50% from 1992 to 2008, with a noted increase in overall productivity (Levy, 2014). Additionally, the World Health Organization estimates a 1% cost increase associated with foregoing the use of antibiotic growth promoters in pig farmers, which is minimal in terms of the human health benefits from combating antibiotic resistance (Gilchrist et al., 2007).

Research done in the U.S. has shown similar results in terms of costs estimates of eliminating non-therapeutic use of antibiotics in the agriculture industry. A cost analysis study of eliminating antibiotic growth promoters (AGP) in the Delmarva Pennisula showed an actual increase in the net value of poultry flocks from $0.0009 to $0.0097 per chicken. This analysis suggests that withdrawing AGPs from feed is not associated with a significant cost to growers as has been argued previously by industry (Graham et al., 2007). Market demand for sustainable meats produced without the use of non-therapeutic antibiotics is shifting, with major companies taking notice. Perdue, one of the top poultry integrators in the U.S., has already eliminated the inappropriate use of antibiotics for both growth promotion and disease prevention purposes, with estimates of 95% of chickens never receiving antibiotics at all. This shows that this process can be implemented on an industrial scale. Other major corporations such as McDonalds, Chipotle, FreshDirect, and Chick-fil-A are either currently sourcing meat produced without the use of non-therapeutic antibiotics or have committed to eliminate purchasing of meat produced in this manner over the span of two to five years. This decision by major corporations recognizes the shift in consumer demand and shows that making these products available can be marketable and profitable.

NURSING ROLES

Recommendations from the USDA to reduce antibiotic resistance include adopting a comprehensive and integrated approach to implementing alternative strategies (UDSA, 2014). To assist with federal agency efforts, health care organizations can use their purchasing power to affect market demand. The health care food service is a $12 billion industry and a large purchaser of meat in the U.S., demonstrating tremendous potential to shift local markets to increase the demand for sustainably produced meat (Lagasse & Neff, 2010). In the Northeast, U.S. region hospitals were found to serve an average of 344 patients and 1,974 visitors and staff daily, showing the significant population served and amount of purchasing power these organizations have (Ranke et al., 2014). This uniquely places health care facilities and health professionals in a position to set an example for the rest of the nation on the importance of producing and consuming sustainable meat to improve human health.

To assist with this process, nurses employed in hospitals and other facilities can encourage organizational leaders to take part in Health Care Without Harm's Balanced Menus Initiative. The Balance Menus Challenge is a voluntary commitment for health care facilities to reduced meat purchases by 20% over a 12 month period. With

cost savings from decreased meat procurement, health care facilities can then work to purchase locally-sourced and sustainably produced meat, such as meat produced without the use of subtherapeutic antibiotics. By working to implement such initiatives, nurses can support grassroots efforts in local communities to contribute to collective change across the nation.

To enact more uniform change, policies at the federal and state level have been attempted to promote the judicious use of antibiotics in agriculture. States, such as Maryland and California, while unsuccessful at enacting legislation, have worked to introduced and advocate for policies that would regulate and limit the use of antimicrobials in food-producing animals. The Preservation of Antibiotics for Medical Treatment Act has been introduced in Congress on numerous occasions, with the most recent reintroduction in March 2015, and attempts to place similar restrictions on the agriculture industry at a federal level. Most recently in March 2015, the Obama administration released *The National Action Plan for Combating Antibiotic-Resistant Bacteria,* including recommendations for the FDA to place measures on the agriculture industry to restrict antimicrobial use, new proposals for an increase in funding for developing new antimicrobials, and the development of international partnerships to combat antibiotic resistance.

Nurses can work to advocate for the development or enactment of policy that attempts to limit inappropriate use of antibiotics in livestock in their own states or at a federal level. Learning from examples of successful policy changes and initiatives that have placed restrictions on antimicrobial use in livestock in European countries can assist with advocacy efforts and inform legislation in the U.S. In the European Union, medically important antibiotics were banned in animal use, with AGPs subsequently phased out by 2006 (Gilchrist et al., 2007). In Denmark, the Danish Integrated Antimicrobial Resistance Monitoring and Research Program was implemented to track the effect of legislation changes that imposed limitations on the use of AGPs, overall antibiotic use in agriculture, along with the prevalence of resistant bacteria (Wielinga, Jensen, Aarestrup, & Schlundt, 2014). This program helped engage stakeholders, educate leaders on the issue of antibiotic resistance, and led to the development of evidence-based policy and guidelines for the judicious use of antimicrobials in agriculture (Wielinga et al., 2014). The policy changes adopted in other countries not only serve as examples, but show that adoption of such initiatives is feasible nationwide.

Because there is a growing public health threat of antibiotic resistance, we must ensure that restrictions are in in place to limit non-therapeutic use of antibiotics in food animals. These restrictions are an important priority to protect environmental and human health. Unified efforts from a variety of stakeholders, including public health professionals, federal and state agencies, and the public will be necessary to combat this issue and promote the development of a sustainable food system in the U.S.

To further your knowledge regarding this topic, here are some links for additional information:

Organization	URL	Key Content
Centers for Disease Control and Prevention	Antibiotic Resistance Threats in the United States, 2013	Report on antibiotic resistant threats in the U.S. by microorganism Core actions to prevent antibiotic
Food and Drug Administration's Center for Veterinary Medicine	Animation of Antimicrobial Resistance	Nine-minute video explaining how antibiotic resistance develops and proliferates among bacteria
Health Care Without Harm	Antibiotic resistance and Agricultural Overuse of Antibiotics: What Health Care Food Systems Can Do	Outlines actions health care facilities can take to reduce antibiotic use in agriculture Sample food procurement guidelines
Health Care Without Harm	Balanced Menus Challenge	Outlines actions health care facilities can take to reduce antibiotic use in agriculture Sample food procurement guidelines

Organization	URL	Key Content
Keep Antibiotics Working	Fact sheet: Antibiotic Resistance and Animal Agriculture	Quick overview of issue and suggested solutions
Natural Resources Defense Council	Reduce Antibiotic Misuse in Livestock	Information and short video clips about food producing animals and spread of antibiotic resistance
Obama Administration	National Action Plan for Combating Antibiotic-Resistant Bacteria	Discusses goals and objectives of the action plan with set timelines and milestones
Pew Commission on Industrial Farm Animal Production	Putting Meat on the Table: Industrial Farm Animal Production in America, Executive Summary	Public and environmental health concerns related to farm animal production Recommendations of the commission to address public health, the environment, and animal health
U.K. Review on Antimicrobial Resistance	Antimicrobial Resistance: Tackling a Crisis for the Health and Wealth of Nations	Issue of antimicrobial resistance Economic cost of drug-resistant infections Impact of AMR on world health
U.S. Department of Agriculture	USDA Antimicrobial Resistance Action Plan	USDA's action plan to address antimicrobial resistance Current actions and proposed initiatives
USDA: Alternative to Antibiotics Resource Center	Alternatives to Antibiotics	Examples of alternatives to antibiotics Links to scientific publications and reports on AMR and ATA
U.S. Department of Health and Human Services Food and Drug Administration	Guidance for Industry #209: The Judicious Use of Medically Important Antimicrobial Drugs in Food-Producing Animals	Voluntary guidance for industry outlining FDA's recommendations for limiting antimicrobial drugs in food-producing animals for growth promotion purposes
U.S. Department of Health and Human Services Food and Drug Administration	Guidance for Industry #213: New Animal Drugs and New Animal Drug Combination Products Administered in or on Medicated Feed or Drinking Water of Food Producing	Voluntary guidance for drug companies on how to label antimicrobial drugs for animal production purposes

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ENVIRONMENTAL JUSTICE

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In order to understand health disparities it is essential to consider the inequities in environmental exposures among various population groups. Inequities are exposures that are not evenly distributed among populations; these uneven distributions are considered unfair or unjust. Environmental exposures are one of the social determinants of health: circumstances that occur where people live, learn, work, play, and pray. In response to inequities in environmental exposures and health outcomes, nurses and others seek environmental justice.

"Environmental Justice (EJ) is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies" (EPA 2015a). This definition suggests a legal mandate to respond to factors that cause health disparities related to environmental policies that fail to address health outcomes related to environmental hazards. The Environmental Protection Agency's (EPA's) explanation of fair treatment is that "no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental and commercial operations or policies" (EPA, 2012). The EPA website further indicates that meaningful involvement means that "people have an opportunity to participate in decisions about activities that may affect their environment and/or health; the public's contribution can influence the regulatory agency's decision; their concerns will be considered in the decision making process; and the decision makers seek out and facilitate the involvement of those potentially affected" (EPA, 2012).

In response to the mounting concerns raised by citizens, scholars and activists, the federal government addressed environmental racism. Therefore, many communities bear the extra burden of waste, pollution and hazardous exposures. These communities across the globe are the homes to persons of color and those living in poverty. Considered a form of institutionalized racism, environmental racism, "refers to environmental policy, practice or directive that differentially affects or disadvantages (whether intended or unintended) individuals, groups or communities based on race and color" (Bullard, 2002).

HISTORY

Historically, people of color and those living in poverty have born the greatest burden of exposure to environmental hazards in their communities, homes, workplaces and schools. Such exposures most often come from landfills, garbage dumps, chemical plants, factories, smelters and incinerators that are built in low income and minority communities (Bullard, Johnson & Torres, 2011). The roots of the movement to address this injustice began in the 1960s with several key events. First, the publication of *Silent Spring* by Rachel Carson informed the general public of the health hazards associated with pesticides. In addition, during the 1960s Cesar Chavez and farmworkers protested their exposures to harmful pesticides in their agricultural work in fields treated with chemicals hazardous to human health (Skelton and Miller, 2014). The Civil Rights movement led to the Civil Rights Act of 1964 that prohibited the use of federal funds to discriminate based upon race, color or national origin.

Concerns for civil rights and equal opportunity under the law developed during the 1960s. Public concerns for both health and the environment also gained momentum and culminated with the creation of the Environmental Protection Agency in 1970 under President Nixon. The EPA was charged to protect human health and the environment. Legislation such as the Clean Air Act of 1970 and the Clean Water Act of 1972 launched a series of legal mandates for the EPA to regulate and enforce standards to protect health and the environment.

These inequities threatened those living in communities that were unjustly bearing the toxic burdens. Environmental racism is defined as "the disproportionate impact of environmental hazards on people of color" (Environmental Justice Network, 2015). (See http://www.ejnet.org/ej/)

Citizens in Warren County, North Carolina began what is known as the environmental justice movement. The dumping of 31,000 gallons of polychlorinated biphenyl (PCB) in 1973 along roadways in North Carolina contaminated large areas of soil. In response, the state devised a plan to build a landfill for the contaminated soil. The landfill was to be located in Warren County, a largely African American community that lacked both a mayor and a city council. In addition, it was ranked as one of the three poorest communities in terms of gross domestic product. The local African American citizens protested the plans for the landfill fearing that their water would

become contaminated by the PCBs to be dumped there. (Click on photos below to watch videos)

PCB Protest in Warren County 1982

Robert Bullard - The Genesis of Environmental Justice

Dr. Robert Bullard, currently the Dean of the Barbara Jordan-Mickey Leland School of Public Affairs at Texas Southern University in Houston, Texas, is considered by many to be the "father of environmental justice." He became active in the environmental justice movement in the early 1980s when he actively investigated the siting of municipal waste sites in predominantly black communities in Houston. His scholarship led to his book, *Dumping in Dixie: Race, Class and Environmental Quality* published in 1990. During the past 25 years of his academic career he has published 18 books and championed topics such as environmental racism, regional equity, environmental justice, climate justice, sustainable development, urban land use, smart growth, industrial facility siting, community reinvestment, housing, and transportation. http://www.ejnet.org/ej/bullard.html

FEDERAL AND STATE MANDATES

Federal and state mandates were developed in response to the growing movement to address environmental injustice. President Bill Clinton signed Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," on Feb 11, 1994. The purpose of the Order was to address the human health and environmental conditions of minority and low-income populations with the goal of achieving environmental protection for all communities. The Order directed the EPA and other federal agencies to develop environmental justice strategies to help each agency address how their programs create disproportionately high and adverse human health or environmental effects on minority and low-income populations. The Order aims to provide minority and low-income communities access to public information and public participation in matters relating to human health and the environment through fair treatment and meaningful involvement (EPA, 2012).

At the Federal level, in February, 2014, the EPA's Office of Environmental Justice (OEJ) celebrated the 20th anniversary of the signing of EO 12898. The OEJ webpage offers links to their *Plan EJ 2014*, the Partnership for Sustainable Communities, the Interagency Working Group, grants, teleconferences among other informative information for the public.

STATE AND REGIONAL EPA ENVIRONMENTAL JUSTICE (EJ) OFFICES

The EPA also supports 10 regional offices across the United States where each includes an EJ office. EPA Region 6 is comprised of Arkansas, Louisiana, New Mexico, Oklahoma, Texas, and 66 Tribal Nations, and offers links to their EJ strategy, EJ Training workshop, mapping tools, resources and other information for the region.

During the past two decades, state legislatures have addressed EJ for their communities. In Massachusetts for example, an Environmental Justice Policy was signed in 2002 and guides efforts to address inequities and injustices for people of color and low income populations. Their services include links to state policies and initiatives, modules to address smart growth/smart energy policies, and case studies. The Massachusetts toolkit is available online.

An example of an educational module is Brownfields where the viewer can see examples of how former brownfields have been revitalized into useful and beautiful additions to the community. According to the EPA, "brownfield site" means real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. The Jackson Square case study of a Jamaica Plain neighborhood in Boston, Massachusetts, highlights the development of an 11 acre

former urban intersection comprised of brownfields and heavy traffic use into a mixed-income, mixed-use, and sustainable transit-oriented area.

In addition, the Massachusetts Environmental Justice site offers tools such as EJ mapping. With EJ mapping, Geographic Information Systems (GIS) tools can be used to map various toxic exposures to communities that meet the criteria for EJ.

RELATIONSHIP TO SOCIAL DETERMINANTS OF HEALTH (SDH)

The EPA published their Plan EJ 2014 in 2011 to address the need to put the topic of environmental justice front and center across the entire agency to improve overburdened communities. The Plan includes areas such as community based programs, decision making, rule making, permitting, compliance and enforcement, as well as their work with other federal agencies. Now working on the draft EJ 2020 Action Agenda Framework, the EPA is committed to advance the work to mark progress in achieving environmental justice in overburdened communities.

Environmental justice is essential for the protection of those who live in overburdened communities and to provide legal support to remedy the disparities in their environment. However, an upstream approach is required to more effectively address the needs of EJ communities. To address the root causes of such disparities, a social determinants of health (SDH) approach must be taken. The World Health Organization defines SDH as "the conditions in which people are born, grow, live, work, and age. These circumstances are shaped by the distribution of money, power and resources at global, national, and local levels" (World Health Organization, 2014b). In response to a charge from EPA to address the impact of social determinants of health upon children's health, the EPA's Children's Health Protection Advisory Committee (CHPAC) sent a letter to EPA Administrator Gina McCarthy in November 2013 urging EPA to "incorporate SDH in all programs, policies and regulatory efforts across all offices of the Agency."

CASE EXAMPLES OF CITIZENS' ENVIRONMENTAL JUSTICE EFFORTS

The first example of a citizen effort specifically to address environmental justice was the example from Warren County in North Carolina (Skelton & Miller, 2014). Since that time there have been a number of other examples where citizens join together to address the unjust environmental burdens of their community.

WE-ACT

In 1988, the organization West Harlem Environmental Action (WE-ACT) was founded in New York City to address environmental justice. WE-ACT was the first environmental justice organization in the city and one of the first in the U.S. run by people of color. Issues of environmental racism led to the siting and environmental exposures from the following: North River Sewage Treatment Plant, 6 out of 7 New York City diesel bus depots in Northern Manhattan, a 24-hour Marine Transfer Station in Manhattan, as well as the practice of using Northern Manhattan communities as New York City's dumping ground.

Currently the organization has grown and serves to inform, educate, train and mobilize residents of North Manhattan on environmental issues that impact their health, lives and community. Recent efforts emphasize citizen participation in public policy and enforcement of environmental regulations. WE-ACT focuses on three organization priorities: 1) reduction of toxic exposures, 2) climate change preparedness and resiliency and 3) community access to green resources. These initiatives include solid waste management, pest management, healthy indoor environments, clean air, open green space and sustainable food and land use (WE-ACT, 2015)

JESUS PEOPLE AGAINST POLLUTION

Jesus People Against Pollution (JPAP) is a grassroots environmental justice organization located in Columbia, Mississippi. The organization was created in response to an explosion in March 1977 at the Reichold Chemical Company. "The explosion wrecked the facility and poisoned the local air, water and land with cancer-causing agents and other dangerous compounds. After the explosion, Reichold abandoned the site and left toxic, deadly substances buried in 55 gallon drums in the earth

and around the nearby community and in local landfills" (Earthjustice, 2015). In time, toxic chemicals oozed into the water tables and soil, causing the ground to spontaneously combust, vaporizing into the atmosphere, and leaving offensive odors making many people sick. The community has sustained health problems ranging from nose-bleeds and respiratory problems to cancers and premature deaths. Consistent with the well documented practice of "waste following waste," the Reichold site was compounded further by pesticide spraying, oilfield operations, transportation, nuclear waste and incineration. Advocacy by JPAP played a role in the Reichold site being listed as a Superfund Site in the 1980s; however, it has since been delisted. It is now considered a brownfield site and continues to seek remediation in the form of relocation and life-time environmental/primary health care for impacted residents.

JPAP is a grassroots advocacy organization that has also embraced a mission to "educate and inform impacted communities about the availability of toxicology and environmental health information so that communities can better understand the relationship between environmental exposure and disease." Its founder and primary spokesperson Charlotte Keys, Evangelist and Environmental Justice Advocate, is a national figure frequently speaking in the policy arena and contributing to the EJ dialogue at relevant federal agencies.

NATIVE AMERICANS AND NUCLEAR WASTE

During the 1990s a number of Native American tribes fought legal battles to protect their sacred land from radioactive waste disposal. The Eastern Navajo reservation residents fought to protect their land by filing a suit with the Nuclear Regulatory Commission to block a permit for uranium mining in Church Rock and Crown Point, New Mexico. Likewise, the Western Shoshone tribe in Nevada is fighting the Yucca Mountain dumping (University of Michigan, 2015). The Mohave tribe in California and the Skull Valley Goshutes in Idaho are also fighting the construction of radioactive waste dumps on their tribal lands (Bullard, 2002).

HYDRAULIC FRACTURING (FRACKING) AND ENVIRONMENTAL JUSTICE

A growing concern for energy justice is for communities throughout the United States that have fracking operations. Studies in Pennsylvania and in Texas indicate that poverty is closely correlated with communities where fracking occurs (Bienkowski, 2015). Citizens of such communities are taking action to address the concerns in their communities (Carre, 2012) by addressing public policy. New York State has banned fracking and Maryland has a moratorium on fracking, while many cities and counties have enacted legislation to limit fracking.

OCCUPATIONAL JUSTICE

As noted in our discussion of vulnerable populations, workplace exposures vary by type of occupation, location of work, and biologic, physical (including ergonomic), chemical, noise and radiologic exposures. Further, various population groups are more vulnerable such as pregnant women, children, adolescents, older adults and those from ethnic and racial minority groups. Adverse health effects can occur immediately or many years later. The federal government regulates worker safety primarily through the Occupational Safety and Health Administration (OSHA) within the U.S. Department of Labor. OSHA was formed in response to legislation passed in 1970. Other agencies offer guidance and support for education and research to improve workplace safety. One must consider all aspects of a work environment including job stress, opportunities for healthy diet and exercise, violence, and protective equipment, in addition to the specific workplace exposures in any particular occupation. The Centers for Disease Control (CDC) notes in their Immigrant Worker Safety and Health website that, "Immigrant workers face a disproportionate risk for workplace injury and illness. This is due to a confluence of factors including an overrepresentation in the most hazardous industries including construction and agriculture. Additionally, workplace safety interventions often do not reach immigrant worker populations due to barriers created by social, cultural, and economic issues including language, literacy, and marginal economic status. Furthermore, immigrant workers often lack knowledge of their rights to workplace safety and are reluctant to pursue these rights" (CDC, 2014).

Ethnic minorities are more likely to be employed in physically demanding jobs with hazards such as construction, farming, mining and meat packing (Frumkin, 2010). Immigrants are often employed in more hazardous work settings (Panikkar, et al., 2012). Factors such as language proficiency and access to occupational health services contribute to their type of employment. Murray (2003) studies low-income workers and their health risks. She reports that industries such as forestry, fishing, farming, and machine operators are among those with the highest proportion of workers who live in poverty. She further notes that Black and Latino workers lag behind White workers in both their compensation for their work and job desirability. Arcury and colleagues (2002) looked at the multiple risks of farmworkers from pesticide exposure in farm fields and also in their homes. Study findings indicate that the farmworkers were exposed to

pesticides to a great degree in their housing and workplaces. Ahonen and colleagues (2007) note that immigrant workers are not only overrepresented in the most hazardous work conditions but are exposed to the most danger within those jobs.

Although the Environmental Justice movement began in response to communities where residents experienced disproportionate exposures to hazardous chemicals, the federal government recognizes that many people are exposed not only in their homes but also in the workplace. The Department of Health and Human Services (HHS) developed the HHS Environmental Health Strategy and the Department of Labor the Environmental Health Strategy to promote environmental justice.

GLOBAL ENVIRONMENTAL JUSTICE

Low income communities and communities of color in the U.S. continue to experience gross inequities and discriminatory practices related to hazardous waste, pollutants, and the disposal of toxins. Such communities are at greater risks for adverse health effects than communities associated with less waste. Despite national and state environmental laws, policies, and regulations as well as governmental agencies dedicated to environmental protection, health problems associated with hazardous waste increase with potential for long term impact on the quality of life. People living in developing parts of the world are vulnerable and disproportionately plagued by negative extremes of social determinants of health, including the following:

- joblessness,
- poverty,
- lack of education and information,
- food insecurity,
- inadequate housing,
- poor access to health care,
- lack of clean water,
- premature deaths,
- air pollution,
- inadequate control of disease carrying insects such as mosquitos and other vectors transmitting malaria and others diseases, and an overall sense of powerlessness and despair.

Just as in developed countries, these disabling conditions, affect major segments of the population in the developing world and classify them as potential victims of environmental injustices.

INTERNATIONAL HAZARDOUS WASTE DISPOSAL

In addition to the negative extremes of social determinants of health acting as magnets to environmental justice issues, the rise of economic globalization, liberalized trade rules and the dominance of multinational corporations play key roles in transporting environmental pollution from industrialized to developing countries (Clapp, 2014). Shipping hazardous waste from developed countries to developing countries for disposal is a regular practice. The receiving countries often have inadequate or lax regulations and protocols, inadequate resources, and insufficient training for the safe management and disposal of environmental waste. According to the Basel Action Network, the primary motivation for exporting hazardous waste to developing countries is economic. As the deleterious health and environmental impacts of unsound disposal of hazardous waste have become increasingly apparent, governments of industrialized countries have enacted stringent regulations for waste disposal---a costly endeavor. An economist with the World Bank wrote (and later retracted) that "the economic logic behind dumping a load of toxic waste in the lowest wage country is impeccable and we should face up to that" (Lipman, 2011). He further noted, "health-impairing pollution should be done in the country with the lowest cost, which will be the country with the lowest wages." Evidence collected in in the late 1980's found that 'the average disposal cost of one ton of hazardous waste in Africa was between US $2.50 to $50.00, while the cost in industrialized countries ranged from US $100 to US $2,000" (Lipman, 2011).

Dumping of waste in developing countries has occurred in some cases with the consent of government and in other cases as part of an illegal scheme frequently related to strategic motives of the sending country, and corruption of the receiving government (Lipman, 2011). This dumping occurs with little regard for the people who will handle or work with the received toxic waste. Just as the motives for permitting the siting of "dirty industries" in low income, often jobless communities in the U.S. are based on promises of jobs, money and political favor, the same inducements are evident in developing countries.

The Basal Convention on the Control of Trans boundary Movements of Hazardous Waste and their Disposal (Lipman, 2011) is an international treaty that was designed to reduce the movements of hazardous waste between nations and specifically to prevent transfer of hazardous waste from developed to less developed countries (Basel, 2015). It was signed in 1989 and became effective in May,

1992. As of February, 2014, 180 states and the European Union are parties to the Convention. Fourteen (14) of 194 UN member states have not signed, including the United States.

E-Waste is another environmental health problem of recent ascent (e-Stewards, 2008). E-waste results from the rapid obsolesce of electronic gadgets in response to the high demand for new technology. Electronic equipment contains toxins, including mercury, lead, cadmium, arsenic, beryllium brominated flame retardants, and on burning, dioxins and polycyclic aromatic hydrocarbons. The latter are some of the most toxic substances to humans. Early manufactures gave little thought to their disposal, the level of toxicity in their products, or potential reclamation of non-toxic components of the electronic products.

There is little financial value in recycling outdated electronic waste in the U.S. and other industrialized countries. There are few incentives or government regulations at this time to safely manage the disposal of E-waste in industrialized countries. Many have advocated for humanitarian reasons to send old or refurbished computers and computer parts to resource poor countries. Others have found it considerably cheaper to dispose of E-waste in developing countries. The most common destinations of waste from Europe and the US are the Far East, India, Africa, and China (Greenpeace International, 2009). Targeted countries lack the proper infrastructure and regulations/or adherence for disposal of E-waste.

The growing numbers of scrap yards in developing countries seek to harvest parts and precious metals (cooper, iron, silicon, nickel and gold) from electronic equipment during recycling and sell them for profit; workers and purchasers are exposed to toxins. In developing countries, children are used in recycling, removing metal and parts by hand. Mislabeling is a common practice in shipping hazardous waste, which is in non-compliance with the requirements of the Basal Convention. Because the U.S. has never signed the Basal Convention, its shipments are not illegal. Additionally, lax maritime and immigration regulations place vulnerable populations at-risk, particularly those who are poor and people of color. The U.S. also sends much of its hazardous waste to prisons in the U.S. to process in less-regulated environments without the same worker protections and rights afforded in the private sector (Greenpeace, 2015). These are serious environmental justice issues.

CLIMATE CHANGE AND ENVIRONMENTAL JUSTICE

In recent years, among the most pressing environmental threats is climate change which has been linked with international environmental justice. The Center for Progressive Reform provides a thorough overview of international environmental justice and climate change. Global warming and climate change result from the burning of fossil fuels, including coal, gas, and oil for cars and industries. Fossil fuels are primary sources of carbon dioxide that is one of the principal gases responsible for trapping heat in the atmosphere. The release of these gases has increased by one-third since the Industrial Revolution (middle of 19th century). The rate of discharge is expected to double by the end of the 21st century, associated with increasing energy consumption in developing countries. Of significance, the United States is responsible for 25 percent of the world's greenhouse gases, although it only contains 4 percent of the world's population (Center for Progressive Reform, 2013).

"Greenhouse gases will substantially disrupt ecosystems and water supplies across the globe, intensifying dangerous weather patterns and causing a host of other health, environmental, economic, and social problems" (EPA, 2015b). The effects of climate change are most devastating to populations in urban centers and coastal regions and those dependent upon subsistence fishing. Such populations are overwhelmingly people of color and dwell in poor communities. Contributing to already existing health and environmental problems, heavy rains, floods, and hurricanes occurring over a few days can further compound the health challenges of these vulnerable communities. Similarly, rural areas in developing countries experience droughts and excessive heat, limiting hydration for humans and animals and diminishing the production of food for subsistence and as a marketable crop. According to the World Health Organization (2014a & b), of the approximately 80,000 world-wide deaths per year resulting from natural disasters, approximately 95% are in poor countries. In weather-triggered disasters, people and animals die; homes, crops, and resources are destroyed; and public health infrastructure (hospitals and clinics, roads) are damaged. These catastrophes threaten the health, food security and livelihoods of poor populations across the globe, particularly people of color. Hence, these disparities can be characterized as environmental injustices and/or environmental racism (Environmental Justice Network, 2015).

Policy debates have prevailed over time to have all nations significantly reduce the use of carbon-based fuels. "Developing countries maintain that they should not have to bear social and economic burdens of controlling

greenhouse gas emissions disproportionate to their causal responsibilities, particularly when they have yet to achieve a basic level of development" (International Environmental Justice, 2013). "The Kyoto protocol was the first agreement between nations to mandate country-by-country reductions in greenhouse–gas emissions" (The Guardian, 2011). Kyoto emerged from the UN Framework Convention on Climate Control (UNFCCC), which was signed in 1997. The UNFCCC aimed to reduce the collective greenhouse gas emissions of developed countries by at least five percent below 1990 levels between 2008 and 2012. Nearly all industrialized countries have ratified the treaty with the exception of the United States, due to the Senate's failure to ratify (The Guardian, 2011).

MOVEMENT TO GLOBALIZE ENVIRONMENTAL JUSTICE

Robert Bullard, the father of Environmental Justice, noted that "all people and communities are entitled to equal protection of environmental and public health laws and regulations" (Bullard, 1990). The concept of environmental justice applies to communities where there are perceived disadvantage, whether due to race, ethnicity, socioeconomic status, immigration status, lack of land ownership, geographic isolation, formal education, occupational characteristics, political power, gender, or other characteristics, which puts them at disproportionate risk for being exposed to environmental hazards (Claudio, 2007). The movement to globalize environmental justice parallels a series of environmentally- oriented agreements and global conventions. Following is a timeline of early, progressive milestones in the globalization of environmental justice:

1991: *Principles of Environmental Justice*, a guide for grassroots organizing, was adopted by environmental justice leaders during the First National People of Color Environmental Leadership Summit, Washington, DC.

1992: The Earth Summit in Rio de Janeiro, Brazil, lacked a focus on environmental justice within the context of human health; human health and urban centers were not considered part of the environment. However, a promising sign was that the *Principles of Environmental Justice (1991)* had been translated into Portuguese and circulated to local community leaders at the Summit.

2000: The United Nations Summit in New York adapted the eight *UN Millennium Development Goals* that included one on "Ensuring Environmental Sustainability."

2002: The leadership of the World Summit on Sustainable Development in Johannesburg, South Africa formerly recognized the issue of environmental inequity.

Advocates, including grass roots workers for environmental justice, face common concerns around the globe and share a common goal: "to improve the conditions for vulnerable populations in their nations." Throughout the world, disadvantaged communities typically suffer the highest burdens of environmental degradation. With increased attention to common international environmental justice issues, grassroots and other community-based advocacy groups have begun to communicate across national and continental borders. Such groups share concerns, approaches to advocacy, and educational materials and approaches, and coordinate strategies for addressing common offenses. Several universal concerns and international strategies are highlighted below:

- Rural farmworkers across Latin America, South Africa, among others, suffer from the effects of disproportionate exposure to pesticides and other chemical agents as well as the lack of access to health and education services. Members of the *Farmworkers Associations of Florida* have exchange visits with citrus farmers in Brazil to trade ideas on how to address environmental justice issues. The problems faced are the same across international borders: literacy, lack of government support, the strong influence of chemical industries that produce pesticides, and lack of access to health care and housing. http://www.floridafarmworkers.org/
- *Global Alliance for Incinerator Alternatives* (GAIA), headquartered in the Philippines, aims to coordinate efforts to reduce waste and stop incineration around the world with a particular focus on representing disadvantaged communities in both developed and developing countries. Its approaches include sharing information electronically, coordinating regional meetings, developing joint strategies for community organizing, and hosting international training sessions where skills can be shared. GAIA has members in over 77 countries (Claudio, 2007). http://www.no-burn.org/about
- Poor and disadvantaged communities around the globe face similar problems associated with globalization and the advance of multinational corporations. Diamond, Louisiana is home to more than 130 petrochemical facilities, incinerators, and landfills known as the Chemical Corridor or Cancer Alley. Other similar sites are victims of the "waste follows waste" phenomena (http://www.ejnet.org). See the following site for images of the Vision Project http://www.visionproject.org/images/img_magazine/pdfs/canceralley_louisiana.pdf

- Grassroots organizations such as Concern Citizens of Norco, established in 1990, engaged and confronted leadership of The Shell Corporation, owner of nearby petrochemical facilities in Louisiana, to take responsibility for the pollution and to relocate people to cleaner locations. The group used strategies such as highly visible campaigns at the state, national, and international levels, winning the community relocations and a reduction in Shell's toxic emissions by 30%. The persistent advocacy and community organizing earned Margie Richard, founder of Concern Citizens Norco, the Goldman Environmental Prize (Claudio, 2007).
- Similar cases of multiple toxic waste facilities located in the same area have spread internationally and are generally owned by multinational corporations. The Shell Corporation has multiple toxic waste facilities such as plants, landfills, and incinerators in Texas, South Durban, South Africa, the Philippines, Nigeria, Brazil, Curacao, and Russia. Lessons learned about the strategies used by *Concern Citizens Norco* have been shared around the globe, linking environmental justice issues internationally.
- One grassroots organization is Friends of the Earth International, described as the largest grassroots environmental network with 70 national members and 5,000 local activist groups who are supported in community organizing and finding common grounds for action.

International collaboration and partnering continues to grow. Collaborators share experiences, strategies and educational resources, and engage in collaborative problem solving. Common strategies for class advocacy for environmental justice include the following:

- use of media,
- mediation,
- expert testimony,
- community organizing,
- program development, and
- coalition building (Powell, 1999).

NURSES AND ENVIRONMENTAL JUSTICE

Nurses became involved in environmental justice largely through their work with communities and concern for social justice. Dorothy Powell, EdD, RN, FAAN, retired and Clinical Professor Emeriti of Duke University was one of the first nurses to become involved in the environmental justice movement. Active in the Civil Rights Movement in Vance County, North Carolina, during her youth, she credits her involvement in environmental justice to the events in Warren County, a neighboring county to Vance County. She became aware of the oil dumping there through the work of her uncle and other community leaders. In 1978, when PCB-laced oil was dumped along the roadways of Warren County, critics claimed that the area was selected because it was rural and a majority of the residents were poor, black and politically unable to determine their fate. However, hundreds of community activists worked alongside environmental groups and civil rights groups to protest the dumping and the plan for a landfill by physically blocking truck access to the landfill. This powerful example led Powell, an African-American nurse, to be professionally swayed by her commitment to equality and justice as a youth and by the discriminatory practices in neighboring Warren County.

The Mississippi Delta Region (219 counties in 7 states) was another exemplar of environmental pollution and environmental injustices. Through a 1994 agreement with the Minority Health Professions Foundation, Howard University Nursing spearheaded a nursing initiative to enhance understanding of environmental health, including environmental justice, among nursing students and practicing nurses in the region. Funding for the work was through the Center for Disease Control and Prevention (CDC) and the Agency for Toxic Substance and Disease Registry (ATSDR). Dr. Powell and nursing colleagues developed a modular curriculum *Environmental Health and Nursing: The Mississippi Delta Project* (1999), published by ATSDR. Dr. Powell gained recognition as a leader in environmental justice following publication of the modules where she authored the unit on Environmental Justice and was overall project lead. Other modules included: Environmental Health of the MDR (Hansberry & White, 1999); Role of Culture, Race and Economic Development on Environmental Health (Lassister & Mitchem-Davis, 1999); Toxicology: Major Substances Affecting the Delta (Green, Mitchem-Davis, & Richardson, 1999); Assessing Individual, Family and Community Responses to Toxic Substances (Copes & Richardson, 1999); Community Organization, Empowerment, Partnering and Education (Lassister,1999). The learning modules include learning objectives, content, learning activities, teaching methods and evaluation as well as appendices and references.

Other nurses have written on the topic to advance professional understanding of environment and social determinants, justice, and environmental justice (Butterfield, 2002; Larrson & Butterfield, 2002; Pope, Synder & Mood, 1995). Lillian Mood, RN, MSN, Director of Risk Communication and Community Liaison, Environmental Quality Control, South Carolina

Department of Health and Environmental Control chaired an Institute of Medicine committee to study enhancing environmental health content in nursing. The 1995 report, *Nursing, Health & Environment*, wove environmental justice throughout the curriculum. The report stressed the importance for nurses to understand the disproportionate risk of economically disadvantaged patients for exposure to hazardous environmental pollutants. Because nurses are accessible to members of vulnerable communities it is important for nurses to bring the concerns of impacted communities to the policy arena and health systems (Pope, Snyder, & Mood, 1995).

Patricia Butterfield, PhD, RN, FAAN, and Julie Postma, PhD, RN, of Washington State University applied an environmental justice lens to rural environmental health (Butterfield & Postma, 2009) through conceptualization of the Translational Environmental Research in Rural Areas (TERRA) Framework. Rural populations are increasingly challenged by confined animal feeding operations (CAFOs), groundwater exposures, agricultural run-off, as well as, exposure to specific hazardous waste sites located in their communities. The framework considers macro determinants as well as family level determinants to better understand the environmental health risks experienced by the rural poor.

Laura Anderko, PhD, RN, the Robert and Kathleen Scanlon Chair in Values Based Health Care at Georgetown University, has served on the National Environmental Justice Advisory Committee Research Workgroup, teaches a course on environmental justice, and worked with communities to address health disparities and justice issues. She serves to advance justice issues at not only Georgetown, but for nurses nationally. Anderko has also been selected as a White House Climate Champion for Change.

The American Nurses Association in 2007 developed the *ANA's Principles Environmental Health for Nursing Practice and Implementation Strategies* that address environmental justice, citing concerns for social justice and health disparities. The nine assumptions upon which the principles are grounded include the following: "environmental and social justice is a right of all populations and assumes that disparities in health are not acceptable."

RESOURCES

Websites

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b. EPA Plan EJ 2014 https://www.epa.gov/environmentaljustice/plan-ej-2014

c. EPA Plan EJ 2014 Progress Report (2014) https://www.epa.gov/sites/production/files/2015-02/documents/plan-ej-progress-report-2014.pdf

d. National Institutes of Environmental Health Sciences (NIEHS)-Environmental Health Disparities and Environmental Justice http://www.niehs.nih.gov/research/supported/dert/programs/justice/index.cfm

e. NIEHS-Advancing Environmental Justice http://www.niehs.nih.gov/research/supported/assets/docs/a_c/advancing_environmental_justice_508.pdf

f. NIEHS-Liam O'Fallon, Coordinator for Partnerships for Environmental Health http://www.niehs.nih.gov/research/supported/dert/phb/ofallon/index.cfm

g. Environmental Justice Network www.ejnet.org/ and http://www.ejnet.org/ej/

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Unit VI:
Climate Change

CLIMATE & HEALTH
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INTRODUCTION

There is growing evidence and concern about the impacts of climate change on health and how to respond to these impacts. Because there is limited information about health risks associated with a variety of climate changes such as heat waves, droughts, wildfires, and flooding, nurses have an opportunity to inform others and limit adverse health impacts. Nurses are one of the most trusted health professionals.

WHAT IS CLIMATE CHANGE?

Climate change is a significant and lasting change in the distribution of weather patterns over periods of time ranging from decades to millions of years. It may be a change in average weather conditions, or in the distribution of weather around the average conditions (i.e., more extreme weather events).

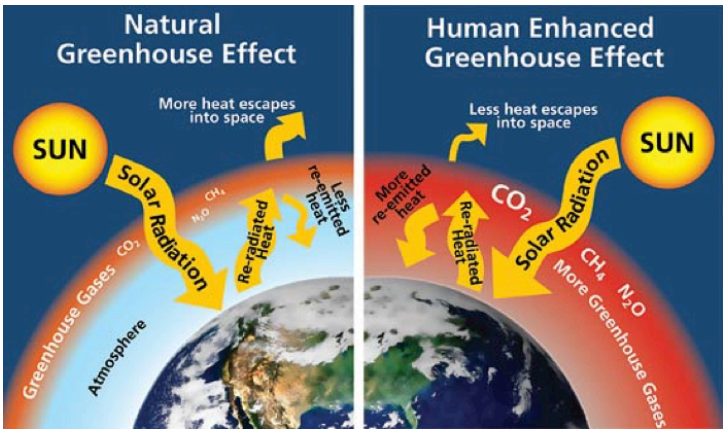

Figure 1: http://www.nps.gov/goga/naturescience/climate-change-causes.htm

Left - Naturally occurring greenhouse gases—carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O)—normally trap some of the sun's heat, keeping the planet from freezing.

Right - Human activities, such as the burning of fossil fuels, are increasing greenhouse gas levels, leading to an enhanced greenhouse effect. The result is global warming and unprecedented rates of climate change. Will Elder, NPS

The greenhouse effect is a process caused by greenhouse gases, which occur naturally in the atmosphere. This process plays a crucial role in warming the Earth's surface, making it habitable. However, greenhouse gas emissions (generated by humans) disrupt the natural balance and lead to increased warmth. Greenhouse gases in the atmosphere prevent energy from immediately escaping from the Earth's system. The greenhouse gases then distribute this energy, warming the Earth's surface and lower atmosphere (See Figure 1)

CLIMATE CHANGE AND HEALTH

Human activities are causing environmental changes of epidemic proportions. The earth's temperature is increasing, mainly as a result of human activity such as burning fossil fuel and greenhouse gas emissions. Emissions come from energy production, transportation, industry,

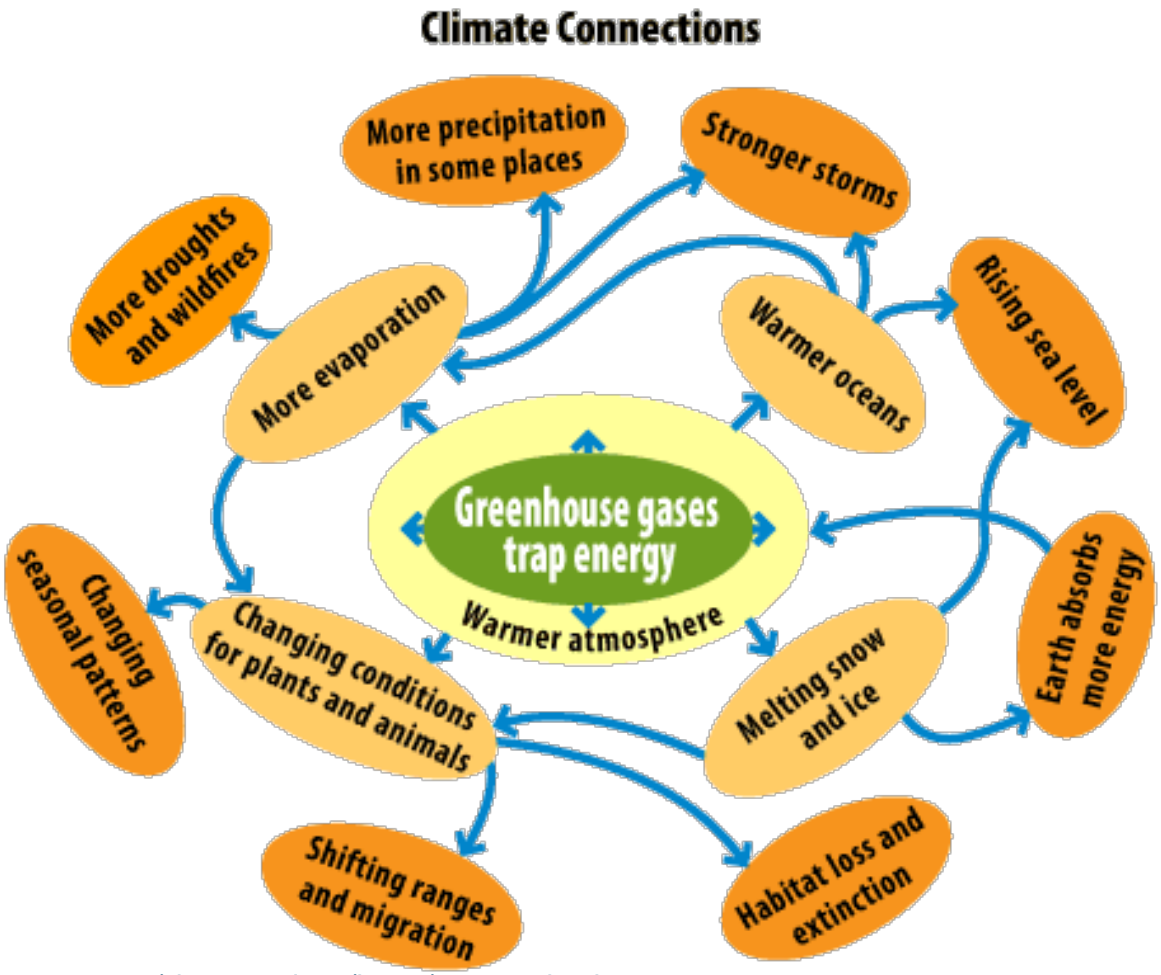

Figure 2: www.epa.gov/climatestudents/basics/concepts.html

and agriculture. These changes are occurring globally at a rate that exceeds what the world has experienced over the last 650,000 years (Parry et al., 2007).

Climate change can be experienced as extreme weather events such as heat waves, melting of snow and ice with rising sea levels, changes in precipitation resulting in flooding and drought, more intense hurricanes and storms, wildfires, as well as poorer air quality. These changes highlight the critical need for us to consider the consequences of these environmental changes on health. Health impacts can result from direct exposures to climate change through changing weather patterns (e.g., heat waves), or indirectly through changes in water availability, air quality, and resultant changes in agriculture and the economy. Learn more by viewing the EPA video on Climate 101.

Regional climate changes are on the rise. In some locations, extreme precipitation events are becoming increasingly common such as the Northeast U.S., while in other areas droughts are more frequently experienced such as in the Southwest (Portier & Tart, 2010). The map from the Natural Resources Defense Council (NRDC) (see Figure 3) shows a range of extreme weather events in the US. Health impacts should be considered based on

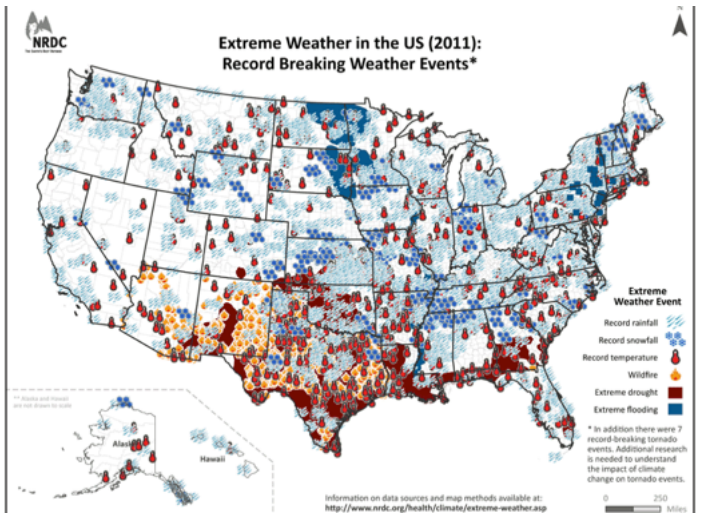

Figure 3

these climate changes, which are regionally determined. These effects will continue to increase with climate changes.

HEAT-RELATED ILLNESSES

Average global temperatures are rising and are expected to continue to increase. The health impact of heat waves is an emerging environmental health concern. Health consequences of this global temperature rise include increasing rates of heat stress and exhaustion, heat cramps, heat stroke, and death. Heatwave events including the 2003 European event with 80,000 victims and the Russian event with approximately 54,000 fatalities have focused attention on the issue. With the anticipated increase in intensity and frequency of extremely hot weather events the impact on human heath is expected to increase dramatically (Amengual, Homar, Brooks, Ramis, Gordaliza& Alonzo, 2014. Heat –related mortality in US cities is expected to more than double by the mid-to-late 21st century (Stone, Vargo, Habeeb, DeLucia, Trail, Hu & Russell, 2014). In the U.S., extreme heat events already cause more deaths annually than all other extreme weather events combined (Portier & Tart, 2010). Much of the excess mortality from heat waves is concentrated in infants, children, and those with chronic illnesses and those over 65 (Amengual, Homar, Brooks, Ramis, Gordaliza& Alonzo, 2014; Haines & Patz, 2004; Portier & Tart, 2010). Those living in urban environments are at added risk because of heat trapping materials used in the construction of roads and buildings.

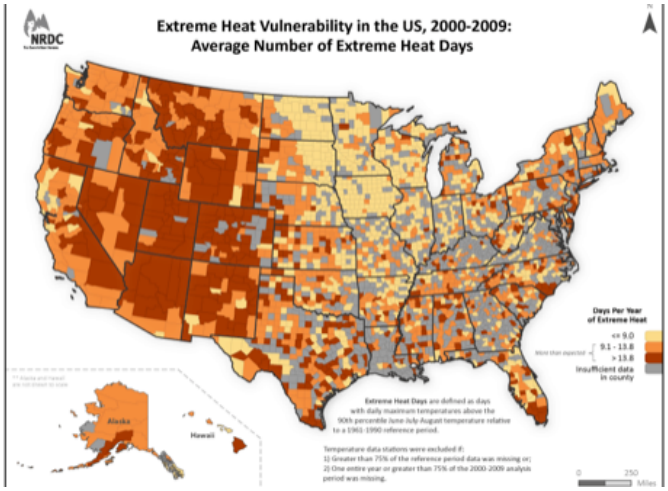

Figure 4

Additionally, cities lack significant tree cover, exacerbating the high temperatures. Cities frequently experience ambient air temperatures from 1.8–5.4°F (1–3°C) warmer than the surrounding rural and suburban areas. This "urban heat island" also absorbs heat during the daytime and radiates it outward at night, raising nighttime minimum temperatures by 22°F (12°C) (Environmental Protection Agency (EPA), 2011a).

Learn more at: http://www.nrdc.org/health/climate/

WATER SECURITY AND DROUGHT

Water security, or the reliable availability of water for drinking, agriculture, manufacturing, and many other uses, is essential to human health. However, floods and droughts that result from climate change can dramatically impact water availability and surface water quality (Delpla at al., 2009). In Southern U.S. states, droughts have become a more frequent occurrence; Western states have experienced water shortages worsened by reduced mountain snowpack attributable to global warming (Portier & Tart, 2010).

Figures 5 & 6 provide information on drought and flood vulnerability in the U.S.

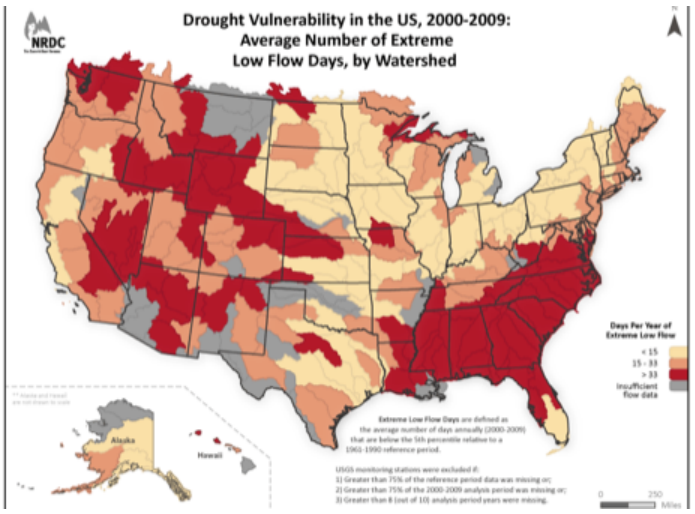

Figure 5

INSECT-BORNE DISEASES

Many major infectious disease agents (such as bacteria and viruses) and the vectors or organisms that carry them (e.g. mosquitoes) are highly sensitive to temperature and rainfall (Patz, Campbell-Lendrum, Holloway & Foley, 2005). There is potential for climate change to impact the range and incidence of vector borne and zoonotic diseases which are influenced by the ecology of insects and on the life cycles of the disease-causing germs they carry (www.cdc.gov/ncezid). As environmental conditions change, the geographic range of the vectors for illnesses is extended, increasing the potential for infection. For example, as temperature increases, the malaria parasite reproduces at a higher rate and mosquitoes feed more

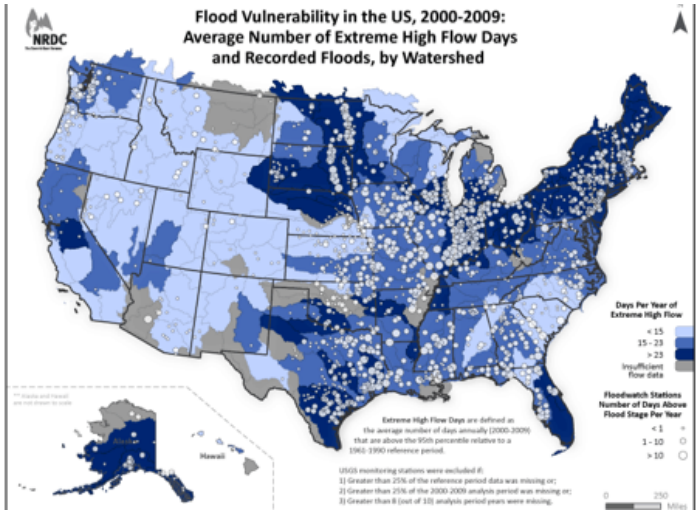

Figure 6

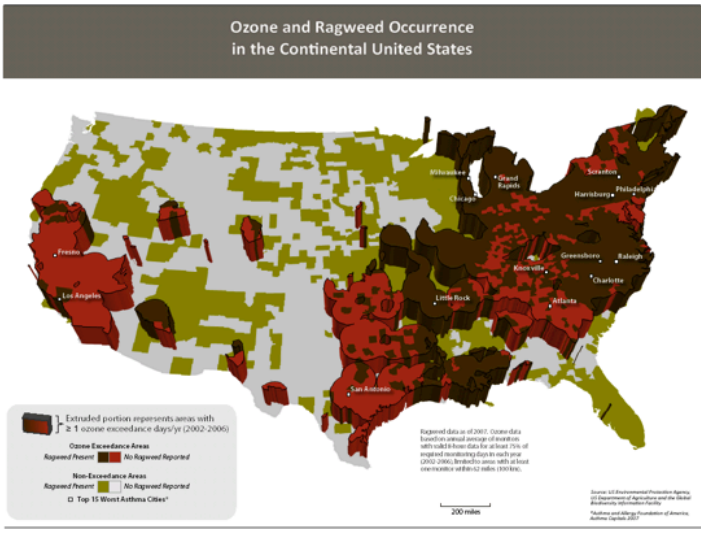

Figure 7: https://www.nrdc.org/sites/default/files/sneezing-report-2015.pdf

frequently. Changes in climate may make insect-borne diseases harder to control.

RESPIRATORY DISEASES AND PREMATURE DEATH

It is predicted that health impacts from climate change and ozone pollution in 2020 will result in significant increases in acute respiratory symptoms, asthma-related emergency room visits, weather-related hospital admissions for infants and the elderly, lost school days, and premature deaths (Costello et al., 2011). Small changes in temperature (a degree or two) coincide with increasing ground-level ozone and, with it, a significant effect on death rates. An estimated 3,700 deaths annually can be attributed to these small increases in ozone levels (Bell et al., 2004; Bell et al., 2008; Perera & Sanford, 2011).

Climate change and resulting air pollution poses a serious threat to respiratory health (Babin et al., 2007; Ebi et al., 2006; Ebi & McGregor, 2008; Parry et al., 2007). There is now strong evidence linking changes in the seasonal pattern of allergenic pollen and excess death from heat waves. Global warming has caused an earlier onset of the spring pollen season in the Northern Hemisphere (Metz et al., 2007) and increased the production of allergens (e.g., ragweed). Temperature increases and increased carbon dioxide (CO_2) concentrations produce earlier flower blooming, affecting the timing and distribution of allergens such as pollen. It is anticipated that respiratory allergies and asthma will become more common and severe because of increased exposure to pollen, molds, and air pollution as a result of climate change (D'Amato et al., 2010; Ebi et al., 2008). Figure 7 shows ozone and ragweed occurrence in the U.S.

MENTAL HEALTH

Climate change may affect mental health directly by exposing people to trauma (Berry, Bowen & Kjellstrom, 2010). Adverse psychiatric outcomes are well-documented in the aftermath of natural disasters (Page & Howard, 2010), and can include both acute traumatic stress and more chronic stress-related conditions (such as post traumatic stress disorder). Extreme heat events, which will become common as global temperatures rise, may be associated with a general increase in aggressive behavior, higher rates of criminal activity, and increased suicide rates (Berry et al., 2010). There will likely be an increase in the overall burden of mental disorders worldwide as extreme weather conditions and natural disasters can lead to displacement, loss, and social disruption. Those who are already vulnerable to stress-related disorders and mental health disease are at even higher risk following extreme weather conditions.

FOOD SECURITY

Climate change compromises agricultural production, especially in areas with limited capacity to adapt to these variations (Muller et al., 2011; Burke & Lobell, 2010). Climate change is predicted to worsen malnutrition in the developing world (Parry et al., 2007). Extreme weather events and changes in temperature and precipitation patterns can directly damage or destroy crops and other food supplies. This may happen seasonally, but is anticipated to become a chronic problem under changing climate conditions. (Portier & Tart, 2010). Modeling studies have shown that corn and soybean yields in the U.S. fell by 17% for every degree rise in growing season temperature (Lobel & Asner, 2003). It is predicted that by the end of

the 21st century one half of the world's population could face severe food shortages due to the impact of rising temperatures on staple food crops. In subtropical and tropical regions, staple food crops could fall by 20-40% (Battisti & Naylor, 2009).

NATURAL DISASTERS AND CLIMATE CHANGE

Extreme weather conditions result in disasters. It has become evident both nationally and globally, that climate change in the form of extreme weather events such as hurricanes, floods, heat waves, droughts, and tornados requires us to protect our communities through adaptation and preparedness measures. Many municipalities and states within the U.S. have outlined preparedness and/or adaptation plans to address disasters from extreme weather events. Georgetown Climate Center offers an Adaptation Clearinghouse with policy and adaptation toolkits to assist communities in preparing for extreme weather events.

With the increase in the intensity and frequency of natural disasters there is the threat to public health from fallout of energy sources such as nuclear power. One recent example is the nuclear crisis in the Japan crisis post-tsunami in 2011 (http://www.pbs.org/newshour/news/japan-disaster/; http://www.usgs.gov/newsroom/article.asp?ID=2727&from=rss_home).

The promotion of sources of energy such as solar and wind would avoid environmental concerns that are present with nuclear energy, as natural disasters increase in the number and severity with climate changes. A recent study found that wind turbines can actually reduce winds from hurricanes, providing in essence, a protective effect.

Additional benefits of energy sources such as solar and wind are that these are renewable. This means that energy is generated from natural resources that are naturally replenished. Nurses must advocate for clean energy policies that support safe, renewable sources of energy such as wind, solar, biomass, geothermal, hydro, tidal, and wave. A comprehensive State Energy and Analysis Tool that can provide a state-level overview of the energy sector and clean energy options can be found at: State Energy Analysis.

For more information about climate preparedness watch the TED Talk: "Let's prepare for climate change" by Vicki Arroyo.

POPULATIONS AT GREATEST RISK

Populations considered most vulnerable to the adverse effects of climate change, lack the ability to cope with the consequences of climate change. Women and children, older adults, and the poor are typically more susceptible to illness and death associated with heat- and extreme weather events, as well as waterborne, vector-borne, and food-borne illnesses.

Women and Children

Women and children are particularly vulnerable to extreme weather events. For example, women and children represented 90% of all victims in the 1991 cyclone in Bangladesh (Homer, Hanna & McMichael, 2009). Climate change will increase the risk of infant and maternal mortality, birth complications, and poorer reproductive health, especially in the tropical, developing countries (Rylander, Odlamd & Sandanger, 2013).

Pregnancy and Birth Outcomes

While the study of the potential influences on pregnancy and prenatal complications related to climate change is an emerging area of research, there is already evidence suggesting the adverse impacts associated with extreme heat and air pollution. In a study of approximately 60,000 births in California increased temperatures were significantly associated with preterm birth for all mothers, regardless of maternal racial/ethnic group, maternal age, maternal education, or sex of the infant. An 8.6% increase in preterm delivery was associated with a 10°F increase in the weekly average temperature, with greater risks observed for younger mothers, Blacks, and Asians (Basu et al., 2010). Deschenes, Greenstone & Guryan (2009) found the effect of extreme heat during pregnancy to be most important in the second and third trimesters on US births. Subramanian (2007) found evidence of associations between climatic variables, such as increased humidity, and pre-eclampsia and eclampsia which can adversely impact both mother and the fetus. Evidence also supports a strong causal relationship between air pollution and respiratory deaths in the post-neonatal period (Radim et al., 2005). As temperatures continue to increase in some regions of the world, consideration of its impact on birth outcomes is critical (Anderko, Chalupka, & Anderko, 2012).

Children

Children spend more time than adults outdoors, breathe more rapidly than adults, and are still developing their respiratory structures. There is strong evidence of associations between respiratory disease and a wide range of environmental variables impacted by climate, such as heat waves. Additionally, children are less able to deal with heat and are more susceptible to dehydration. They are therefore, more vulnerable to heat-related disease and death and will suffer disproportionately as the Earth warms (Ebi & Paulson, 2007; Sheffield, & Landrigan, 2011).

Elderly

Advanced age is one of the most significant risk factors for heat-related death in the U.S. because older adults are less able to regulate extremes in temperatures (Physicians for Social Responsibility (PSR), n.d.). In addition, older adults often have pre-existing medical conditions, such as cardiac and respiratory illnesses, that are made worse by climate related-conditions (Balbus & Malina, 2009). Finally, older adults are also more likely to live alone, and have limited mobility, cognitive constraints, and reduced social contacts, all factors that further increase their vulnerability (Anderko & Chalupka, 2012; Anderko & Chalupka, 2013; Amengual, Homar, Brooks, Ramis, Gordaliza & Alonzo, 2014)).

Poor

Those living in poverty are also extremely vulnerable to many of the health effects of climate change. Existing illnesses and challenges in daily life are further complicated by disruptions in access to public services, displacement from homes and the need to migrate with limited transportation options, and increased stress as a result of extreme climate events (Anderko & Chalupka, 2012).

Table 1 summarizes information related to health effects and populations most affected by extreme weather events.

Weather Event	Health Effects	Populations Most Affected
Heat waves	Heat Stress	Extremes of age, athletes, people with respiratory disease
Extreme weather events (rain, hurricane, tornado, flooding)	Injuries, drowning	Coastal, low-lying land dwellers, low socio-economic status (SES)
Droughts, floods, increased mean temperature	Vector, food, and water borne diseases	Multiple populations at risk
Sea-level rise	Injuries, drowning, water and soil salinization, ecosystem and economic disruption	Coastal, low SES
Drought, ecosystem migration	Food and water shortages, malnutrition	Low SES, elderly, children
Extreme weather events, drought	Mass population involvement, international conflict	General population
Increases in ground-level ozone, airborne allergens, and other pollutants	Respiratory disease exacerbations (COPD, asthma, allergic rhinitis, bronchitis)	Elderly, children, those with respiratory disease
Climate change generally; extreme events	Mental health	Young, displaced, agricultural sector, low SES

Table 1: Center for Disease Control: Weather Events, Health Effects, and Populations Most Affected

Source: http://www.cdc.gov/climateandhealth/pubs/Climate_Change_Policy.pdf

ADVOCACY: THE CLEAN AIR ACT AND CLIMATE

Clean air, with reductions in carbon pollution is essential for a healthier climate and public. The health, environmental, and economic impacts of air pollution are significant. Each day, air pollution causes lost days at work and school, as well as reduces agricultural crop and commercial forest yields by billions of dollars each year.

The original Clean Air Act of 1963 was passed and established funding for the study of and cleanup of air pollution. However, there was no comprehensive federal response until Congress passed a much stronger Clean Air Act of 1970. That same year Congress created the EPA and gave it the primary role in carrying out the law. In 1990, Congress revised and expanded the Clean Air Act, providing EPA broader authority to implement and enforce regulations reducing pollutant emissions.

By reducing air pollution, the Clean Air Act has led to significant improvements in human health and the environment in the United States.

Since 1970,

- The six commonly found air pollutants have decreased by more than 50 percent,
- Air toxics from large industrial sources, such as chemical plants, petroleum refineries, and paper mills have been reduced by nearly 70 percent,

- Production of most ozone-depleting chemicals has ceased.

At the same time,

- The US gross domestic product, or GDP has tripled
- Energy consumption has increased by 50 percent
- Vehicle use has increased by almost 200 percent.

In 2013, President Obama initiated carbon pollution standards as part of his Climate Action Plan. His speech addressing his Climate Action Plan may be viewed at https://www.youtube.com/watch?v=r4lTx56WBv0. His climate action plan can be found at: http://www.whitehouse.gov/share/climate-action-plan. In 2014, President Obama unveiled the Clean Power Plan with Carbon Pollution Emission Guidelines .

NURSES: OPPORTUNITIES FOR ACTION

Climate change will cause enormous health challenges, which will require a significant response from nurses. According to Dr. Margaret Chan, Director General of the World Health Organization (2007), "We have compelling reasons for doing so. Climate change will affect, in profoundly adverse ways, some of the most fundamental determinants of health: food, air, water."

Nurses have a significant role and professional responsibility to act. The American Nurses Association has taken a stand on climate and the role of nurses through resolutions introduced in 2008. Nurses must first become informed about the health implications of climate change in order to educate clients and communities. A list of key resources can be found on the Health Care Without Harm website.

The Alliance of Nurses for Healthy Environments (ANHE) offers a free online media module series on Health, the Clean Air Act and Climate Change.

Nurses have been actively advocating for the Clean Air Act and its positive impact on health (and the environment) through letter writing campaigns, op-eds, interviews with the media, and providing testimony to the Environmental Protection Agency and Congress. See an example of testimony about the Clean Air Act at: http://nursingworld.org/CleanAirAct-Testimony.aspx.

In July 2013 the White House honored two nurses with the Champions of Change award for their work in Public Health and Climate: Laura Anderko and Therese Smith. Read their stories at http://www.whitehouse.gov/blog/2013/07/12/changing-lens-communicating-public-health-issues and http://www.whitehouse.gov/blog/2013/07/17/protecting-human-health-changing-climate

ADAPTATION

Implementing steps to reduce Green House Gas (GHG) emissions is only part the challenge of addressing climate change. Scientific evidence indicates that even if GHG emissions were to be stabilized at current levels, the earth is already committed to significant warming by the end of the century. Climate change preparedness projects must begin immediately, as we advocate for regulations to reduce GHG emissions (Knowlton, 2008). Nurses can play a vital role in local and regional climate adaptation strategies by preparing their communities to be resilient and best cope with the anticipated health impacts of climate change (Gould, 2011; McMichael et al., 2008). Georgetown Climate Center has an Adaptation Clearinghouse with information for local communities and a listing of adaptation plans for each state in the U.S..

Effective advocates influence public policy, laws, and budgets by using facts, their relationships, the media, and messaging to educate government officials and the public on the changes they want to bring for a healthier environment. Tips for advocating effectively include:

- Know the facts: To gain and maintain credibility, it is critical that you have the all of the facts on both sides of any issue. Having this information will help you in conversations with government officials, the media, other advocates, and the general public.
- Use the facts: Any position you take should be grounded in the facts. It is often helpful to put your facts into one-pagers that you can distribute. Many organizations such as the American Lung Association provide talking points or letters that can guide you (See Appendix A).
- Have clear and concise message: Government officials, the press and the general public do not have time for long-winded conversations or documents—you need to get to your point quickly and concisely. And remember to watch out for the jargon and acronyms used in different fields—you want everyone to understand the issues you are raising.
- Nurture relationships and work collaboratively: Advocacy is a joint venture- you need to find your allies and work with them. Your chances of success are much greater when there are large numbers of organizations and people on your side. Whenever possible, be sure you and your allies have consistent data and the same messages.
- Engage the public: Use the media, social media, petitions, letters, e-mails and other grassroots

strategies to engage as many people as you can. Remember numbers speak loudly to elected officials!

- Make your voice heard! Advocacy is not the place for being shy. Make sure you spread the word—through meetings with government officials, press conferences, letters, petitions, rallies, and phone calls. And don't forget to talk about what you are advocating for at dinner parties and social events-- you never know who can become a useful ally.
- Say thank you: Remember that everyone is busy and their time is valuable. Keep your meetings short and always say thank you afterwards. When your advocacy is a success, always thank everyone who helped you achieve your victory!

CONCLUSION

Nurses are trusted by society worldwide. They must advise and advocate for a cleaner environment that mitigates climate changes through strong clean air and energy policies. Also nurses must help to prepare communities to adapt to extreme weather events resulting from climate changes.

APPENDIX A - CLIMATE CHANGE RESOURCES

Interviews:

- Dr. George Lakoff- climate change - NPR interview - talks about framing with linguistics
- Smog Deaths in 1948 led to Clean Air Laws - NPR Interview

Webinars/Videos:

- 350.org
- American Public Health Association
- Climate Adaptation Mitigation and E-Learning
- Climate change and health webinar sponsored by Health Care Without Harm and the Alliance of Nurses for Healthy Environments:
- Climate Reality Project
- National Climate Assessment Webinars

Websites:

- Addressing climate change in the health care setting
- Anesthetic gases and carbon footprint
- Population Connection
- Climate 911-- Dr. Wendy Ring's U.S. Bike Tour
- Climate Change Action Info
- Climate Communication
- Environmental Protection Agency's Carbon Footprint Calculator
- EnviRN - The Alliance of Nurses for Healthy Environments (ANHE)
- Green Guide for Healthcare
- Health Care Without Harm
- Intergovernmental Panel on Climate Change
- Physicians for Social Responsibility
- Practice Green Health
- League of Conservation Voters
- Reducing Carbon Emissions: State and Company Successes
- US Climate Action Network (USCAN)
- USCAN Member Action Centers
- USCAN Climate Risks and Preparedness
- USA Today: Weathering Change – information about allergies and climate change

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Unit VII:
Energy

INTRODUCTION

The energy that we use to heat our homes, run hospitals and clinics, and transport our food enhance our lives, but energy choices also have an impact on health. Nationally, the effect of energy on health of the communities and vulnerable populations has been recognized in the Clean Power Plan. This national plan for energy is targeted to move away from greenhouse gas emitting fossil fuels (coal, gas, oil) and expands renewable energy (solar, wind, geothermal). Nurses have played a role in articulating the impact of energy extraction on communities through research, advocating for safer alternatives, and educating other nurses and health providers of environmental health risks of energy extraction (mining). Unit VII introduces the ANA resolution on healthy energy and addresses the important topic of Hydraulic Fracturing (Fracking) and its implications for health.

INTRODUCTION TO THE ANA ENERGY RESOLUTION: NURSE'S ROLE IN RECOGNIZING, EDUCATING AND ADVOCATING FOR HEALTHY ENERGY CHOICES TO THE AMERICAN NURSES ASSOCIATION HOUSE OF DELEGATES

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Nurses caring about our energy choices? Really? What does this have to do with meeting the health needs of the patients, families, and communities that we serve? The truth is our energy choices matter. They affect communities where fossils fuels such as coal, oil and gas are extracted from deep within the earth. Additionally, burning fossil fuels for energy also contributes to greenhouse gases that lead to global climate change.

We have long been aware of the occupational risks of coal mining in this country from black lung disease to mining disasters such as West Virginia's Upper Big Branch mine explosion that claimed the lives of 29 minors in 2010. We are also aware that coal mining, including mountaintop removal, has had negative environmental consequences on air and water quality, thus impacting the communities where mining occurs. But burning coal for energy also leads to air quality problems and contaminated water for communities beyond the source of the coal. Furthermore, extraction of coal, oil, and natural gas can influence local air quality and contribute to greenhouse gas emissions that lead to climate change.

Health impacts of a newer method of oil and gas extraction by unconventional high volume hydraulic fracturing (or fracking) can be found in the next chapter of this unit. Unconventional natural gas development (UNGD) and oil extraction has been identified as an energy boom in the U.S. and is seen as a bridge to the U.S. energy needs. However, like other extraction methods, this energy technology is not without health risks. Pennsylvania's Department of Environmental Protection air quality monitoring from 2011-2013 showed an increase of 19 percent for volatile organic compounds (VOC's), 12 percent for particulate matter, and 8 percent for nitrogen oxides in 2013 when compared to 2011 in counties where UNGD was occurring (see air quality section for health impacts of these pollutants). The report did show, however, methane and carbon monoxide emissions have decreased since Pennsylvania started measuring in 2011 (Phillips, 2015). This decrease was reportedly related to improvements in natural gas well completion processes and indicates that with improved processes we are able to extract more safely. Part of insuring improvements in processes to protect community health was educating other nurses and advocacy on the part of ANHE nurses from Pennsylvania and Maryland. So, yes, nurses must be aware of the health impacts of energy and continue to educate others about the health impacts. Nurses must advocate to protect our own health, the health of our families, and the most vulnerable, especially the world's poor.

In 2012, nurses, Nina Kaktins, MSN, RN, Ruth McDermott-Levy, PhD, MPH, RN, and Barbara Sattler, DrPH, RN from Pennsylvania State Nurses Association and Maryland Nurses Association, collaborated to submit a resolution, Nurse's Role in Recognizing, Educating and Advocating for Healthy Energy Choices to the American Nurses Association House of Delegates. The ANA House of Delegates unanimously accepted the resolution. This resolution outlines ANA's positon on our energy choices to protect the health of our patients, family and communities.

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UNCONVENTIONAL NATURAL GAS DEVELOPMENT AND NURSING

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INTRODUCTION

Since the 1990s, unconventional natural gas development (UNGD) activities have increased across the United States. UNGD includes the entire process from choosing the site for the drilling (fracking) to the delivery of the gas to the consumer. Drilling and associated industrial activities are often in close proximity to residential areas including schools, play grounds, and farms. People living in regions where UNGD is occurring have reported experiencing health effects from these activities. The purpose of this chapter is to describe an overview of the process involved in UNGD and the emerging issues related to health and the environment that nurses need to consider when assessing their clients for possible environmental exposures.

OVERVIEW OF THE PROCESS OF UNGD

The process of UNGD includes hydraulic fracturing or fracking. The fracking process begins with dynamite detonations to identify the geological formations under the surface prior to the drilling.

The initial drilling is done vertically down to a distance of approximately 8000 feet. After the vertical shaft is completed, horizontal shafts are drilled. Approximately 2-5 million gallons of water mixed with chemicals and propping materials such as sand are injected under high pressure down the well and out into the horizontal shafts. The high pressure is needed to create openings or fractures in the gas-bearing rock. The propping material enables the fractures in the rock to remain open and provide a way for the trapped gas to flow out of the horizontal shafts into the well. The released gas that flows into the well also contains waste water. The waste water includes the chemical mixture and salts injected into the well, as well as the heavy metals, hydrocarbons, radioactive materials and other substances from deep under the surface of the earth. At the well, the gas and the waste water are separated, and the waste water is stored in open pits or in tanks near the well (http://www2.epa.gov/hydraulicfracturing).

In some areas, such as Western Pennsylvania, the open pits, or impoundments, are lined with black plastic. Misters are used in these impoundments to spray the waste water into the air to aid in evaporation. Any waste water that remains is moved via tanker trucks to be disposed of in deep injection well sites often in another state or miles from where the drilling took place. An estimated 60% of the water injected into the wellhead during the drilling process will come back with the gas. This growing volume of waste water can also be recycled to be used in multiple wells (Easton, n. d. retrieved from http://www.waterworld.com/articles/wwi/print/volume-28/issue-5/regional-spotlight-us-caribbean/fracking-wastewater-management.html).

Drilling is a 24-hour/7 day per week operation. There is constant activity related to the drilling site including transportation of materials, machinery, water, sand, and chemicals by diesel trucks. Often times the drilling sites are located in rural regions. It is not unusual for these diesel trucks to have to travel over one lane, dirt roads to and from the drilling site.

Activities at the drilling site include gas production and onsite condensing stations. After fracking is completed, flaring is often used as a controlled burning of natural gas at the well site to test and stabilize the well. Flaring can last for several days or weeks. This process of burning natural gas is also used during emergencies at processing plants and compressor stations or to take care of small amounts of waste gas. Flaring involves bright columns of flames shooting into the sky associated with noise 24 hours per day (Penn State Extension, 2013).

Additional components of UNGD include compressor stations which are used to maintain pressure and velocity of the natural gas to keep the gas flowing in the pipelines to distant ports and refineries. Pipelines can run for hundreds of miles through residential and rural areas to the final destination (Keystone Energy Forum, n.d.). Herbicides are often used to control the vegetation along the pipelines. The capacity of pipelines to transport the products from the site of extraction to the final destination is augmented by railroad tank cars. These tank cars carrying flammable fluids pose a risk in the event of puncture or accident (http://time.com/2970282/a-year-after-a-deadly-disaster-fears-grow-about-the-danger-of-crude-oil-shipped-by-rail/; http://www.phmsa.dot.gov/hazmat/safe-transportation-of-energy-products; Taylor, 2013).

OVERVIEW OF CHEMICALS, FINE PARTICULATES, DIESEL EXHAUST ASSOCIATED WITH UNGD

Exact chemical composition of fracking fluid is proprietary information and because of this, specific chemicals cannot be identified at any one drilling site. However, Colburn and

colleagues (2011) identified 353 chemicals used in the fracking process. These chemicals were found to result in adverse health effects involving the integument, respiratory, cardiovascular, gastrointestinal, nervous, and endocrine systems. A percentage of these identified chemicals were known carcinogens, neurotoxins, and endocrine disruptors. Different times and lengths of exposures to these chemicals can result in different symptoms and diseases. Epidemiological studies have shown that some cancers take years to develop after exposures to carcinogens used in other industries (EPA, 2000a, Benzidine).

It is well documented that endocrine disruptors may take a generation or generations to manifest their effect on human and animal reproduction (Alonso-Magdalena, Morimoto, Ripoll, Fuentes, & Nadal, 2006; Timms, Howdeshell, Barton, Bradley, Richter, & von Saal, 2005; Vandenberg, Maffini, Wadi, Sonnenschein, Rubin, & Soto, 2007).

The following substances have been identified in fracking fluids: barium, arsenic, volatile organic compounds, poly-aromatic hydrocarbons, benzene, ethybenzene, toluene, and xylenes (BTEX), methylene chloride, glycols, radium, acetaldehyde and formaldehyde, and microbial contamination and biocides (Colburn, Kwiatkowski, Schultz, & Bachran, 2011). Benzene is a known carcinogen (EPA, 2000a). Toluene is considered a "potential occupational carcinogen" and is associated with euphoria, hallucinations, dizziness, slurred speech, respiratory symptoms, depression, and coma and death with large acute exposures. Chronic exposures to toluene may result in liver, kidney and neurological damage, contact dermatitis, and is considered a possible teratogen. Xylenes, although not classified as carcinogen at this time, has been known to cause irritation of the eyes, nose, throat and gastrointestinal and neurological symptoms with acute exposure. Long term exposure has been known to result in headaches, tremors, fatigue, dizziness, lack of coordination, as well as respiratory, kidney and cardiovascular disease (EPA ,2000b).

Fine particulate matter, a result of silica dust and carbon monoxide, has also been identified in and around drilling sites (Esswein, Kiefer, Snawder, & Breinstein, 2012). Crystalline silica is a known lung carcinogen. Silicosis develops after chronic exposure. Inhalation of silica dust is associated with chronic obstructive pulmonary disease, chronic renal disease, and autoimmune diseases (Esswein, Kiefer, Snawder, & Breinstein, 2012).

Diesel exhaust is associated with human health hazards (National Center for Environmental Assessment, Office of Research and Development, U. S. EPA, 2002). Long term inhalation is "likely" to result in a lung cancer risk to humans as well as cause lung disease. Acute, short term exposures can result in irritation and inflammation as well as cause an exacerbation of pre-existing conditions such as allergies, bronchitis and asthma (EPA, 2014a). Diesel exhaust also contributes to the dissemination of other toxins such as fine particulates and nitrogen oxides.

ENVIRONMENTAL HEALTH ISSUES

The environmental health issues surrounding the process of UNGD are complex. There are three major sources of exposure to chemicals and other potential health hazards associated with UNGD. Individuals could be exposed through contact with contaminated air, water, or soil. Potential sources of air contamination include fine particles of silica dust from the sand used in the fracking fluid, diesel exhaust, emission from the well head, flaring off of the methane, evaporation of waste water from impoundments, venting of condensation tanks during filling, compression stations emissions, and herbicide spraying to control vegetation along pipelines.

A potential source of water & ground soil contamination includes leakage that seeps from impoundments into the ground soil. Contaminated soil can affect food supply in the form of crops and meat production through undetected animal exposure. Because animals reproduce more frequently than humans, animal health can be an early indication of potential impacts of UNGD on human health (Bamberger & Oswald, 2012).

Individuals living in close proximity to extraction activities or downwind from the industrial sites have reported negative health effects (Bamberger & Oswald, 2012; McKenzie et al, 2012; Resick, Knestrick, Counts, & Pizzuto, 2013; Subra, 2009, 2010; Wilson, Subra, & Sumi, 2013). Negative health effects include burning of the eyes, decrease in the ability to smell, bleeding from the nose, "a sweet metallic taste" in the mouth, and a gradual decrease in the ability to taste. Commonly reported dermatological signs and symptoms include a burning sensation, lesions, rashes, and chemical burns. Pulmonary complaints include an increase the symptoms of chronic conditions such in asthma and chronic obstructive pulmonary disease. Potential exposures occur to air borne contaminants such as fumes from evaporation of the drilling fluids in fracking pits. Individuals living near industrial sites may experience air contaminated by increased traffic from diesel trucks and the fine particulates of silica dust from the sand used in the fracking fluids (Saberi, Propert, Powers, Emmett, & Green-Mckenzie, 2014). Gastro-intestinal symptoms of abdominal pain have been reported. Neurologically, individuals have reported headache, dizziness, and confusion (Wilson, Subra, & Sumi, 2013).

McKenzie et al. (2012) found that people living within a half mile of exposure to air pollutants experienced greater health risks. In addition to physical complaints, individuals close to UNGD sites also have reported feelings of powerlessness (Resick et al., 2013) as well as generalized symptoms such as stress (Greiner et al, unpublished manuscript), fatigue, and sleep disturbance. Non chemical exposures may include continuous noise created by the increased truck traffic, compressor stations, and drilling operations and continuous light related to flaring.

ENVIRONMENTAL HEALTH CONCERNS FOR SPECIAL POPULATIONS

Young children, pregnant women, and older adults are at greater risk for exposures to environmental toxins (EPA, 2010). Children are more vulnerable to environmental toxins. They are smaller in stature which makes them closer to the ground surfaces to absorb contaminants. Children have a faster metabolism rate so their breathing is faster. Faster respiration enables the absorbing of potential contaminates at a faster rate than that of adults. Associations between children living near high traffic areas and childhood asthma have been reported in the literature (Li, Williams, Jalaludin, & Baker, 2012).

Childbearing age women and pregnant women are also vulnerable to these toxins. The literature reports low birth weight, small for gestational age, and low APGARs reported in births of women living near UNGD activities (Hill, 2012). Also congenital heart defects and a trend toward neural tube defects were found in mothers living near UNGD activity (McKenzie, Guo, Witter, Savitz, Newman, & Adegate, 2014)

Older adults who tend to have chronic illnesses are at risk. The literature reports an exacerbation of symptoms related to diesel exhaust that may aggravate chronic lung problems. Long term exposure has been reported to increase the risk of cancer of the lung (Office of Environmental Health Hazard, California, 2007).

COMMUNITY HEALTH ISSUES RELATED UNGD

The literature reports changes in local communities brought about the "boom and bust" cycles of the drilling activities (Perry, 2012). One example, North Dakota, has experienced one of the largest economic booms in the country due to the UNGD. The crime rate has increased in the boom period to more than 7% in the last year of this boom cycle (Michael, 2013). In Pennsylvania, cases of sexually transmitted infections were found to be higher in rural counties where UNGD occurred compared to rural counties where no UNGD was occurring (Food & Water Watch, 2013).

IMPLICATIONS FOR NURSES

Standard of Practice and Education

The 2010 edition of the American Nurses Association (ANA) publication, *Nursing: Scope and Standards of Practice*, included a new Standard 16: Environmental Health. This Standard mandated that environmental health knowledge and skills are a requirement for all nurses at the entry level of practice and this has been supported in the third edition in 2015 (ANA, 2010). Because the process of UNGD is a relatively new environmental health concern, nursing education at both the entry level and advanced practice level may not include information about the need to assess for possible environmental exposure as a cause of presenting illnesses.

Clinical Practice

For all levels of nursing, it is important to assess if the client is living near or working near or with oil and gas drilling activities; if so, a more in depth assessment needs to be completed. This screening may include an individual exposure health assessment, a home exposure assessment, and a residential environmental screening. In rural areas, special consideration must be given if the water source is well water and must include questions about animal exposure such as livestock and health of pets.

Research

Research is needed to investigate not only the health but also the economic, social and long range greenhouse effects of UNGD. Without such studies, humans, animals, and the earth will potentially be at great risk now, in the future, and for generations to come.

Advocacy

Nurses and other health care providers have an ethical obligation to "first do no harm" and to promote disease prevention and health promotion interventions. When there is an absence of evidence-based studies, the Precautionary Principle serves as a guide to practice. The *Precautionary Principle* states "When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically" (Wingspread, 1998). The American Nurses Association adopted the Precautionary Principle in 2003 (Nursing World, 2003).

Nurses play a vital role in the advocacy of health for individuals, families, and communities. In this role, the nurse has a great deal to contribute by staying informed of environmental health issues, meeting with elected officials, taking part in community meetings, and sharing

information about health and safety issues in the community.

OIL AND GAS DRILLING AS A GLOBAL HEALTH PHENOMENON

Concern about environmental health and UNGD is a global issue. Several European countries including France and Bulgaria have placed a ban on UNGD (Finkel & Hays, 2013). Drilling has resumed in the United Kingdom after a short halt related to two small earthquakes (Finkel & Hays, 2012). China (Ng, 2013) and Poland have begun exploration of UNGD. Africa is in a position to be a large region for UNGD (Weeden, 2013).

SUMMARY

The environmental health concerns involved in UNGD are complex. Little is known about the health effects related to UNGD. Environmental health concerns related to UNGD are a global health concern and not limited to drilling in the United States. Contamination concerns are not from one source, but from multiple routes including possible contamination from air, water, and ground sources. The profession of nursing is charged with having environmental health knowledge and skills. Nurses are held to the standard of including environmental health knowledge and skills in their practice which includes assessment for environmental health concerns.

ONLINE RESOURCES

Since early 2012, the Southwest Pennsylvania Environmental Health Project (SWPA-EHP) has been in operation in Southwestern Pennsylvania, an area which has experienced a proliferation of natural gas drilling. The purpose of this private non-profit group is to provide education and referrals to area residents experiencing adverse health and resources to health care providers in the areas. This organization has environmental health assessment tools related to oil and gas drilling activities available for health care providers:

- Individual Exposure Health Assessment
- Home Exposure Assessment related to Oil and Gas Drilling Activities

Tox Town is a good online resource to learn sources of toxic chemical exposure and how this exposure could affect health. *Tox Town* also includes an overview on fracking

Physicians Scientists and Engineers for Health Energy (PSE) has developed online educational modules that can be accessed for no cost.

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Unit VIII:
Advocacy

INTRODUCTION

Nurses are uniquely educated and positioned to advocate for policies that improve the health of populations and communities. The nursing process, though commonly applied in the clinical practice setting, provides the foundation for advocacy and policy in a broader setting. According to Gallup polls, nurses are the most trusted professionals and therefore play a critical role in shaping policies aimed at protecting the public. Unit VIII demonstrates how the steps in the nursing process-- assessment, diagnosis, implementation and evaluation-- are readily transferable to the policy arena. Unit VIII also provides guidance on how nurses can, and should, engage in advocacy initiatives to shape broader public health policy. Strategies for advocacy are discussed; these include building coalitions and influencing policy through legislative meetings. Examples of advocacy at the organizational, statewide, and federal levels are covered. The latter discusses nurses' involvement in chemical policy reform.

USING NURSING PROCESS TO GUIDE ADVOCACY FOR ENVIRONMENTAL HEALTH

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The nursing process is one of the first, and arguably most important, processes a nurse will ever learn. The key elements of assessment, diagnosis, planning, implementation, and evaluation guide everything that nurses do regardless of the area in which they practice. It is the very act of assessing and diagnosing patients with nursing problems that allows a nurse to best advocate for the patients he or she cares for. It only makes sense then that the same process would guide the way in which nurses advocate for themselves, and the larger nursing profession. Additionally, nurses can advocate for individuals and families, populations, policies, legislation, and environmental justice.

Advocacy can be defined as the act of supporting a cause (Merriam-Webster, 2014). The important piece of the definition is the act of supporting the cause. It is one thing to agree with a cause or a process, but to support it through an act is where advocacy is born. Many nurses have particular passions within the profession but are unsure of how to advocate for them. The nursing process is the natural guide to successful advocacy.

ASSESSMENT

The first step in the nursing process is assessment. A thorough assessment takes into account both objective and subjective data that then helps the nurse better understand the problem. It is important to gather as much data on a specific topic so that advocacy can be successful. Not understanding every side of an issue can be a big mistake. When an opponent of the issue raises a concern or a neutral party asks a question, the nurse advocate must be prepared to address the concern. This is not to say that the nurse advocate must know everything, but he or she should have a baseline comprehensive understanding of all sides of the issue. What is most important is that the nurse advocate understands how the issue impacts the profession of nursing.

DIAGNOSIS

Assessment leads naturally to the second step in the advocacy process: diagnosis. Diagnosing the problem requires the nurse advocate to step away from the collected data, form themes, and determine the root problem. It is important during this step to remember that the data collected is evidence of a problem. It is the problem that must be identified to successfully advocate for a solution. For example, if one were to advocate for all residents in a particular area to recycle but no recycling programs were easy accessible (pick up, drop off centers, etc.) the true problem would not be addressed. The advocacy would need to focus on recycling programs first.

PLANNING

The planning phase of advocacy comes naturally to most nurses in clinical practice. Once the problems are identified, there are usually specific actions that need to take place. This is not the case with advocacy, as many nurses are not sure how to take action for advocacy. As the old saying goes, knowledge is power. Education is always a good starting point. Think about who needs to understand the problem. Once education starts, others will begin to ask questions and challenge ideas. The nurse advocate must be able to discuss the given issue from all sides. In planning for advocacy there may not always be a clear direction to take. This is why is important to stay open minded and be ready for opportunities. Always be willing to talk to those around you about your concerns; you never know who you may be talking to or what connections that person may have.

IMPLEMENTATION

The implementation phase of advocacy is continuously evolving and requires multiple skills.

Be ready. As mentioned in the planning phase, there may be new opportunities that present themselves so the nurse advocate should always be ready. It is important to get the information out to the public and key people who need to know about it such as legislators, agency leaders, and other nurses.

Do not be shy; be assertive. Using the knowledge the advocate has gained, it is important to not by shy. Write letters to newspapers, government officials, large organizations, and nursing journals. Post information to blogs and other social media outlets. Call in to radio or television shows that are discussing related topics. Offer to speak on the topic at local schools, conventions, or town hall meetings. Remember that how the advocate presents themselves verbally and in writing, will determine how much weight others put on the information being shared.

Be professional. Be sure to always be professional and objective. Do not get into arguments but rather state facts and allow others to share their opinions. If the advocate knows the problem well, they will already be expecting what those on the other side of the issue may say.

Be persistent. If important people with action power only hear about the issue once in a while, they tend to not put much weight to it.

Collaborate with others. The more decision-makers hear a message, the more they will be aware of the issue and possible solutions. Nurse advocates display their leadership by partnering with existing groups and requesting others' support for nurses engaged in advocacy. The foremost nursing organization that advocates for environmental health is the Alliance of Nurses for Healthy Environments (ANHE). The Policy/Advocacy Workgroup of ANHE can be found at http://envirn.org/pg/groups/4108/anhe-policyadvocacy-work-group/.

The following Table lists examples of environmental organizations that nurse advocates can partner with to reduce environmental health risks and promote healthy communities.

Organization name	Website	Organizational purpose
Safer Chemicals, Healthy Families	http://saferchemicals.org/	A national effort to protect families from toxic chemicals
Environmental Working Group (EWG)	http://ewg.org/	Empowers people to live healthier lives in a healthier environment. EWG drives consumer choice and civic action with breakthrough research and an informed public
Environmental Defense Fund (EDF)	http://edf.org/	We think differently about how to solve environmental problems, working across disciplines and with diverse groups of people
Health Care without Harm (HCWC)	https://noharm.org/	An international coalition of hospitals and health care systems, medical professionals, community groups, health-affected constituencies, labor unions, environmental health organizations and religious groups leading the global movement for environmentally responsible heath care
Center for Health, Environment, and Justice	http://chej.org/	Mentors a movement, empowering people to build healthy communities, and preventing harm to human health caused by exposure to environmental threats
Physicians for Social Responsibility (PSR)	http://www.psr.org/environment-and-health/	PSR's Environment and Health Program addresses toxics and global warming — challenges to life and well-being that pervade the entire planet

An interview with a nurse advocate can be found at http://www.psr.org/environment-and-health/environmental-health-policy-institute/responses/nurses-as-environmental-health-advocates.html where she discusses her experiences as an environmental health advocate with legislators. Advocacy experiences of nursing students can be found in award winning essays at http://www.theluminaryproject.org/article.php?id=56

EVALUATION

Contrary to how it may seem, evaluation is not the end of the nursing process, but rather a check point along the way. It is also a necessary step in the advocacy process. It is important that the nurse advocate take time to reflect on the advocacy that has been done and determine how to move forward. The nurse advocate should ask themselves questions: Is there more information that needs to be collected? Are there people or groups that I have not yet reached out to? What change has taken place in regards to this issue? What change is left? What other initiatives exist that support this cause? Can we partner together? Always go back and relook at assessment, diagnosis, planning, and implementation to see if anything needs updated or changed. This step is crucial in keeping your advocacy relevant.

Part of evaluation is also celebrating where you have come. Even if big change has not occurred, celebrate that fact that people were educated who previously did not fully understand the issue. Each small win contributes to bigger change. Do not be discouraged but rather be encouraged to keep pressing forward.

CONCLUSION

The nursing process becomes the subconscious guiding force behind all that nurses do. The same can be said for advocacy. By taking one's time to thoughtfully move through each phase, the nurse advocate can develop a successful plan of advocacy. Remember advocacy is a form of action. Find others who are passionate about the same topics and join together to take action. Advocacy is a powerful tool that can be used to transform people and guide change. Why wait? Get started today!

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COALITION BUILDING: A POWERFUL POLITICAL STRATEGY

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Nurses are the most trusted professionals according to Gallup polls year after year (Gallup Poll, 2016). We hear this a lot. So what does it mean and how do we utilize the public's trust to advocate for policies that improve health for all citizens? The fact is that nurses are viewed by the public as highly educated healthcare practitioners that truly have their clients' best interest at heart. Patients trust us to advocate for them at the bedside, in the clinical setting and broadly, in the public arena. Unfortunately, nursing education does not often include courses or practicums on how nurses can advocate for more health protective policies. As a result, we don't view ourselves as the powerful leaders that we really are. We advocate daily with physicians and other members of the health care team but somehow don't think we are qualified to talk to lawmakers—who usually know far less than you do about nursing and healthcare. So can nurses play a role in shaping policy? It seems like a daunting task and one that most nurses are not comfortable with. And yet, we are from the very beginning, educated to advocate for patients. The irony is that while we may not think of ourselves as proficient at advocating with policy makers for laws that protect the health of citizens, nurses are uniquely positioned—and educated—to do just that!

So, how do we transfer the skills that we've learned and applied at the bedside to our state houses to be effective advocates for improving health? How do we acknowledge the trust placed in us by the public to make a difference on a broader scale? In this chapter, the reader will

- review the theoretical underpinnings and skills gained in our nursing education that are readily transferrable to advocating for public policies to improve health for all citizens,
- learn how to apply those skills outside of the traditional healthcare setting, and
- learn to incorporate the leadership skills of team or coalition building to enhance the nurses' capacity to effect change on a broader scale.

Our professional role as advocates started with Florence Nightingale. Florence Nightingale was a strong nurse advocate who shaped the delivery of healthcare and health policy. She recognized the value of collecting and analyzing data to improve outcomes and to effectively communicate with leaders to help implement changes that improved health outcomes. She worked with supporters, colleagues and policymakers to enact broad social change (Mason et al, 2007).

Since this time, the professional role of nurses includes competence in advocacy. The ANA Revised Code of Ethics for Nurses with Interpretive Statements states the nurse is expected to collaborate with "other health professionals and the public in promoting community, national, and international efforts to meeting health needs" and to shape social policy (Mason et al, 2007).

The International Council of Nurses (2008) states "nurses have an important contribution to make in health services planning and decision-making, and in development of appropriate and effective health policy. They can and should contribute to public policy related to preparation of health workers, care delivery systems, health care refinancing, ethics in healthcare and determinants of health." It is essential that the nurse recognize the concept of "upstream thinking" of primary prevention that addresses the notion that to protect the health of an individual, it is imperative to see the person holistically (Butterfield, 2002).

Despite this, nurses often don't recognize the skills and preparation gained through their nursing curriculum that enables them to serve as professional, credible advocates outside of the traditional clinical setting. Our educational preparation usually does not include practicum opportunities that allow us to apply the very same skills used in a hospital or clinical setting advocating for what is best for our patient to the statehouse or the board room where we advocate for public policies to improve health care systems. This is unfortunate as nurses often don't recognize that they are highly skilled advocates in these settings. Nurses often shy away from taking advantage of these opportunities and lose out on utilizing our collective power for transformative change (Patton, 2015).

NURSING PROCESS

How do we become more comfortable transferring the skills and expertise we gain from our practice to non-traditional settings where we can influence policy? It might not seem readily apparent but the nursing process that we use every day provides a strong framework for advocating for policy at the state house or other non-traditional setting. Without even thinking about it, nurses are adept at assessing the situation, developing a plan, implementing and evaluating that plan to achieve desired outcomes.

Lesson Applied

As a critical care nurse and nursing director, the nursing process was something that became second nature in my daily practice. Without thinking, I would assess my patients, develop and implement plans and evaluate outcomes. As a director, I would do the same—assess the situation, develop a plan to implement a new program on the units, implement the plan in collaboration with other members of the health care team and evaluate how it all went. This all changed when I had the opportunity to go to meetings at our state house to discuss concerns about the health impacts of exposure to chemicals. I found that I was nervous and unsure of how or what to say and lacked confidence in my ability to talk to legislators despite being knowledgeable on the subject. What I found, after reflecting on the meeting, was the nursing process applied here as well. I realized that during the meeting, I assessed the legislators' knowledge base and level of support and this guided how we proceeded during the meeting. Intuitively, we were able to gauge our discussion and develop a plan for next steps. This awareness helped to build confidence for future meetings, our advocacy work and our evaluation of next steps.

COMMUNICATION

From the start, nurses are taught effective communication skills in order to interact with patients, family members, and other members of the health care team. We are used to speaking with physicians to advocate for what we think is best for our patients—even when the physician or other member of the health care team may not agree. We are educated to take complex issues and explain them to different audiences and we are good listeners. Nurses are also used to giving organized reports to on-coming shift personnel which turns out to be a very effective template for advocating for policy changes with legislators.

Talking to policy makers or legislators is no different. Generally, nurses are much more educated on patient care, health issues, the health care system and relevant policies than most lawmakers. As we do in the clinical setting, nurses should incorporate peer-reviewed research and evidence-based practice when advocating for policy changes. Nurses' credibility as informed health professionals goes a long way in influencing policymakers that often have little experience with the health care issues you are working to address. Policy makers are often very busy with multiple issues from multiple constituents. Here again, nurses are highly skilled to communicate effectively in these types of situations. The practice of giving report to another healthcare practitioner in advocating for a patient readily transfers to communicating with legislators. Nurses often use a consistent format to present the situation, background, assessment and resolution needed for a patient. Advocating for a change in policy fits this format nicely.

Lesson Applied

When I first started working as a nurse lobbying for more health protective chemical policies—like banning bisphenol-A from recyclable containers including baby bottles and infant formula containers, I was unsure what to say to legislators that I would see at the state house. I found they would often not have much time and somehow, I assumed that they knew more than I—after all, they were legislators. However, I always introduced myself, stated I was a nurse and explained that BPA is synthetic chemical that disrupts hormones and is particularly harmful to infants and young children. Depending on the legislator's questions and time, I'd provide some background and hand them a research fact sheet that explains the problem and I'd end by asking for their support of the bill to ban BPA in these products. I realized that this method of communicating was no different than speaking with a physician or health care practitioner when I felt a patient needed an order for pain medication.

WORKING IN TEAMS

Nurses are critical members of the health care team, working with both licensed and unlicensed personnel to achieve the patient's goals. By virtue of our academic preparation, we learn to work collaboratively, to delegate, to supervise and to build effective working relationships with co-workers. Working with other team members, we identify patients' needs and work to achieve patient care goals. Nurses utilize leadership skills to coordinate patient care and advocate on behalf of the patients and families that they serve. These skills are vital to the work of advocacy and crucial to building coalitions—an important vehicle for advancing policy and one that will be discussed in more detail.

Nurses, often without recognizing it, are uniquely qualified and have critically important roles as advocates outside of

their traditional work setting. Our knowledge and expertise, use of the nursing process, communication and leadership skills and our ability to work effectively in teams are the foundations for being effective leaders in health policy and advocating for changes that broadly impact public health. Providing mentoring and academic opportunities to practice these skills in non-traditional settings are needed to expand nurses' involvement in shaping policy at the local, state and federal levels.

COALITIONS - POWERFUL VEHICLES FOR CHANGE

Coalitions are groups of individuals and groups that come together around a common interest and agree to work together to achieve agreed upon goals (Berkowitz, 2007). Coalitions are actually a lot like health care teams—individuals with different backgrounds working to achieve patient care goals. These teams can be extremely effective or sources of frustration if the dynamics of the group are not managed well or mutual respect and a sense of team is lacking. In this section, we'll discuss what makes a coalition successful and share a case study in which nurses have led a successful coalition working to advocate for more health protective chemical policies.

COMPONENTS OF A COALITION

Mason, Leavitt and Chaffee suggest that successful coalitions have four common ingredients—leadership, membership, resources and serendipity or opportunity (2007). Leaders who can facilitate open dialogue; work with coalition members to tap into individual skills, comfort levels and expertise; and foster camaraderie and a sense of team are critical to a successful coalition. A leader who inspires others, creates a vision and organizing plan for the work, and facilitates sharing of the workload helps to build and sustain a passion for keeping coalition members engaged. The work of the coalition often arises from a problem or issue that is not easily solved within routine structures or methods. It is incumbent upon the leader to be able to help shape and articulate a winning strategy, build consensus, and communicate often so that all members feel included and empowered.

While the leader has an important role, successful coalitions utilize a shared governance framework and structure rather than the typical organizational structure that most are used to working in. While shared governance models have been typically implemented in health care and academic settings, this framework is well suited for coalitions. While there are numerous definitions of shared governance, the concepts of partnership, accountability, equity and ownership are fundamental (Anthony, 2004). A shared governance structure means that accountability for outcomes is shared, that all members are on equal footing and decisions are made by consensus rather than a majority vote. This structure may be viewed as inefficient and cumbersome by some at first. However, proper facilitation and supporting individual members as they learn and grow in this work environment yields a strong commitment to the team, a sense of empowerment, and pride in the accomplishments of individual members and the group as a whole. Coalition partners that collaborate in this manner "demonstrate their willingness to enhance each other's capacity for mutual benefit and a common purpose by sharing risks, responsibilities, resources and rewards" (Himmelman, 2001).

Membership

When people come together to discuss collaborating on an issue, community problem or the need for policy change, the first step is to identify who else should be involved. Building diverse groups of individuals helps strengthen a coalition, build the base and power of the group, and promote a cohesive and unified vision. Reaching out to all stakeholders in the process is an important first step. Members of the coalition often represent various groups that lend strength and capacity to the overall mission. Again, similar to working in health care teams, nurses are used to working with members from different academic disciplines and yet are competent to coordinate the care plan for their patients. Similar skills apply when working with diverse coalition members. Here again, it is important to recognize and solicit the input of all coalition members, evaluate their skills and contributions to the work and achieving the goal, utilize this information to collectively develop a plan for achieving the goal and, together, implement the plan. Coalition membership may change for a variety of reasons including shifting priorities for coalition group members and individuals, funding, capacity to continue to support the coalition, and individual life choices. It is important to acknowledge this as a normal part of a Coalition's life cycle and to work to continue to build and strengthen relationships with new stakeholders, continue to develop coalition leaders, empowering them to their full capacity, and to stay focused on the overall goal.

STRUCTURE

The structure of the coalition may vary depending on the work, the membership, and the resources. Some coalitions may have a formal steering committee that almost serves as a board or advisory group along with other committees to achieve certain aspects of the work such as marketing and social media and advocacy. Other coalition structures may not be as formalized, with members assisting with all

aspects of the work. No matter the structure, it is important for the leader and the members to assure that the principles of shared governance and the overall campaign are moving forward. While these structures are often not as formalized as those in a typical health care setting, the inherent nature of nurses' ability to apply the nursing process provides a valuable framework for routinely assessing and revising the plan. Nurses work collaboratively with other members of the team to gain consensus on adapting to changes, while still working towards the overall strategic goal.

COALITION MEETINGS

Nurses frequently interact with other members of the health care team as they are planning for and taking care of patients. These interactions help to build trust, promote collegiality and a sense of common purpose, and serve as the mechanism to achieve the goal—what is best for the patient. The same principles apply in coalitions though there are struggles. Regular meetings and communications are critically important for coalitions yet often challenging as members have regular jobs and other priorities. Face to face meetings allow coalition members to further develop personal relationships, a sense of belonging, and ownership for achieving the goal of the coalition. Using on-line meeting scheduling technologies help to schedule meetings at times that are best for all coalition members. See http://doodle.com/. In addition to in-person meetings, regular conference calls enable members to stay connected and develop short-term goals and activities that build the coalition's momentum. A combination of these formats is vital to establishing an overall identity and sense of purpose and structure for coalition members. Also these meetings help provide a framework for getting work done by busy coalition members. Coalition leaders must work hard to develop and strengthen relationships and a sense of "esprit de corps" outside of the traditional workplace setting.

RESOURCES

Coalitions may not have a lot of resources like funding or marketing or communications departments; so the membership of the coalition is often the most valuable resource. Members are involved for a reason—a common passion or vision. There is nothing more powerful and it is critical that this energy is tapped into and utilized to its fullest capacity. Each member brings unique skills and abilities to the team, which the leader must tap into, develop and rely on. Empowering members of the coalition so that they are contributing and growing in their roles helps to achieve and sustain momentum and builds the power of the coalition far beyond what a marketing or communications department might be able to do.

Members of the coalition also serve as the best marketers of the coalition and the goal that the group is working on. Using social media, setting up on-line invitations to events, sharing the day to day work on websites, Facebook and other sites, helps to build the campaign, expand name recognition and engage others in the coalition's work.

NEXT STEPS

Now that you have the coalition's goal in mind, the key stakeholders involved and a structure and processes for getting the work done, what are next steps? Again, our basic nursing preparation serves us well. Developing a campaign plan with a coalition is not all that different from developing a plan of care for a patient with other members of the health care team—and nurses do this with great skill.

The coalition plan or campaign plan is really no different in that it includes the team's assessment of problems and barriers, identifying stakeholders and developing a plan that lays out the key steps and accountabilities that ultimately lead to achieving the goal. The plan is often laid out so that it provides a long-term view of all the steps and processes needed to achieve the goal and is intended to be a working document that is revised, updated and modified along the way. More on campaign planning can be found here: http://knowhownonprofit.org/campaigns/campaigning/planning-and-carrying-out-campaigns/planning.

PROMOTING THE COALITION

The importance of building name recognition and promoting the work of the coalition cannot be underestimated. Doing this well assures that current members will stay engaged and energized, new members will be attracted, decision-makers will be aware of the objectives and goals of the coalition, and a momentum for success will be developed and shored up for the long haul —even when the going gets tough. Everyone wants to be on a winning team so it is important to convey the message that you are winning or at least, achieving concrete positive steps towards a win even if you are not winning right now. It is critical that you keep the coalition in the news and in the forefront of people's minds.

How do you promote the Coalition with limited resources and capacity? Fortunately, using social media is a great first step. Setting up a campaign website and Facebook page can make a huge difference in sharing the coalition's name and goal as well as serve as a vehicle for 'action-alerts' and mobilizing people to events. Encouraging coalition members to write letters to the editor and opinion editorials are also great ways to share the coalition's priorities develop coalition leaders and show a diversity of members that support the cause. Also,

it is helpful to identify contact members of key media outlets who will receive press advisories and releases from the coalition. Reaching out to members of the media to build relationships and educate them on the issues that the coalition is working on also goes a long way to building momentum for your campaign. Here again, nurses are well suited to promote communications and marketing of the coalition's work. Typically, printed letters and opinion pieces need to be short, concise and compelling, much like the routine communication skills that nurses use to advocate for patients' needs. Similarly, when talking with reporters and other members of the media, nurses are highly credible and adept at framing the issue and the means to resolve the problem. Gaining comfort talking with members of the media is really no different than talking with other members of the health care team and is a valuable skill for nurses to utilize when working with coalition partners on policy initiatives.

While social media is a great tool, there is nothing more important in building and sustaining a coalition than building true relationships. Coalition leaders should invest time in personal connections, reaching out to new members and groups and understanding the value of supporting mutually beneficial work. A new group that may be interested in the Coalition's mission will likely appreciate and remember an offer to attend the group's meeting or event. Helping new members or groups with things that they need builds a symbiotic relationship that strengthens a coalition. Staying connected with personal phone calls, thank you notes or meeting for coffee go a long way to help new members and groups feel engaged in the coalition and build a sense of team, even when members are not physically working together on a daily basis

RESOURCES FOR COALITION BUILDING

- Beyond Intractability: Coalition Building
- Developing Effective Coalitions: An Eight Step Guide
- Community Tool Box: Starting a Coalition

CASE STUDY: The Coalition for a Safe and Healthy CT

In 2007, members of the Connecticut (CT) Nurses' Association, CT Nurses Foundation, the CT Public Health Association, the CT Coalition for Environmental Justice, Connecticut, CT Citizens Action Group, CT Clean Water Action and ConnPIRG, came together to discuss the growing body of evidence linking exposure to toxic chemicals in consumer products with the rise in many diseases. None of these organizations were working on this issue at the time yet, key leaders of these groups recognized a need to collaborate to raise awareness and to develop campaign strategies to press for more health protective policies at the state and federal level. During the initial meetings, a decision was made to form a coalition of like-minded organizations and member groups and to map out a plan to educate policymakers and citizens across Connecticut. It also provided an opportunity for the organizing groups to share resources, garner expertise, and set short term and long term goals to address environmental issues in a coordinated proactive manner. It provided an opportunity to bring a more powerful voice to the legislative process. The Coalition provided a more organized effort as we approached issues considered relevant to changing policy at the state level.

Coalition leaders identified that focusing on the presence of toxic chemicals such as lead and phthalates in toys would serve as a great way to elevate the profile of the issue, garner media attention and generate public support. Giving presentations at events, schools, and meetings all over the state helped to get the word out and to establish the Coalition's identity. These forums were also effective at engaging new members and building momentum for a winning campaign to pass a law in Connecticut restricting lead and phthalates in toys!

The Coalition continued to build on this success by working with national experts and partners to identify other chemicals like bisphenol-A (BPA), a commonly used chemical found in polycarbonate plastic (like baby bottles), thermal receipt paper and the lining of aluminum cans. BPA is also a hormone disruptor and strongly linked to breast cancer, reproductive disorders, insulin resistance and diabetes. In 2009, the Coalition expanded its grassroots campaign, added new members, organized several high profile events to garner media attention and successfully passed a landmark bill banning BPA from recyclable containers and infant formula containers! This was a huge win against extraordinary odds and tremendous opposition from the industry lobbyists. No other state had successfully banned BPA this broadly and Connecticut was now leading the way!

The Coalition has stayed together and grown stronger through in-person meetings, weekly conference calls, and using consensus-based decision making in all of its work. A strong focus on developing individual members' interests and leadership skills helps to keep people feeling good about their contributions even as they fluctuate over time and as other commitments come up. Coalition partners continue to work hard on outreach, engaging new members, providing education, and engaging with media outlets and policy makers to press for on-going reform. Frequent updates to the website and social media

help to keep citizens engaged and active in Coalition activities.

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CASE STUDY IN ENVIRONMENTAL HEALTH ADVOCACY

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It started with Styrofoam. The hospital cafeteria was under renovation and suddenly all plates and trays went from paper to Styrofoam. As a staff nurse and founder of Nurses Healing Our Planet (NHOP), Michelle Lauer took notice of the change and was concerned by the seemingly endless heaps of non-recyclable garbage being generated. Spurred by participation in the hospital's shared governance council as well as returning to school for her Master's in Nursing Science degree, Michelle felt empowered and compelled to get involved in changing hospital policy on recycling. She joined the 'green team' that was forming in the hospital and started learning about environmental nursing.

After a positive discussion with the Director of Nursing Education, Michelle was encouraged to reach out to the nursing staff for help in hospital waste reduction. Several volunteers, with a similar vision, agreed to participate in her efforts. To better understand the scope of the problem, the group followed the hospital trash trucks to the landfill. It was an eye opening experience as they noticed the landfill was filled to capacity. Turns out, hospitals in the United States produce more than 5.9 million tons of waste annually and often have not developed recycling strategies or green teams. This spurred the nurses to develop and implement a hospital-wide recycling program that started with placing recycling receptacles at the hospital. Eventually five baby units began to recycle baby bottles and, in the emergency room, one-time use items such as urinals, bedpans and emesis basins were changed from plastic to a durable cardboard.

The group agreed that environmental health issues should not be limited only to the waste the hospital generated but should be a state-wide effort. This led to the formation of Nurses Healing Our Planet (NHOP), an ad-hoc committee of the Delaware Nurses Association in 2007. "We were really on a roll," said Michelle.

Flushing or pouring down the drain was the standard practice for medication disposal which resulted in contaminated drinking water. One of the first projects for NHOP was to provide another means for the public to dispose of unused/unwanted medications. NHOP members worked with the Drug Enforcement Agency (DEA) to hold the first pharmaceutical drug take back events in the state of Delaware. These events became successful due to the support and effort of State and Federal agencies, pharmacists and many volunteers. The take back events created public awareness of contamination of the drinking water caused by pharmaceuticals, how best to dispose of medications, and discussions about management of controlled substances. Many other states were moving in the direction of safe drug disposal at the time of these events. This led to national drug take back events coordinated by the Drug Enforcement Agency. Each year, spring and fall, drug take back events across the country eliminate thousands of pounds of drug waste from entering the nation's water supply and reduce risk of drug abuse.

NHOP received grant funding from the Campaign for Safer Cosmetics to increase awareness of toxics in personal care products among nurses and the public. The Campaign for Safer Cosmetics is a broad based coalition whose mission is, through public advocacy, to eliminate drugs known to cause cancer, reproductive harm and other adverse health impacts in cosmetics and personal care products. Through public education, NHOP crisscrossed the state advocating for safer products and elimination of cancer-causing chemicals. Nurses Healing Our Planet was very busy in 2009. The group developed a partnership with the University of Maryland Nursing Environmental Health Education Center. Through this relationship, NHOP members learned about an array of other environmental health issues that required attention at the State and National levels. NHOP nurses attended the Clean Med conference that year and collaborated with other nurses at the conference to send postcards requesting that cows, providing milk for a common brand of yogurt, not to be treated with growth hormone. One year later, the yogurt maker announced it would no longer make yogurt with milk from cows treated with recombinant bovine growth hormone (RBGH).

Concurrently, in Delaware, a coal burning power plant was being proposed for development. NHOP nurses testified against the power plant and in favor of a wind farm as an alternative energy source. Citizens for Clean Power and NHOP partnered for a grassroots campaign against the coal plant proposal, citing health effects of the coal and gas power plants. The efforts included letters to the newspaper and testifying before the regulatory body. Fortunately the outcome was the proposal did not move forward and Delmarva Power, the local utility, now factors in the health effects on how they generate electricity.

At this time, NHOP learned about babies being born "pre-polluted." A study showed an average of 200 industrial compounds, pollutants and other chemicals in umbilical cord blood of 10 newborn babies, with a total of 287 chemicals found in a study group. Of the 287 chemicals

found in umbilical cord blood, 180 cause cancer in humans or animals, 217 are toxic to the brain and nervous system, and 208 cause developmental problems. The dangers of exposure to these chemicals in combination have never been studied (EWG, 2005). An NHOP nurse worked at changing hospital policy by replacing plastic products with phthalates-free products in the NICU. At this time, nationally these products were being removed from IV bags and tubing in the hospital setting.

NHOP also met with Delaware congressional legislators regarding the Safer Chemicals Act of 2011. NHOP recognized that Federal law does not adequately protect Americans from toxic chemicals. These chemicals are being found in makeup, personal care products and items used every day. The primary law responsible for ensuring the safety of chemicals, called the Toxic Substance Control Act (TSCA), was passed in 1976 and has not been updated since. The law is so weak that the U.S. Environmental Protection Agency (EPA) has only been able to require testing on less than 2% of the more than 80,000 chemicals that have been on the market since TSCA was adopted (Denison, 2009). NHOP continues to meet with our U.S. Senators regarding the Chemical Safety Improvement Act (CSIA) S.1009. As drafted, the CSIA would not deliver the critical elements of meaningful public health and environmental protection. NHOP believes the bill should not move forward unless fundamental issues are fully addressed as outlined by Safer Chemicals Healthy Families.

In 2010, NHOP became aware of Bisphenol-A (BPA), which is a hormone-disrupting chemical. BPA can mimic or block hormones and disrupt the body's normal functions and is found in baby bottles, sippy cups, the linings of food cans, and in paper register receipts. BPA is also found in medical devices and equipment such as plastic flasks, beakers and containers. BPA can leach, especially when heated, from products into food and drinks (Calafat, 2009). Monitoring studies find the chemical in more than 90% of the adult population (Calafat, 2008). With this information, members of NHOP worked with local legislators, some who were Registered Nurses, to pass a Resolution (SCR 32), which enumerated and recognized the health concerns related to BPA.

One year later, members of NHOP worked on helping Delaware become the 10th state to implement a ban on BPA in children's products by getting support letters, going to meetings and educating legislators about the harms of BPA. Working with State Senators and Representatives who were Registered Nurses greatly accelerated the bill's movement and NHOP learned a lot about the legislative process in the interim.

The BPA ban passed unanimously in both House and Senate but members of NHOP had to prepare testimony about BPA and its effects should the legislature ask for more information. The bill's sponsors requested NHOP members to be present each time the bill was presented in a committee meeting or voting sessions should testimony be required or questions asked. This required a number of NHOP trips to Legislative Hall. NHOP quickly formed collaborations with Natural Resource Defense Council, the Mid-Atlantic Center for Children's Health and the Environment, Delaware Chapter of the American Academy of Pediatrics, Physicians for Social Responsibility, the Breast Cancer Fund, and the Consumers Union. Many provided support letters and some came in person from Washington D.C. in case testimony was necessary. In June 2011, the Governor of Delaware signed into law a ban on BPA (SB 70) in children's products. The ban prohibits manufacturers from selling or offering to sell any children's product containing BPA. Knowingly selling products with BPA intended for children under age 4 designed to be filled with food or liquid, is now a Class A Misdemeanor in Delaware. It was especially exciting to see that in 2012, when the FDA banned BPA from baby bottles and sippy cups nationally due to a request from the American Chemistry Council, the American Chemistry Council directly cited the number of state bans that had passed as a reason for requesting the FDA ruling (FDA Regulations, 2013; Safer States, 2013).

There are limited ways for the general public to safely dispose of mercury thermometers and thermostats. In 2011, NHOP organized a dual county mercury return in collaboration with the Delaware Division of Public Health and two local hospitals where mercury thermometers were collected, in exchange for a digital thermometer, and safely disposed of by the Division of Public Health. Overall, 10 pounds of liquid mercury was collected. Delaware Division of Public Health provided the electronic thermometers and disposed of the mercury waste free of charge. Collaborations are key in environmental health!

NHOP hosted an environmental health nursing conference in 2011 featuring our Secretary of Natural Resources in Delaware. NHOP invited nursing students, as we know that the next generation of nurses will need to understand the context in which they and their patients will be living and working.

In 2011, along with other environmental groups, NHOP requested the Governor of Delaware to create a Comprehensive Energy and Climate Change Plan.

NHOP members have testified in Washington D.C. for the American Nurses Association on the Clean Air Act to keep it strong for the health of their patients and the

public. NHOP has participated in stroller brigades in Delaware and Washington D.C. and two nurses have been Delaware Clean Air Ambassadors on behalf of the American Nurses Association. There are also a number of nurse luminaries in the NHOP group.

NHOP continues to follow and support progress being made on uncovering the health effects of hydraulic fracturing (fracking) and flame-retardants. Flame retardants, used for over 30 years, can be found in consumer electronics, furniture, and mattresses and find their way into blood, breast milk, and umbilical cord blood impairing memory, learning, and behavior in laboratory animals at very low levels. They may also affect thyroid hormones and reproduction. Most at risk are developing fetuses, infants, and young children (Washington Toxics Coalition, 2005).

Through 2014 and beyond, NHOP will continue to participate in work groups, such as the Delaware plastic bag workgroup, which discussed options of plastic bags, educates nurses and the public on environmental concerns that affect health, partners with environmental groups such as the Delaware Sierra Club and give talks on energy, air quality and their health effects.

NHOP writes an environmental article for each publication of the Delaware Nurses Association quarterly newspaper, The Reporter. Our group continues to write op eds and letters to the editor and most importantly be the voice for the health of our patients when environmental issues arise.

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CHEMICAL POLICY REFORM
TOXIC CHEMICALS IN THE ENVIRONMENT: EFFORTS TO CONTROL AND REGULATE

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The issue of hazardous chemical exposure is a serious concern for nursing practice, education, research and advocacy. In the United States, efforts to regulate chemical safety have not been effective. The vast majority of the more than 80,000 chemicals developed during the past sixty years have not been evaluated for safety to humans. However, during that time, a large number of chemicals have been implicated as possible causes of a variety of health conditions such as cancer, reproductive health issues including birth defects, neurological conditions such as autism, and learning disabilities, and chronic diseases such as cardiovascular disease, pulmonary diseases and diabetes.

The first legislation to control chemicals was the Toxic Substances Control Act of 1976 (TSCA). TSCA was enacted with the purpose of controlling harmful chemicals but has not been an effective law to protect humans. Further, it was the only major piece of environmental legislation never updated.

During the past few years, US legislators have proposed changes to the law. The late Senator Frank Lautenberg first introduced a bill in 2005 to improve the federal government's surveillance, testing and control of chemicals for safety. In April 2011 Senators Senator Frank Lautenberg (D-NJ) Senator Inouye (D-HI) and Senator Kirsten Gillibrand (D-NY) introduced the Safe Chemicals Act but this bill died in Congress and was not enacted. Later efforts such as the Chemical Safety Improvement Act were not enacted. This bill would have limited individual state's power to enact stronger laws, creating weaker chemical standards and putting human health at greater risk.

On March 10, 2015, Senators Udall (D-NM) and Vittner (R-LA) introduced S.697. The Senate passed this on December 17, 2015. Congressman John Shimkus (R-IL) introduced the TSCA Modernization Act in the House and it passed 398 to 1 on June 22, 2015. As these bills were different approaches to the same issue, the bills were sent into Conference Committee where members of the Senate and House negotiated a final bill that would be voted on in both Houses. On May 24, 2016, the House of Representatives voted to pass a bipartisan House-Senate agreement of the Frank R. Lautenberg Chemical Safety for the 21st Century Act, HR 2576 by a margin of 403-12. The US Senate then passed this on June 7, 2016 and the act was signed into law by President Barack Obama on June 22, 2016.

According to Safer Chemicals Healthy Families, the new Lautenberg Act gives the EPA new authority to strengthen chemical safety and protection of the health of the people living in the United States. However, as EPA is only mandated to address 30 chemicals within the first 3.5 years after enactment, the pace with which unsafe chemicals will be addressed will be very slow. The law:

- Requires EPA to regulate a chemical based solely on its health and environmental impacts. This replaces TSCA's burdensome cost-benefit safety standard—which prevented EPA from banning asbestos.
- Establishes a minimum enforceable schedule and requires EPA to "begin safety reviews on 10 chemicals within 180 days of enactment and then another 20 chemicals from the high priority list within 3.5 years."
- Expedites action on persistent, bioaccumulative, and toxic (PBT) chemicals;
- Explicitly requires protection of vulnerable populations like children and pregnant women.
- Gives EPA enhanced authority to require testing of both new and existing chemicals.
- Sets judicially enforceable deadlines for EPA decisions.
- "[R]equires that manufacturers substantiate the basis for claiming chemical identity as confidential and creates a deadline for EPA review of confidential business information (CBI) claims." Under the new law, EPA can now share information with states and health and environmental professionals as long as confidentiality is maintained.
- Still has no minimum health and safety data requirements for new chemicals; however EPA must make an affirmative finding that the chemical is not likely "to present an unreasonable risk before a company can begin to manufacture."
- States can regulate a chemical until the EPA designates it a "High-Priority" chemical. The state's regulation will then be pre-empted until EPA decides on its restrictions (a process that can take 2-3 years). (Safer Chemicals, Healthy Families, 2016)

While the health and advocacy community did not achieve many of the health protective policies that they had worked to include in TSCA reform, this bill is an improvement over TSCA and the June 22, 2016 signing was an historic event.

Concern for issues such as chemical policy reform does not end with the passage of this Act into law. Nurses, citizens and advocacy groups continue to advocate for better polices to protect human health. For example, the advocacy group Safer Chemicals, Safer Families is a coalition that represents millions of individuals from citizens to health care professionals. More than 450 organizations are represented in the coalition. Of these 16 are nursing organizations including the Alliance of Nurses for Healthy Environments (ANHE), the American Nurses Association, the National Association of Hispanic Nurses, the American College of Nurse Midwives, and state nurses associations from Connecticut, Delaware, Idaho, Maryland, Massachusetts, Ohio and Washington state.

The coalition seeks to achieve:

8. A well-educated public that can use its power as both citizens and consumers effectively. (Strong federal and state polices to protect the public from toxic chemicals.)
9. Strong corporate policies to substitute safer chemicals for those that are already known to be toxic.
10. A well-educated public that can use its power as both citizens and consumers effectively (http://saferchemicals.org/what-we-want/)

The Safer Chemicals, Safer Families coalition offers information for the public such as their section on chemicals and health as well as action plans such as the Stroller Brigade and the Mind the Store campaign.

Many nurses have been active in chemical policy reform for a number of reasons: to protect themselves, their patients and their families from chemicals that cause adverse health effects personally and for their offspring. Physicians for Social Responsibility (PSR) conducted a biomonitoring study of 12 doctors and 8 nurses to determine their exposures to hazardous chemicals. The report, Hazardous Chemicals in Health Care: A Snapshot of chemicals in Doctors and Nurses notes an average of 24 chemicals in their bodies, including those known or suspected to be carcinogens, endocrine disruptors, or neurotoxicants.

The nurses of the Alliance of Nurses for Healthy Environments (ANHE) have been working to support safer chemical policies with their advocacy efforts. Look at the statement Achieving Real Chemical Policy Reform to learn more about the need to protect vulnerable populations, preserve state's rights, establish deadlines and timetables, ensure adequate data, act on the worst chemicals and support the right to know. In addition to chemical policy reform, ANHE nurses work across all areas of environmental health as advocates for safer energy sources, climate action, healthier communities, and use of safer products among others.

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Resources:

1. Nurses Chemical Policy Toolkit
2. Environmental Working Group
3. Safer Chemicals, Healthy Families
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ANATOMY OF A LEGISLATIVE MEETING

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Legislative meetings are a great opportunity to talk directly with decision makers of local, regional, and national governments. These meetings help educate and guide government leaders on important topics. Legislative leaders base their decisions on what they currently know and understand. This makes it important that nurses, and others, educate leaders on specific topics so that they can make truly informed decisions. Knowing the importance of meeting with legislative leaders is only the beginning. Before one can ever attend a meeting, it is imperative to understand the anatomy of such a meeting.

BEFORE THE MEETING

First and foremost before a legislative meeting, you must schedule the meeting. It is next to impossible to show up unnoticed and spend time with a legislative leader. Take time to schedule the meeting. Secondly, be sure to do all necessary homework. If the topic of the meeting is something that has already been discussed in legislative circles, be sure to understand all sides of the issue. It is also important to fully understand the message that you want to bring. Having evidence and personal stories to back your message is also helpful. Thirdly, the message should be condensed. Legislative meetings tend to be brief and you must be prepared to make all your important points in a timely fashion. This takes preparation ahead of time to be sure you do not miss anything. Although you can never guarantee that the legislative leader will read it, you can send information ahead of time or bring written materials with you. The fourth step to prepare for the meeting is to be on time. With such brief meeting times schedule, being even a few minutes late can result in not meeting with the leader at all.

DURING THE MEETING

Once inside a legislative meeting, begin to develop a relationship. Introduce yourself, what you do, and what brings you to the meeting. Be sure to stick to the message you want to send. Do not start talking on a tangent or switching issues. Take notes! If important information related to another issue is mentioned, write that down to follow up on later. Stay objective and truthful. If you are asked a question you do not know, say you do not know, but you will find out! Word your message in a way that is not threatening or critical of specific people or government parties. Allow time for questions so you can be sure the legislative leader understands your message. Before leaving the meeting, be gracious for the time and thank the leader for meeting with you. This helps build the relationship.

AFTER THE MEETING

Legislative relationships should never end with the meeting. Always follow-up. If there was information you did not know during the meeting, research it and follow up with the leader. Send a letter or email or make a phone call thanking the leader for their time and reinforcing the key point of the message. Offer yourself for questions if the leader has any. Make sure to keep in contact with the leader. Legislative leaders keep track of how many points of contact people make with them. Having just one or two is not enough to make a strong statement. This is why developing a relationship is so important.

CONCLUSION

Legislative meetings are an effective way to advocate and educate legislative leaders on important issues. In order to ensure successful meetings, care must be taken to prepare for the meeting. With specific action before, during, and after the meeting, a relationship can be built that will be key in having your voice heard.

Unit IX:
Research

INTRODUCTION

Since the early days of professional nursing practice, nurses have been observing and analyzing environmental data. Nurses have used their findings to influence the care they provide. In the 1850's Florence Nightingale subscribed to the health theory of the time, miasma. Miasmatic theory held that "bad air" was responsible for diseases such as cholera and chlamydia. Of course, now we know that is incorrect. But, it took people willing to look at the problem differently, ask questions of those exposed, and conduct further research to advance our understanding of the impact of the environment on our health. Technological advances, such as the microscope, helped as well.

The scientific community, including nurses, has made observations and analyzed data to accurately identify what is happening related to human health and the environment. Over time the theories that frame our understanding of a problem have changed. Advancing our knowledge of how our environment influences our health does not occur unless we formally examine a problem through research methods. Nurses at all levels of practice are positioned to make observations, collect data, and analyze data regarding the environmental impact on the health of individuals, families, communities, and nations.

This unit describes the work of nurses who are engaged in environmental health research. Each nurse researcher has been interviewed and the answers to the interview questions are provided. As you read about each researcher and his/her study consider: 1) What was the environmental problem the nurse researcher addressed (the research question)?; 2) What was the target population (the sample or participants)?; 3) How could their findings influence the patients or populations that you care for?; 4) Have their findings made you change the way you think about an environmental problem?; and, 5) How might you address and environmental health concern through research?

MARIA AMAYA, PHD, RNC, WHNP-BC
Professor of Nursing
Wakefield Professor of Health Sciences
Women's Health Care Nurse Practitioner
University of Texas at El Paso

(1) Background: Could you tell me about your academic background and nursing career? How did you get interested in environmental health? How did you get interested in this research topic and why is it important?

Educational Background:

BSN 1976 University of Texas at El Paso

MSN 1978 Texas Woman's University

PhD 1986 New Mexico State University

WHNP 1994 Certificate UT Southwestern Medical Center

GIS certificate 2012 The Johns Hopkins University

Nursing Career: I have been a staff nurse and unit charge nurse from 1976 through 1993. When I became a women's health care nurse practitioner in 1994 I switched my role and clinical setting. I provided primary women's health care as well as specialty women's health care in out-patient settings. My patients were mostly low-income women of Mexican descent throughout the life-span. I returned to UT Southwestern Medical School in 2002 to obtain training in cervical colposcopy. I, therefore, have experience in diagnosing and treating abnormal pap results. In that experience, I was exposed to women in the sex trade, women with HIV/AIDS and women with herpes and other STD's. I continued to develop my conceptual framework for practice through praxis. My eyes were opened to new situations and I learned to provide quality individualized care to these women. I have thoroughly enjoyed my nursing practice experience, which has been done mostly on a part-time basis throughout my career. It has been done in conjunction with my role as an educator and researcher. In this sense, my journey has been unique and exciting. I have met colleagues and friends from all backgrounds and perspectives.

Interest in environmental health: Environment is one of the four metaparadigms of nursing theory, including nursing, person, and health. Environmental exposures are causative and contributory factors to many chronic and acute health conditions in our time. Genetic factors are important contributory factors. Epigenetics and phenotypic mutations passed down to children are ripe for investigation in our understanding of health and illness. Therefore, I was led down the path of genetics and genomics. I trained in a colleague's laboratory, the University of New Mexico, Molecular Epidemiology Lab, in 2007 under the direction of Dr. Esther Erdei and colleague. I learned the techniques for extraction and amplification. Today, I teach the DNP course Nurs 6340 Clinical Genetics. I have a good understanding of that field. I believe the study of environmental health goes well with the study of genetics.

My research grants focused on the effects of hazardous heavy metals exposures and the relationship between air quality and asthma. Once again, my path opened up to study geographic information systems (GIS), and I earned a Graduate Certificate in GIS from Johns Hopkins in 2012. I live in a medically-underserved region, with a low-income and low-educational level population of Mexican descent. This population is under-studied. Added to my unique skill set, I believe my research is critically important to advancing knowledge about environment and health in this population.

(2) Description of research: What is your research question(s), methods, results, and implications for practice and policy?

My first grant was an NIH RO1 from the National Institute of Environmental Health Sciences (NIEHS). The focus was on binational mapping the geographic distribution of lead in the soil and measuring children's blood lead levels. This was a learning experience for me. Firstly, I was kicked out of Juarez Mexico by political authorities. I was threatened with arrest, even. So I learned that my studies were politically threatening to bureaucracies. I believe that environmental health researchers need to cope with this possibility. Although the study objectives were completed in El Paso, the second most important thing I learned was that the techniques for measuring blood lead level must be well thought out. For example, the samples were tested by Atomic Graphic Furnace, and this did not allow for much variability of scores to allow for statistical analysis. Later I purchased a Lead Analyzer I (for its low detection capability) and a Lead Analyzer II (for its clinical acceptance). I struggled with not having autonomy to provide results and found I needed a physician colleague to review the results. The lack of full autonomy for nurse practitioners (NP's) in Texas was an obstacle. Today, I am developing manuscripts to report my results. I learned how to deal with huge data bases, and the paper involved. Thankfully, I have adopted computer technology to record keeping, devising ways to comply with Human Subjects mandates while minimizing paper. There were many other lessons but these were the major ones. My team was awarded an RV van, which I equipped to do this work in the field. My next step would be to implement the follow-up armed with new knowledge, skills and experience.

My second major grant was as the co-investigator in a city-wide project to map air quality and measure prevalence of asthma among Hispanics of Mexican descent. My previous experience managing large projects came in handy. Our findings were important because of the meticulous epidemiologic methodology, the use of GIS, and the results showing reliable, replicable data on asthma in Hispanics of Mexican descent. Respiratory illnesses are rapidly becoming common among both children and adults. This Project also has potential for follow-up. Having the RV, the experience, the instruments, the skill set all bode well for continuing my research.

(3) Collaborators: What individuals, communities, or non-profits did you work with?

I was an original inter-disciplinarian before inter-disciplinary research was "cool". It helped that my nursing theoretical framework was Betty Newman's Systems Theory, which originated as an inter-disciplinary theory for nurses. I was already open-minded about the idea, and did not have territorial issues (at least not many). I have worked with geologists, physicians, physician-assistants, chemists, engineers, and other disciplines in my work.

(4) Funding: Who funded your research?

My major funding has come from NIH, namely NIEHS. However, I have been funded by Environmental Protection Agency (EPA). I have participated in over $20 million in externally-funded research projects.

(5) Did you publish your research? Can you provide a link for us to share? Did you engage in any policy-related efforts associated with your research?

I will answer the second question first. After my experience in Juarez Mexico I developed an aversion to politics and research. I can say that rather I was engaged by policy makers, and it was not always pleasant. When one is an objective scholar, and the data are authentic, there will always be policy-makers who are very happy with your findings and those who are very unhappy. The same is true for communities and community leaders. I have published some of my research, but I am dealing with a tremendous amount of data and have been slowly digesting it for publication. I am tempted to take on "easier" projects, but I find that doing "good" research often involves broad objectives. This is especially true when the researcher's focus is on community health.

See URL for photo of Dr. Amaya; see pages 8 and 9 for additional information https://academics.utep.edu/Portals/297/Magazine/SON-WEB.pdf

ADELITA CANTU, PHD, RN
University of Texas Health Science Center, San Antonio
School of Nursing, Family and Community Health Systems
San Antonio, TX

(1) Background: Could you tell me about your academic and career background? How did you get interested in environmental health? How did you get interested in this research topic and why is it important?

Bachelors in San Antonio, Texas. Masters in Dallas from Texas Woman's University in 1985. PhD in 2006 from University of Texas Health Science Center.

My career path as a nurse has always been community and public health nursing for almost 40 years. I am interested and deeply passionate about all issues with the environment and community that have an impact on resident health; the social determinants of health are very broad and all encompassing and related to this work as well.

As I pursued advanced education, I discovered that I had the ability to have some impact through my research and my expertise, generally looking at vulnerable populations, particularly minority, and even more so Hispanics. From that interest, grew knowledge of many of the things in the environment that keep Hispanics and vulnerable populations from reaching their optimum level of health. I have done work on what it takes in terms of the initiation and sustainability of healthy lifestyles i.e. physical activity across the lifespan of Hispanics, which has blended into cultural perspectives of physical activity. A natural outgrowth of that has been the environment itself. I come from the barrio myself. I live and work in neighborhoods that have poor infrastructure when it comes to roads, streets, air, and educational level that children are exposed to.

I have always been a person who wants to be a part of movements. I joined the National Association of Hispanic Nurses. Our national president knew of my interest in environmental health and, when the Alliance of Nurses for Healthy Environments (ANHE) was looking for more diversity in their steering committee, she tasked me for that and I have been working with them ever since about 2007-2008. I have an interest in environmental health, but more broadly an interest in public health.

(2) Description of Research & (3) Collaborators

The study is called "Community Perceptions of the Environmental Issues Related to Donna Reservoir." My research partners are from South Texas, including an anthropologist and sociologist. In this study, we were looking at residents of the colonias of Hidalgo County. Colonias are unincorporated areas that lack infrastructure and are principally Hispanic, either Mexican Americans or undocumented Hispanics. The Donna Reservoir and its canal system is a Superfund site because fish are contaminated with PCBs. The EPA still does not know where the PCBs are coming from, but the suspicion is that there are transformers buried in the reservoir. What is known is that the fish are contaminated, and the residents are fishing, eating the fish, and selling the fish. PCBs are a known neurotoxin and have been banned.

We formed an academic and community partnership with a non-governmental organization called the Institute for Valley Health. We worked with them to arrange focus groups so we could understand more richly how the residents interact on a daily basis with the Donna Reservoir: Are they fishing and do they know about the fish (contaminated with PCBs)?

We wanted to design culturally-tailored messages from the data received, and we are still working on that. From the focus group we found that although the residents are living in poverty they do have smart phones. This is their line life. This is how they communicate and get information. We asked for an extension of our study to ask them how they use information from their smart phones so that we can better design our messages. What we have discovered from the focus group is that we are still challenged to create something that is meaningful for the residents.

(4) Funding

Pilot funding is from the Community Translation Science Award that the Health Science Center received from NIH.

(5) Publication and Policy

Publication is pending. Nothing policy related yet. I am working with a group called Texas for Responsible Hydrofracking to have some policy influences.

(6) Anything to Add

I also work in San Antonio with a non-profit called San Anto Cultural Arts. We taught children from their day camp the EPA curriculum on climate change. San Anto also helped them to create three public service announcements on how the community can be mindful of climate change issues. We called it an eco-film camp. In 2015, I am getting ready to submit an application for a grant with San Anto to address solid waste disposal in the barrio where there is trash all around and illegal dumping. We are going to take what San Anto does in terms of creative writing and mural making and try to deliver

messages to the community about the environment and solid waste.

We are still struggling to find funding for research on fracking and the Eagle Ford Shale in Bear County. What we know is that the state of Texas is not doing enough in terms of air monitoring. We wrote a grant to provide portable air monitors to residents in the Eagle Ford Shale so they can do their own monitoring. We were going to attach that with qualitative interviews with residents and healthcare providers around that area. We have submitted this research for funding. We may have to look into private funds because it may be too volatile for state or federal funding.

VIKI CHAUDRUE, EDD, MSN, RN
Nursing Director
Mendocino College
Ukiah, CA

(1) Background: Could you tell me about your academic and career background? How did you get interested in environmental health? How did you get interested in this research topic and why is it important?

Suffice it to say that I have worked in many capacities as an RN, both on the East and West Coasts. I received my doctorate degree, Ed.D, in August of 2013.

I think I was always interested because my parents taught me how to respect the environment and how to garden. My *passion* for environmental health began when I became a white water rafting guide. In that capacity I was able to go into areas that were protected and undeveloped. I soon craved to be in the wilderness, and disliked coming back into "civilization" because I believe we have destroyed most of what was civilized due to personal greed, corporate greed, ignorance, and apathy. More importantly, I did not understand why nursing and medical education did not address environmental health, because clearly it was all intertwined. But then a colleague of mine mentioned that she had gone to a conference in San Francisco about environmental health and nursing education, and she gave me some of the pamphlets and handouts that she had received. That is how I became involved with the Alliance of Nurses for Healthy Environments (ANHE) in 2010.

(2) Description of Research: What is your research question(s), methods, results, and implications for practice and policy?

My dissertation pertained to educating undergraduate nursing students on the toxins in personal care products (lotions, deodorants, cosmetics, etc). I became interested in this topic because the personal care products that are often offered to clients after a mammography frequently contain substances that are known endocrine disrupters. I used a mixed-method approach and the results indicated that graduates of my local nursing program would have liked information pertaining to my research topic during their undergraduate education.

(3) Collaborators: What individuals, communities, or non-profits did you work with?

University of California at San Francisco's (UCSF's) Program on Reproductive Health and the Environment and of course, the nurses that belong to ANHE.

(4) Funding: Who funded your research?

Me

(5) Publication and Policy: Did you publish your research? Can you please provide a link for us to share? Did you engage in any policy-related efforts associated with your research?

My research has not been published yet, although I did obtain a copyright. I have not engaged in policy-related efforts regarding my research; however, I have engaged in policy-related efforts pertaining to fracking and the passage of California SB 1132 to impose a moratorium on fracking. (This bill was defeated in 2015.)

ROSEMARY CHAUDRY, PHD, RN, MHA, MPH, PHCNS-BC
Planner - Delaware (Ohio) General Health District
Adjunct Faculty- Ashland University College of Nursing
Ashland, OH

1) Background: Could you tell me about your academic background and nursing career? How did you get interested in environmental health? How did you get interested in this research topic and why is it important?

My academic background is BSN, MS, and PhD in nursing with minors in public health and health policy; masters degrees in health administration (MHA) and public health (MPH). My interest in Environmental Health (EH) began when I filled in for a colleague at a conference on methylmercury at the University of Wisconsin provided through a grant to two nurse EH researchers- Drs. Jeanne Hewitt and Ann Backus. If you didn't have previous coursework in environmental health, you had to complete the American Association of Occupational Health Nurses (AAOHN) EH modules. Between what I learned in the modules and at the conference, I was hooked. I took an EH course, decided to focus on that area in PH nursing, and completed the coursework I had done for my public health minor in my PhD program to earn my MPH degree. I believe strongly that the environment--from the first environment in utero--is a key determinant of physical, social, and emotional health.

(2) Description of research: What is your research question(s), methods, results, and implications for practice and policy?

I am retired now, but as a nurse faculty member my areas of focus were community interventions and health workforce issues related to childhood lead poisoning, asthma, healthy homes education for nursing students, and social justice in marginalized communities. My research methods included lead poisoning education for providers, a mock home environment for nursing healthy homes assessment, community based participatory research (CBPR) for translational research on EH hazards in a marginalized community, and community education and screening related to childhood lead poisoning. Implications for practice were the importance of teaching students and practicing nurses how to assess the home environment using the healthy homes framework, addressing health providers' perceived barriers to obtaining lead tests for children, supporting community representatives to advocate for changes to reduce litter and to promote completion of Brownfield remediation projects, and continued support and expansion of home-based education for families of urban children with asthma who live in poverty.

In my last position with a local health department, I supervised the staff person who did the agency's first EPH report, health impact assessment, and also wrote a small grant (which was funded) for local education and outreach related to lead poisoning and healthy homes. Now that I am retired, I am continuing my advocacy in areas related to climate change, fracking, indoor and outdoor air, chemicals, water, and the built environment including school EH assessments, health homes, built environment and green building.

(3) Collaborators: What individuals, communities, or non-profits did you work with?

My main EH research colleague was/is Dr. Barbara Polivka, who is now at the University of Louisville. (We worked together at Ohio State University for 8 years.) I have worked with my local county, an inner city neighborhood in Columbus Ohio, and with the Ohio Department of Health, Columbus Public Health, and Marion Public Health.

(4) Funding: Who funded your research?

Funding sources include Ohio Department of Health, Ohio EPA, Ohio State University Center for Clinical and Translational Science.

(5) Did you publish your research?

YES.

Can you provide a link for us to share?

http://www.ncbi.nlm.nih.gov/pubmed/21644481http://onlinelibrary.wiley.com/doi/10.1111/phn.12071/full

http://europepmc.org/abstract/MED/22909044

http://ehp.sagepub.com/content/32/1/23.full.pdf

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3589729/

Did you engage in any policy-related efforts associated with your research?

Intervention to support local neighborhood policy prohibiting discarding solid waste in inner city neighborhood; supported revising education for health care providers on lead testing requirements for children; support of state asthma plan

LINDA MCCAULEY, RN, PHD, FAAN, FAAOHN
Dean and Professor
Nell Hodgson Woodruff School of Nursing
Emory University
Atlanta, GA

(1) Background

Masters in pediatric nursing. Always had an interest in children. PhD at University of Cincinnati in Department of Environmental Health. Mentor at the time was Barbara Valanis, an epidemiologist, and her area was occupational health. Interested in extending pediatrics to the broader area of environmental health.

(2) Description of research

Research in 3 areas: children's environmental health, occupational health, and health of military populations. Strong focus in research has been exposure to chemicals, whether that is occupational exposure to chemicals like nurses handling antineoplastic drugs, or farmworkers handling pesticides, to military populations exposed to chemical warfare agents or fumes from burn pits.

(3) Collaborators

30 years ago studied nurses handling antineoplastic drugs for dissertation. Then studied veterans exposed to chemical warfare agents. Finally studied children exposed to pesticides, then workers exposed to pesticides, including adolescent workers.

(4) Funding

Continued program of research from National Institutes of Health (NIH), National Institute for Occupational Safety and Health (NIOSH), and Veterans Affairs (VA).

(5) Publishing and Policy

Over 80 publications. Most cited work deals with study design issues: how to design the studies to best capture exposures and health effects. Other studies deal with engaging communities and community-based participatory research: how to study environmental exposures in disadvantaged communities and populations.

Website for recent publications: click on publications

http://www.nursing.emory.edu/directory/profile.cfm?PEOPLE_NUMBER=1440

RUTH MCDERMOTT-LEVY, PHD, MPH, RN
Associate Professor, Villanova University
Director, Center for Global and Public Health
College of Nursing
Villanova, PA

(1) Background: Could you tell me about your academic background and nursing career? How did you get interested in environmental health? How did you get interested in this research topic and why is it important?

BSN: Wilkes University

MSN: Villanova University, Community Health Nursing & Nursing Education

MPH: University of Massachusetts – Amherst

PhD: Villanova University

I have always seen the connection between the environment and human health from working in a cardiac unit as a young nurse to working in home care for many years. Where and how you live matters.

I served as the co-chair of Pennsylvania State Nurses' Association Environmental Committee from 2009-2012. During that time, the fracking boom was taking off in Pennsylvania and we began working to educate nurses and other health professionals regarding the health impacts of fracking. As we were doing that work it was evident that more research about the health impacts of fracking communities was needed.

(2) Description of research: What is your research question(s), methods, results, and implications for practice and policy?

I am working on a community based participatory research (CBPR) project in natural gas development communities of Northeastern Pennsylvania. In phase I, I completed a qualitative descriptive study to determine health concerns of communities that are experiencing the impacts of the natural gas industry and which methods would be most effective to disseminate the health information. Residents where concerned about their air and water quality, and felt powerless and stressed by the changes in their communities. In phase II, I am using Dixon et al. (2006) Integrative Model for Environmental Health Education and Shoemaker et al. (2014) Patient Education Material Assessment Tool to determine the educational materials that most adequately address the residents' concerns that were identified in phase I and where are the gaps as noted by the residents.

I am currently working on data collection in a qualitative descriptive study to determine health concerns of Northeastern Pennsylvania communities that are experiencing the impacts of the natural gas industry. I am using focus groups and individual interviews to collect the data.

I selected CBPR as my research goal because I was speaking with a Villanova colleague, Steven Goldsmith, who is studying stream water quality in Pennsylvania's fracking regions and he shared that the people would tell him that the researchers come and collect their data and they never return to let any one know the findings. As a public health nurse, I found this unacceptable, I so I am working to collaborate and form partnerships with community members.

(3) Collaborators: What individuals, communities, or non-profits did you work with?

I have worked with several grassroots community organization as well as churches and service groups to solicit participation in this research.

(4) Funding: Who funded your research?

Phase I was funded by Villanova University, College of Nursing Center for Nursing Research. I also had a research assistant, Victoria Garcia. Phase II was funded by Villanova University Summer Research grant and my research assistant is Mika Inigo.

(5) Did you publish your research? Can you provide a link for us to share? Did you engage in any policy-related efforts associated with your research?

Publication related to research:

- McDermott-Levy, R., & Garcia, V. (2016). Health Concerns of Northeastern Pennsylvania Residents Living in an Unconventional Oil and Gas Development County. *Public Health Nursing*. doi: 10.1111/phn.12265 http://www.ncbi.nlm.nih.gov/pubmed/27079450
- McDermott-Levy, R., Kaktins, N. & Sattler, B. (2013) "Fracking, the environment, and health: An examination of energy practices and policies that threaten patients," American Journal of Nursing, 113 (6), 52-57.
- McDermott-Levy, R. & Kaktins, N. (2012). "Preserving health in the Marcellus region," (a CE offering). Pennsylvania Nurse, 67(3), 4-12.
- Advocacy: I have advocated for clean air with the Pennsylvania State Nurses Association and climate change with ANHE and PennEnvironment. I am a founding member of Protect Pennsylvania:Health

Professionals for a Livable Future, a consortium of health professionals advocating for health protective regulations related to the state's natural gas industry. Ruth is also the ANHE Education workgroup co-chairperson.

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Shoemaker, Wolf & Broch, (2014). Development of the Patient Education Materials Assessment Tool (PEMAT): A new measure of understandability and actionability for print and audiovisual patient information. *Patient Education and Counseling, 96,* 395-403.

BARBARA POLIVKA, PHD, RN
Professor; Shirley B. Powers Endowed Chair in Nursing
University of Louisville School of Nursing
Louisville, KY

(1) Background: Could you tell me about your academic background and nursing career? How did you get interested in environmental health? How did you get interested in this research topic and why is it important?

Bachelors and masters from University of Cincinnati. PhD from Ohio State University. Worked in emergency room, intensive care, med surg, home health. After PhD worked at Ohio Department of Mental Health for a couple of years as research program educator. Then went on faculty at the Ohio State University College of Nursing and was there for 20 years. Then came to University of Louisville 2.5 years ago and have been here ever since.

My interest in environmental health started with my dissertation. For my dissertation I worked with a nurse epidemiologist who looked at the environmental factors related to development of cerebral palsy in children. We did a case control study and I was the research assistant and collected the data. We explored environmental influences but didn't really find any differences between cases and controls; but it got my interest going.

I started out looking at one exposure, lead poisoning, then moved into broader poison prevention. Now I work on healthy homes and look at all the exposures in the entire home.

(2) Description of research: What is your research question(s), methods, results, and implications for practice and policy?

I did a lot of work early on with lead poisoning prevention. I worked with Ohio Department of Health and Columbus Public Health Department in this area. We did 7 studies that were looking at whether or not children were screened according to policy and protocol. Some studies were based on data available from Medicaid. We were able to look at the data and identify whether they were screened appropriately. What we found was that most were not. This influenced policy in having the Department of Health look at how they were approaching providers, what kind of education they were giving to providers, and what kind of incentives and disincentives they were giving to Medicaid providers in order to get them to screen children.

After that we evaluated the Pediatric Lead Assessment Network Education Training or PLANET, which was the training program the Ohio Department of Health had for healthcare providers. We looked at the effectiveness of their educational training. This was when the Internet was first starting to be used for education. Prior to that, education was one-to-one. We did focus groups and reviews of existing data and realized people wanted Internet education that was short, and they could look at on their own time and get the information they needed.

(3) Collaborators: What individuals, communities, or non-profits did you work with?

Ohio Department of Health and Columbus Public Health Department

(4) Funding: Who funded your research?

Medicaid in Ohio. Ohio Department of Jobs and Family Services.

(5) Did you publish your research? Can you provide a link for us to share? Did you engage in any policy-related efforts associated with your research?

All of my research has been published and you can find links in my CV. https://louisville.edu/nursing/directory/polivka-barbara

ELIZABETH C SCHENK, PHD, MHI, RN
Nurse Scientist/Sustainability Coordinator,
St. Patrick Hospital
Missoula, MT and
Assistant Research Professor
Washington State University College of Nursing
Spokane, WA

(1) Background: Could you tell me about your academic background and nursing career? How did you get interested in environmental health? How did you get interested in this research topic and why is it important?

I have been drawn to the natural world since I was a child. I found being in nature, even being outdoors with my feet on the ground to be calming and deeply satisfying. This general groundedness in nature led to my forming a group called the "Anti-Pollutionists" in the 6th grade (!) complete with a neighborhood carnival through which we raised money that helped buy trees for the city. In high school I did a yearlong study (in chemistry class) on the capacity for water hyacinth plants to uptake heavy metals in their roots. I also made an animated film (in film-making class) about can recycling. So, this tendency toward concern and involvement about the natural world has been a theme for a long time.

My first bachelor's degree was in Botany. I was very interested in ecology, and perplexed by the ways that humans were harming other species and ecosystems. When I entered the nursing profession, I immediately felt a collision of values within my experience. I knew how important nursing work was. I felt I was truly relieving suffering, and even saving lives. And yet, I also was horrified by the amount of waste, and later learned more about chemicals and energy use as well.

My first recycling project in nursing was in 1993. Ever since then, I have been working to decrease environmental impacts in my hospital. In 2007 our hospital made a more focused commitment to environmental stewardship and I was able to dive more deeply into content areas for healthcare sustainability. As I attended conferences and saw the nationwide (and worldwide) work being done to decrease environmental impacts of healthcare, I began to focus more on nursing practice itself. Nurses are the largest body of healthcare professionals, are present in a vast majority of healthcare experiences, and can be great advocates for change. One year at Clean Med (national conference on healthcare sustainability), I asked myself, "Why isn't anyone researching the role of nurses?" A few minutes later I felt the proverbial tap on my shoulder and said to myself…Oh, I guess this is what I'm doing next. This led to my work in nursing research and the earning of a PhD in nursing.

(2) Description of research: What is your research question(s), methods, results, and implications for practice and policy?

Though nurses across the nation are often leaders in environmental stewardship in healthcare, it has not entered the world of nursing research, and only minimally in nursing education. Because there was very little in the published literature on the topic, I began my research with the question, "How aware are nurses of the environmental impacts of nursing practice?" There was no validated tool available to measure that, and no published papers about nursing awareness of these issues and their associated health risks. My dissertation work was to develop and test such a tool, which I called the Nurses' Environmental Awareness Tool, or NEAT.

I began with a thorough scouring of available literature and websites. Then I drafted 160 items for consideration. I presented these to seven content experts across the nation, who helped ask clarifying questions, identified important or less important items, validated that important ones were included, and helped address confusing language or ideas.

I refined the items to 48 two-part items across six scales. These addressed nurse awareness of environmental impacts of nursing practice; how related nurses think those impacts are to health; ecological behaviors in the workplace and how difficult or easy they are; and ecological behaviors at home and how difficult or easy they are. I then tested the items in two cycles. The pilot phase was in three hospitals and the next phase (study phase) in four additional hospitals. During the two cycles 698 nurses responded, which allowed two phases of psychometric testing.

The scales performed well, with adequate reliability statistics and correlation scores. Because they performed well, I was able to analyze the results for content in a post-doctoral study. This yielded interesting findings about demographics and responses (age, education level, unit type, etc.) as well as how the scales relate to each other.

There are many implications for practice in acute care. Nurses could use the scales to compare data pre and post an educational intervention. Educators could use them to measure student awareness coming into a program. Nurses could use the scales to provide information about nurses' adherence to ANA Standard 16, which states that

"the RN practices in an environmentally safe and healthy manner." By understanding interactions between awareness and behavior, nurse administrators can help guide actions that result in lower impacts. By studying nurses, researchers can contribute to the broader body of knowledge in sustainability science.

(3) Collaborators: What individuals, communities, or non-profits did you work with?

My dissertation committee was intimately involved with my thinking and writing. They are: Celestina Barbosa-Leiker, PhD; Patricia Butterfield, PhD, RN; Cindy Corbett, PhD, RN; and Julie Postma, PhD, RN.

Alliance of Nurses for Healthy Environments (ANHE) nurses were encouraging and provided content expertise, including Barb Sattler, Denise Choiniere, and others.

(4) Funding: Who funded your research?

I had a small amount of financial support for tuition through my employer, Providence St. Patrick Hospital and the Providence Western Montana Health Foundation.

(5) Did you publish your research? Can you provide a link for us to share? Did you engage in any policy-related efforts associated with your research?

Link to dissertation research: Creating the Nurses' Environmental Awareness Tool (NEAT)
http://whs.sagepub.com/content/63/9/381

I work on a variety of efforts related to environmental stewardship broadly. I work on our community climate action plan; serve on a local river advocacy board; and guest lecture at the college of nursing, medical school, business groups. I work in our larger hospital system with 20 hospitals working on environmental stewardship, and to advance the business case in the organization.

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Unit X:
Conclusion

MOVING FORWARD

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This first edition of the *Environmental Health in Nursing* electronic textbook includes both long-standing and emergent environmental health concerns for nursing and other health professions. Since Florence Nightingale, nurses have been called to consider the environment when promoting human health. In part, this text is a response to the 2005 Institute of Medicine report that called for a renewal of environmental health in nursing (Pope, Snyder & Mood, 2015). Also, environmental health concerns develop from new technologies, new chemicals used globally, new research findings related to health risks, and changes in policy and environmental law. As a result, the topics discussed in each unit of this edition are subject to change.

Since the first efforts to develop this textbook there have been numerous changes in environmental issues. The impact of climate change, growing use of hydraulic fracturing, legislative efforts to address chemical policy reform, new findings about the dangers of flame retardants, BPA, phthalates, and other chemicals are but a few of the ever-changing issues. Such issues have captured the public media and led nurses to become involved in efforts to reduce adverse health outcomes for the populations we serve.

Our first edition was designed to engage nurses to learn more about the impact of the environment upon health, to meet the mandate for the ANA *Scope and Standards of Practice* for their work (ANA, 2015), to become advocates to improve health policy to reduce environmental threats, and to engage in scholarship to improve nursing knowledge for environmental health. We have included broad range of topics and know that they are not exhaustive. Over thirty nurses have contributed to this text from fourteen states. When you find an omission or desire more depth, we hope you will consider contributing to a later edition which is being planned, even as we launch this edition.

In Unit I, we looked at the nursing profession and the importance of professional involvement to advance environmental health in all settings. Environmental exposures can be studied by looking into specific environments such as homes, workplaces, schools, day care centers, long-term care facilities and hospitals. While we introduced information about each of these settings, we plan to expand our discussion for future editions. In particular, the work of nurses in the Healthy Homes initiative has been substantial and well funded. Initiatives such as the Eco-Healthy Child Care of the Children's Environmental Health Network (CEHN) show promise in the reduction of exposures for young children in day care settings (CEHN, 2016).

Further, the role of nurses in education, practice, advocacy and policy making and research has grown since the initial call to action in the 1995 Institute of Medicine report (Snyder, Pope & Mood, 1995). Throughout this edition, we have included examples of the impact of nurses in each of these areas. We invite readers to consider sharing your own examples of including environmental health in nursing for the next edition. More information about the role of occupational health nurses will be added as well.

Our Unit II introduced Harmful Exposures for Vulnerable Populations throughout the life span. Our next edition will be expanded to offer more information about specific topics of that chapter. A serious concern not only for pregnant women and the growing fetus but also for future generations is the impact of endocrine disputing chemicals (EDCs). Many of these are present in pesticides that pose a risk to people of all ages as well. The growing field of epigenetics examines how changes in both cellular and physiologic traits result from environmental factors. Such changes are external to the actual DNA genome. Gene expression can be altered by environmental factors such

as pesticides (Collotta, Bertazzi, & Bollati, 2013). Recent studies suggest that EDCs can be obesogenic, that is influence metabolism in ways that increase susceptibility to obesity (Stel & Legler, 2015).

Children are vulnerable to harmful exposures. We plan to include chapters specifically related to children's issues, including asthma, pesticide exposures (including both specific risk information and preventive strategies), neurological impacts of harmful exposures such as lead, as well as cosmetic use and workplace exposures in adolescents. While occupational health nurses promote the health and safety of workers, many chemicals used in the workplace have not been tested for safety for workers or for children and adolescents who might be exposed through toxins that come home on clothing from the workplace. Nurses have unique opportunities to reduce toxic exposures in children.

Unit III introduced environmental sciences which are essential to our understanding of environmental health for health professionals. Multiple in-depth resources are included in links to internet sites. Future editions will include information about epidemiology and how epidemiologic studies inform our knowledge of environmental hazards. We also plan to include more information about specific chemical hazards, both those that have been studied and evolving concerns. Many environmental science courses examine environmental exposures through the source of exposure be it water, air, food and soil. Future discussions will expand information about common exposures, how to reduce risks, and federal and local regulation of exposures.

Unit IV discussed nurse involvement to advance environmental health and sustainability in practice settings. As nurses increase their awareness of and commitment to healthier practice settings, there will be opportunities for nurses to share information of what has been done. Advocacy will be needed to engage nurses in promoting the work in their own practice setting. One area where nurses have been voices for change is with pharmaceutical waste, in both practice and home settings. One goal is to make nurses aware of healthier choices in their personal health and that of their communities in addition to their workplaces.

Unit V contained information about sustainable communities. Growing concerns at local, national and international levels to protect human health and the environment have led to ways to improve the built environment to advance healthy communities. Efforts to improve housing, alternative means of transportation, green space, and community engagement will increase in the future and we plan to add information about nurses engaged in this work. Sustainability is a growing concern for our health and our planet. Horton et al (2014) argue that public health must lead a social movement to address the threats to sustainability of our civilization that they call planetary health. Without that, they claim that the vast majority of the global population will not maintain health or well-being

Unit VII provided an extensive introduction to climate change and health. We will continue to expand information about climate change including the impact of energy sources and use upon both planetary health and human health. Policies such as the Clean Power Plan to address the toxic effects to health from electricity producing power plants will be followed for updates in future editions of this textbook. Internationally, countries such as Scotland have banned fracking, while in the US states such as New York have developed bans on fracking. Future editions will offer more information about the research into health effects of fracking, and the impact upon the environment.

In Unit VIII we reported how nurses have been instrumental in advocacy efforts for decades in professional roles, and as parents and citizens. Examples include efforts to bring awareness to both the public and governmental entities for chemical safety for families and children (such as stroller brigades), climate change, and hazards associated with hydraulic fracturing. In addition, nurses as reported in Unit IV have been successful in improving environmental health and safety in the workplace through Green team efforts. As more nurses become knowledgeable about environmental impacts upon health, examples of advocacy and policy will expand. We offered some personal stories through interviews with nurse leaders in environmental health nursing and links to the Luminary project. Also, many nurses serve or have served in advisory capacity for the EPA Children's Health Protection Advisory Committee for specialty organizations for school health, oncology, and developmental disabilities among others. In addition, nurses serve as consultants for topics related to the environment and health across the USA and in other countries. As the growth in advocacy and policy work expands our ability to report on these exciting nurse roles will increase.

In Unit IX we introduced you to eight nurse researchers in the area of environmental health. Nursing knowledge is built upon nursing research and scholarship. As more nurses engage in research relevant to nursing and the environment, so too will the examples offered.

In response to emerging concerns we plan both to update topics offered in this first edition and to expand our

textbook to include a wide range of topics important to nursing practice. To succeed in our educational mission we welcome nurse contributions to future editions. With this online format, contributions can include media links that highlight teaching strategies, professional development successes, advocacy workshops and other innovative learning modalities.

All nurses and other health professionals are called upon to include the environment in their practices whether it is clinical practice, education, policy and advocacy, and/or research. We invite you to reflect on your own practice, family life and community involvement to consider where and when you can apply your environmental health knowledge and skills to improve health. Our future depends upon it.

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