

MONTANA PUBLIC HEALTH NURSES' PERCEPTIONS
OF ENVIRONMENTAL HAZARDS AND HEALTH EFFECTS

by

Stephanie Buswell Burkholder

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Stephanie Buswell Burkholder

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Wade Hill, PhD, PHCNS-BC

Approved for the College of Nursing

Dr. Donna Williams

Approved for the Division of Graduate Education

Dr. Carl A. Fox

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ABSTRACT

Public health nurses (PHNs) are in a prime position to educate individuals, families, and communities about the potential detrimental effects of environmental hazards and related health effects. The 2005 Environmental Public Health Tracking (EPHT) survey elicited data from Montana PHNs regarding their concern for environmental hazards and health effects. Using data from the EPHT survey, the aim of this thesis was to determine if differences existed among Montana PHNs regarding their concern for environmentally attributable hazards and health effects based on their level of educational preparation. Findings indicated there were no statistically significant differences between PHNs with a baccalaureate degree or higher versus PHNs with less than a baccalaureate degree and their concern for either environmental hazards or health effects. Qualitative differences were also examined and indicated that PHNs in the total sample were most concerned about tobacco smoke in the homes of children and cancer. Conversely, they were least concerned about residences built in floodplains and infertility. These findings are discussed as they apply to PHN practice and preparation of nurses to intervene where environmental concerns exist.

CHAPTER ONE

INTRODUCTION TO THE STUDY

Environmental health is rapidly becoming a focus area for clinicians, researchers, individuals, and communities aiming to investigate and mitigate exposures to harmful agents. Environmental health can be defined as “freedom from illness or injury related to toxic agents and other environmental conditions that are potentially detrimental to human health” (Pope, Snyder, & Mood, 2005, p. 15). Ample studies continue to demonstrate that well-known environmental hazards such as tobacco smoke, motor vehicle emissions, and lead may lead to negative health effects with continued exposure. Furthermore, specific hazards such as asbestos, arsenic, and radon can be found in rural states like Montana and warrant additional concern for their potentially negative health effects.

To help communicate the importance of real or potential environmental risks, medical professionals are generally accepted as an educated and trusted source to distribute this information (Miller & Solomon, 2003). More specifically, public health nurses (PHNs) are in a prime position to educate the public about environmental hazards and related health effects through environmental education, health promotion, and disease prevention tactics aimed at individuals and communities. However, PHNs come from a variety of educational backgrounds in Montana: from the licensed practical nurse (LPN) with a one-year certificate, to the nurse researcher holding a doctoral degree; therefore, the scope of practice and knowledge base may potentially vary depending on the educational preparation of the PHN.

In order to be effective educators and leaders in the public health system, PHNs need appropriate training in environmental health to respond to the growing public awareness of, and concern about, environmental exposures and human disease (O'Fallon, 2006). However, there is concern that nursing education and training programs may not incorporate sufficient environmental health into their curricula. Due to the lack of emphasis on environmental health education at many levels of nursing education, there is a possibility that some nurses may have a lack of concern about environmental hazards and related health effects. For example, Issel, et. al. (2006) found through a self-reported questionnaire that neither PHNs nor public health faculty in Illinois reported meeting the professionally established level of competence in PHN domains. This finding suggests there is a need to have greater attention given to nursing curriculum development and its inclusion of public and environmental health competencies.

To help address concerns regarding environmental health at multiple levels, the Environmental Public Health Tracking (EPHT) project created a needs assessment in 2005 for PHNs and other environmental stakeholders in the state of Montana. This survey was designed to help develop strategies for Environmental Health Tracking capacity building and eventually enable federal, state, and local agencies to make informed decisions about health and the environment (Hill, 2004). In the survey, PHNs were asked to state their level of concern for specific environmental hazards and environmentally related health effects. In addition, demographic data such as the level of educational preparation of PHN participants was also included. Using data collected from the survey, this thesis explored the relationship between level of educational preparation of the PHN

and his or her level of concern for environmentally attributable hazards and health effects in Montana.

Purpose

Even though PHNs are in an optimal position to assess for and distribute knowledge related to environmental health issues, many nursing education and training programs may not include environmental health within their curricula. Thus, there is a possibility that a lack of environmental health education of the PHN may lead to a lack of concern for environmental hazards and related health effects. The purpose of this thesis was to address the following question: does level of educational preparation among Montana PHNs affect their level of concern for environmentally attributable hazards and health effects?

CHAPTER TWO

REVIEW OF THE LITERATURE

In order to better understand the dynamic between environmental health concepts and their incorporation into nursing education curricula, the literature was reviewed to provide relevant background information on environmental hazards, their health effects, and the role of nurses in addressing these issues. PHNs come from a variety of educational backgrounds in Montana. In addition, environmental hazards and related health effects are issues that warrant increased attention in the public health arena. This literature review was designed to help answer the original question: does level of educational preparation among Montana PHNs affect their level of concern for environmentally attributable hazards and health effects?

A thorough review of the literature was conducted to provide rationale for further research through this thesis. Although environmental health is not a new concept in nursing practice, it has not received as much recent attention due to the emergence of technological advances and disease-specific risk factors surrounding the area of acute care nursing (Butterfield, 2002). Specifically, environmental health does not appear to be emphasized in many nursing education and training curricula, especially in Montana. Because many nurse researchers and faculty members view this discrepancy as a weakness in nursing knowledge (Pope, Snyder, & Mood, 1995), studies on environmental education for nurses are increasingly being warranted to address the need for evidenced-based nursing curricula and practice.

Databases and Terms Used

The Cumulative Index of Nursing and Allied Health Literature (CINAHL) and MEDLINE databases for the years 2000 through 2009 were searched using the following keywords: environmental health, environmental hazards, nursing education, public health, competencies, and nursing practice. These keywords were used in various combinations with each other, which often yielded further articles that were relevant to this literature review. In addition, the reference lists of many articles were scanned for further articles meeting the inclusion criteria. Health-related federal government websites (e.g., Centers for Disease Control, Environmental Protection Agency, etc.) were also searched for information on specific environmental hazards and their health effects.

Inclusion and Exclusion Criteria

Because some searches revealed hundreds of related articles, criteria for inclusion were established to narrow the literature. First, article titles, abstracts, and texts were scanned for appropriate inclusion criteria into this literature review. Second, articles published between the years 2000 and 2009 were defined as current literature. However, one seminal article published before 2000 appears numerous times throughout the selected literature and thus was included in this review. Third, articles reviewed were those written in the English language to ensure comprehension by the author. Finally, articles were relevant to the following specific topics: environmental health in nursing education programs, environmental health nursing competencies, and environmentally-attributable hazards and related health effects.

Articles were excluded if they did not meet the inclusion criteria. They were also excluded if they were not published in nationally-recognized, peer-reviewed journals. This criterion was established to provide more rigor in the literature review and to ensure the information was credible.

Magnitude of Environmental Health Problems

The environment is one of the primary determinants of individual and community health (Pope, Snyder, & Mood, 1995). In fact, environmentally attributable hazards have the potential to affect numerous aspects of one's health and well-being. Healthy People 2010 (n.d.) listed "Environmental Quality" as one of its top 10 Leading Health Indicators, citing the fact that "human exposures to hazardous agents in the air, water, soil, and food and to physical hazards in the environment are major contributors to illness, disability, and death worldwide" (p. 8-4). Moreover, the financial burden of environmental hazards on human health is staggering. One estimate by Landrigan, Schechter, Lipton, Fahs, and Schwartz (2002) stated that each year in the United States, the proportion of health effects attributed to environmental causes for childhood lead poisoning (100%), asthma (30%), cancer (5%), and neurobehavioral disorders (10%) costs taxpayers \$54.9 billion in health care and associated costs.

A large amount of published data exists to support links between environmental hazards and subsequent health effects. The Agency for Toxic Substances and Disease Registry (ATSDR) has created an index of nearly 200 known toxic substances and how they can affect one's health (2009). Some examples from this list found in Montana

include arsenic, lead, and asbestos, and all three have been linked to serious health consequences.

For example, long-term, oral exposure to low levels of inorganic arsenic (related to contaminated soil) may cause dermal effects, peripheral neuropathy, and possibly an increased risk of skin cancer, bladder cancer, and lung cancer (ATSDR, 2007). In addition, the effects of elevated blood lead levels in children have been extensively studied. If not detected early, children with high levels of lead in their bodies can suffer from damage to the brain and nervous system, behavior and learning problems, slowed growth, and hearing problems. Lead is also harmful to adults, often leading to difficulties during pregnancy, high blood pressure, digestive problems, and nerve disorders (Sattler & Del Bene Davis, 2008). Soil, surface water, and ground water in East Helena, Montana were found to be contaminated with lead and other heavy metals due to an active lead smelter in operation there from 1888 to 2001. The site is now designated as an active Superfund site, and the smelter has been shut down (U.S. Environmental Protection Agency [EPA], 2009b). Finally, in the northwestern town of Libby, Montana, extensive studies have demonstrated increased rates of asbestosis and mesothelioma due to environmental exposures to asbestos-contaminated vermiculite mined in that area (Sullivan, 2007). Libby is also now an active Superfund site, and it is estimated that 1200-1400 residential and business properties may need cleanup to prevent ongoing health effects (U.S. EPA, 2009a).

Other well-known environmental hazards are related to air quality and include motor vehicle emissions and tobacco smoke. Studies have demonstrated associations

between residential proximity to traffic-related air pollution and adverse respiratory effects in children such as asthma, wheezing, and bronchitis even without parental history of asthma (Kim, et al., 2008; McConnell, et al., 2006). Tobacco smoke is a well-known carcinogen and contributor to respiratory illnesses. Tobacco smoke is the leading cause of preventable deaths in the United States, and smoking-related deaths are most commonly attributed to cancer, cardiovascular diseases, and respiratory diseases (Armour, Woollery, Malarcher, Pechacek, & Husten, 2005). In addition, children exposed to tobacco smoke are significantly more likely to experience more severe asthma (Mannino, Homa, & Redd, 2002).

Finally, regulatory measures by the U.S. Federal government have attempted to address the magnitude of environmental hazards and health effects, especially those affecting children. In 1995, the U.S. Environmental Protection Agency (EPA) announced its Policy on Evaluating Health Risks to Children, which required that the EPA consistently and explicitly evaluate health risks to infants and children. Two years later, President Clinton signed Executive Order (EO) 13045, Protection of Children from Environmental Health Risks and Safety Risks, which directed federal agencies to identify and assess environmental health risks that disproportionately affect children when developing policies, programs, activities, and standards (Payne-Sturges & Kemp, 2008, p. 1720).

Role of Nurses in the Health Care System

The American Nurses Association's (ANA) Congress on Nursing Practice and Economics provided the following definition of nursing: “nursing is the protection, promotion, and optimization of health and abilities, prevention of illness and injury, alleviation of suffering through the diagnosis and treatment of human response, and advocacy in the care of individuals, families, communities, and populations” (2008, p. 2). The number of licensed registered nurses (RNs) in the U.S. continues to grow and reached just over three million nurses in the most current official survey in 2008 (Health Resources and Services Administration, 2010). In fact, RNs constitute the largest health care occupation in the country (Bureau of Labor Statistics, 2007). Due to the sheer volume of RNs in the workforce, they have the capability to significantly influence the quality of health care in the U.S., including its delivery, effectiveness, and ability to further evidence-based practice.

Role of Nurses in Addressing Environmental Health Problems

Historically, Florence Nightingale is noted as the nursing theorist whose philosophies are most rooted in environmental ideologies. The primary components of Nightingale's theoretical framework - ventilation, warmth, quiet, diet, and cleanliness - are all environmental concerns that remain integral components of nursing care today (Pfetscher, 2006). Even though Nightingale's ideas and theories are now seen to be important aspects of nursing practice, this has not been the case for the last few decades. In the early 20th century, many nurses worked in the community setting where they could

observe firsthand how the environment played a role in health and disease (Gerber & McGuire, 1999). However, by the mid-20th century, environmental health began to lose its emphasis in both education and practice due to the emergence of technological advances and disease-specific risk factors bringing greater attention to the area of acute care nursing (Butterfield, 2002). Even though acute care nursing education and training is critical to caring for many individuals in all populations, Nightingale's approach to environmental health education may be lacking today in many nursing education and training programs.

Pope, Snyder, & Mood (1995) also stressed the importance of nursing's role in prevention by emphasizing that nurses need to identify the environmental hazards that not only contribute to a current diagnosis but also those that have not yet caused illness and may be amenable to intervention. In their Institute of Medicine report, the authors encouraged nurses to embody three roles in addressing environmental health issues: as an investigator, an educator, and an advocate. These roles encourage nurses to identify potential environmental hazards, to inform individuals or communities about the related health risks, and to assist in coordinating access to specialized services related to the hazards or health effects.

Today, nurses also help to create awareness of environmental hazards and related health effects that may enable changes in inpatient settings. For example, there is evidence that reproductive health risks (especially to the male reproductive tract in neonates) may be associated with exposure to the chemical di-ethylhexyl phthalate (DEHP) commonly found in intravenous tubing and bags (Green, et al., 2005). Equipped

with this knowledge, nurses working in Neonatal Intensive Care Units around the country took the lead in changing hospital purchasing policies to instead utilize DEHP-free IV tubing and IV bags (Sattler & Del Bene Davis, 2008).

In a broader scope, rural nurses have the opportunity to address environmental hazards and their potential health effects. “Despite commonly held notions that rural environments offer isolation from environmental contaminants, many rural areas offer the most potent environmental exposures in the United States” due to the impacts of extractive industries and subsequent designations of Superfund sites in many rural areas (Hill & Butterfield, 2006, p. 272) . Thus, it is important that nurses have a critical awareness of potential environmental hazards in all areas including geographical regions, communities, health care facilities, work sites, and homes.

With an awareness of real or potential environmental hazards, nurses can disseminate knowledge to clients, families, and communities. In addition, Grason and Misra (2009) posited that education of nurses and providers could lead to increased assessment of individuals with regard to environmental hazards, more accurate estimation of the risk associated with exposures, communication of risk estimates to clients, and appropriate referrals to specialty care and resources.

Role of Public Health Nurses in Addressing Environmental Health Issues

One way to reduce the morbidity, mortality, and associated costs related to environmental health risks is through the use of community education via public health professionals. In fact, Pope, Snyder, & Mood (1995) reported that “in order to protect

and promote health and well-being, the nation needs a strong governmental public health structure” (p. 3). The current public health structure in the United States is fueled by its public health employees, and PHNs comprise roughly 30% of public health employees, making them the largest segment of this employee base (2002). With PHNs playing such a critical role in the functioning of the public health system, their level of competency directly affects the overall capacity of the public health workforce (Issel, Baldwin, Lyons, & Madamala, 2006).

Core Competencies

The Quad Council of Public Health Nursing Organizations created core competencies for public health professionals in 2003 to provide a guide for public health agencies and academic settings to facilitate education, orientation, training, and lifelong learning for public health nurses. Environmental health is addressed under Domain #6 Basic Public Health Science Skills: “Applies the basic public health sciences including behavioral and social sciences, biostatistics, epidemiology, environmental public health, and prevention of chronic and infectious diseases and injuries.” However, it is only recommended for PHNs to have an awareness of this competency, which equates to “a basic level of mastery of the competency. Individuals may be able to identify the concept or skill but have limited ability to perform the skill” at a generalist/staff PHN level.

Essentials of Baccalaureate Education

The Essentials of Baccalaureate Education for Professional Nursing is a comprehensive set of core standards for baccalaureate-degree nursing education programs. It was first published by the American Association of Colleges of Nursing (AACN) in 1986 with its most recent revision in 2008. Environmental health is covered by Essential VII, which refers to clinical prevention and population health. In relation to environmental health, this essential states that a baccalaureate program in nursing should prepare the graduate to 1) assess protective and predictive factors, including genetics, which influence the health of individuals, families, groups, communities, and populations; 2) conduct a health history, including environmental exposure to identify current and future health problems; 3) use behavioral change techniques to promote health and manage illness; and 4) use evidence-based practices to guide health teaching, health counseling, screening, outreach, disease and outbreak investigation, referral, and follow-up (AACN, 2008).

Theoretical Framework

The theoretical framework that guided this research was the Health Belief Model (HBM). The HBM was originally developed as an intrapersonal theory to better understand the use of health promotion and disease prevention tactics (Strecher & Rosenstock, 1997). The concepts of perceived susceptibility and perceived severity in the HBM are particularly important in helping to understand PHNs' risk perception for

environmental hazards and related health effects. These concepts will be used to further guide this thesis.

Perceived susceptibility measures an individual's subjective perception of his or her risk of contracting a health condition (Strecher & Rosenstock, 1997). For PHNs, perceived susceptibility encompasses a personal belief that exposure to certain environmental hazards could lead to subsequent negative health effects for themselves, their clients, or their communities. One example of perceived susceptibility would be the belief that prolonged exposure to high levels of radon in the home may lead to subsequent respiratory illness or lung cancer. However, a PHN must be informed of where higher radon levels are geographically located, who is at greater risk in the home (i.e., family members spending most of their time in basements or lower levels), and how to objectively measure radon levels in a home.

Perceived severity addresses one's feelings about how serious contracting an illness and its sequelae are (Strecher & Rosenstock, 1997). This concept illustrates the level of concern PHNs may have regarding certain environmentally-related health effects such as cancer, reproductive outcomes, and disease outbreaks. For example, a PHN of childbearing age may have greater concern about potential hormone disruptors such as Bisphenol A (BPA) than she would about contracting *Escherichia coli* from contaminated well water. Perceived severity ultimately addresses how much education the PHN has about particular environmental hazards and related health effects. Thus, it is assumed that with less knowledge regarding the severity of some environmental hazards to human

health, the PHN may not understand the need for closer surveillance and/or monitoring of such hazards.

In essence, perceived susceptibility and severity from the HBM address risk perception (see Figure 1). In relation to this thesis, risk perception was conceptualized as PHNs' concern for environmental hazards and related health effects. Factors that may influence or modify PHNs' risk perception of certain environmental hazards include sociodemographic factors such as age, sex, ethnicity, and level of education. Although the model allows for sociodemographic information as influencing factors for perceived susceptibility and severity, this thesis only addresses level of educational preparation as a factor. Thus, within the framework of the HBM, it is reasonable to investigate the relationship between PHNs' educational preparation and risk perceptions for environmental exposures and related health effects.

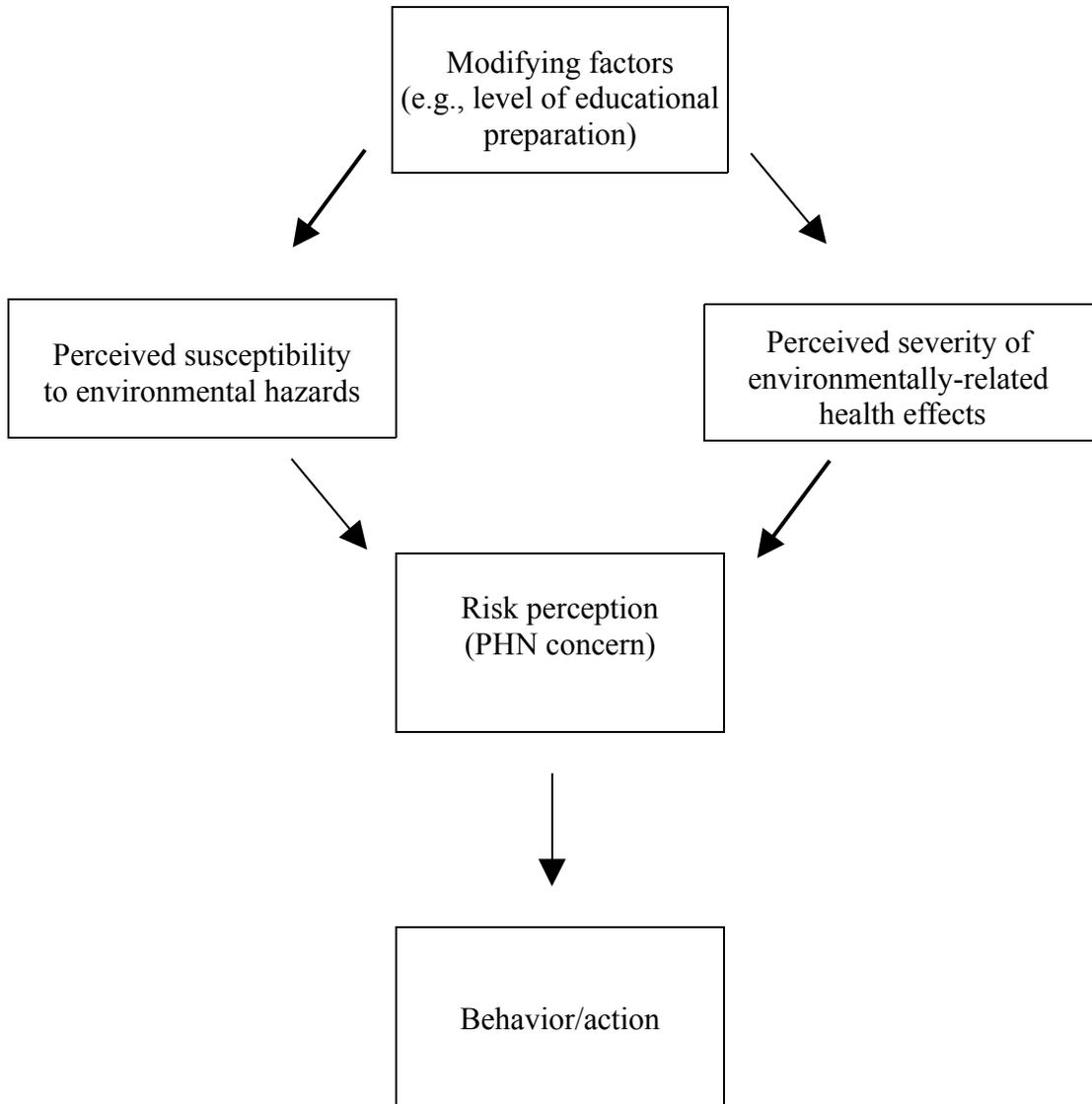


Figure 1. Health Belief Model: Theoretical Framework Adapted From Strecher & Rosenstock (1997)

CHAPTER 3

METHODS

The primary goal of this thesis was to explore if level of educational preparation among Montana PHNs affected their level of concern for environmentally attributable hazards and health effects. The original data was collected as a needs assessment for Montana PHNs as part of Environmental Public Health Tracking; this data was then utilized to examine this research question. The methodology employed to design the study and obtain the data has been previously published in detail (Hill, 2009) and is included in this chapter.

Population and Sample

All participants for this study were recruited from the state of Montana, which has 56 counties and 52 health departments. Data collection was specifically aimed at PHNs employed in Montana, whether through local and state agencies, tribal health and Indian Health Services, or private organizations. Since there is no comprehensive list of all PHNs in Montana, several contact lists were garnered from state-wide public health agencies. All PHNs from available contact lists were invited to participate and constituted the sample. In all, 229 invitations were sent out and 153 responded (66.8% response rate), representing 49 of the 56 Montana counties.

Design

A multi-mode survey was used to collect data for this study. Data was collected during the fall of 2005 using a cross-sectional sample of Montana PHNs. Both paper and electronic (web-based) surveys were administered. Data from electronic collection were entered by participants and merged into the study database. Data from paper questionnaires were entered manually using established coding schemes, and all data were assessed for missing values and outliers.

Procedures for Data Collection

All Montana PHNs with valid email addresses were invited to participate in the online survey, and those without email addresses were mailed paper invitations. Participants were assured that data would not be linked with identifiers and that all data reports would be done in aggregate. The sequence and number of contacts included: (1) an initial invitation letter (or email) explaining the purpose of the project and informing the participant that he/she would be receiving a survey within one week; (2) an initial survey mailing that included an invitation letter, the instrument, and a postage-paid return envelope for those who had no valid email address or an email invitation that included a link for the participant to follow if he/she wished to complete the survey online; (3) a reminder postcard (or email) two weeks after the survey mailing; and (4) a second survey mailing that did not include the electronic option. A paper questionnaire was utilized as a last contact to ensure that any non-response was unrelated to survey mode.

Instrumentation

The self-report questionnaire developed by the initial research team (Hill, 2004) included 39 items to help assess a variety of issues in PHN practice. These issues included barriers and facilitators to the incorporation of environmental health into PHN practice, interventions directed towards improving environmental health, and access to environmental health data sources. The list of issues in the survey was circulated among both experts and PHNs to assess content validity. Specifically for this thesis, two questions from this survey were analyzed. The first question asked “What is your level of concern for each of the following environmental hazards that may occur in the State of Montana?” The second question stated “Below are categories of environmentally related health effects. Please indicate your level of concern with each broad category listed.” For these two questions, a total of nine and 13 items adapted from Van Dongen (2002) asked the participant to rate on a four-point Likert scale their level of concern (not concerned, somewhat concerned, moderately concerned, or very concerned). Standard demographic items such as age, sex, ethnicity, and work status (i.e., full-time or part-time) were included in the beginning of the survey. Also included within the demographic section was the following question: “What is your highest level of educational preparation in nursing?” The choices included Licensed Practical Nurse, Associate Degree in Nursing, Baccalaureate Degree in Nursing, Masters Degree in Nursing or Related Field, and Doctoral Degree in Nursing or Related Field.

Rights of Human Subjects and Consent Process

The original study was approved and monitored through Montana State University's Institutional Review Board for protection of human subjects. Consent was implied when surveys were completed and returned.

CHAPTER FOUR

RESULTS

Statistical analysis was conducted to address the original research question: does level of educational preparation among Montana PHNs affect their level of concern for environmentally attributable hazards and health effects? To address each component of the research question, separate analyses were conducted on the data relating to concern for both environmental hazards and health effects as they are identified in the original survey text.

Sample Description

Of the 229 surveys distributed, 153 surveys were returned. Complete data were available for 120 respondents (52.4% complete response rate), and those respondents were entered into the statistical analysis. The majority of respondents were female (98.3%) and white/non-Hispanic (91.7%). Almost half the respondents were between 45-54 years of age (41.7%), and most were considered full-time employees working 30+ hours a week (78.3%). In order to address the research question, data for educational level of respondents were collapsed into two groups: less than a baccalaureate degree in nursing and greater than or equal to a baccalaureate degree in nursing. Roughly one-third (32.5%) of respondents held less than a baccalaureate degree in nursing, while 67.5% of respondents held at least a baccalaureate degree in nursing (see Table 1).

Table 1
Sample description (n=120)

Demographic	n	%
Gender		
Male	2	1.7
Female	118	98.3
Ethnic group		
American Indian/Alaska Native	10	8.3
White/Non Hispanic	110	91.7
Educational level		
Less than baccalaureate degree	39	32.5
Greater than or equal to baccalaureate degree	81	67.5
Age group		
20-24	1	0.8
25-34	11	9.2
35-44	31	25.8
45-54	50	41.7
55-64	26	21.7
65-74	1	0.8
Employment as PHN		
Full time (30+ hours/week)	94	78.3
Part time (9-29 hours/week)	25	20.8
A few hours (<8 hours/week)	1	0.8

Statistical Results

A Mann-Whitney U test was selected to analyze the data because the dependent variables were measured on an ordinal scale. Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 16.0 (*SPSS for Windows*, 2009), and a *p*-value of less than 0.05 was determined to be statistically significant. Data was analyzed

and is presented separately by concern for environmental hazards and concern for environmental health effects.

Concern for Environmental Hazards

Statistical results exploring differences in level of concern for environmental hazards can be seen in Table 2. Results of the Mann-Whitney U test suggest that respondents were homogenous in respect to all items with regard to educational level, and no statistically significant differences were found. However, qualitative differences were examined by producing frequencies for both educational groups (less than a baccalaureate degree and greater than or equal to a baccalaureate degree) on the four levels of the ordinal measurement scale. Despite lack of statistically significant results with this small sample, frequencies suggest that some differences may exist between PHNs with different levels of educational preparation.

For example, the highest level of concern across both education sets was tobacco smoke in homes with children. Most (92.3%) respondents with less than a baccalaureate degree indicated they were either moderately concerned or very concerned for this hazard, whereas 96.3% of respondents with a baccalaureate degree or greater indicated they were either moderately concerned or very concerned for tobacco smoke in homes with children. Thus, even though both groups demonstrated great concern for environmental tobacco smoke, PHNs with a baccalaureate degree or higher were slightly more concerned about this hazard.

Conversely, the lowest level of concern for environmental hazards across both education sets was residences built in floodplains. Many (61.6%) of respondents with less than a baccalaureate degree indicated they were either not concerned or only somewhat concerned about flooding, whereas 55.5% of those with at least a baccalaureate degree claimed to be either not concerned or only somewhat concerned about this hazard. Again, even though both groups displayed low levels of concern for this hazard, PHNs with a baccalaureate degree or greater demonstrated slightly more concern.

Table 2
Level of concern for environmental hazards by educational level (n=120)

What is your level of concern for each of the following environmental hazards that may occur in the State of Montana?	Level of concern	Non-baccalaureate degree n=39 (32.5%)	Baccalaureate degree or greater: n=81 (67.5%)	Mann-Whitney U standardized test statistic	p-value
Air pollutants such as carbon monoxide, lead, ozone, or sulfur dioxide	Not concerned	4 (10.3%)	4 (4.9%)	0.830	0.407
	Somewhat concerned	14 (35.9%)	29 (35.8%)		
	Moderately concerned	15 (38.5%)	32 (39.5%)		
	Very concerned	6 (15.4%)	16 (19.8%)		
Motor vehicle emissions	Not concerned	8 (20.5%)	14 (17.3%)	0.789	0.430
	Somewhat concerned	16 (41%)	30 (37%)		
	Moderately concerned	10 (25.6%)	23 (28.4%)		
	Very concerned	5 (12.8%)	14 (17.3%)		
Tobacco smoke in homes with children	Not concerned	0 (0.0%)	0 (0.0%)	1.276	0.202
	Somewhat concerned	3 (7.7%)	3 (3.7%)		
	Moderately concerned	7 (17.9%)	10 (12.3%)		
	Very concerned	29 (74.4%)	68 (84%)		
Residences built in floodplains	Not concerned	12 (30.8%)	18 (22.2%)	0.928	0.353
	Somewhat concerned	12 (30.8%)	27 (33.3%)		
	Moderately concerned	11 (28.2%)	25 (30.9%)		
	Very concerned	4 (10.3%)	11 (13.6%)		
Pesticide use patterns	Not concerned	3 (7.7%)	7 (8.6%)	0.254	0.799
	Somewhat concerned	7 (17.9%)	16 (19.8%)		
	Moderately concerned	17 (43.6%)	28 (34.6%)		
	Very concerned	12 (30.8%)	30 (37%)		
Chemical spills	Not concerned	2 (5.1%)	4 (4.9%)	-0.485	0.628
	Somewhat concerned	10 (25.6%)	21 (25.9%)		
	Moderately concerned	13 (33.3%)	33 (40.7%)		
	Very concerned	14 (35.9%)	23 (28.4%)		
Drinking water contamination	Not concerned	2 (5.1%)	2 (2.5%)	-0.041	0.968
	Somewhat concerned	4 (10.3%)	17 (21%)		
	Moderately concerned	12 (30.8%)	16 (19.8%)		
	Very concerned	21 (53.8%)	46 (56.8%)		
Toxic contaminants in foods	Not concerned	1 (2.6%)	5 (6.2%)	-0.272	0.786
	Somewhat concerned	6 (15.4%)	14 (17.3%)		
	Moderately concerned	14 (35.9%)	24 (29.6%)		
	Very concerned	18 (46.2%)	38 (46.9%)		
Unsafe work environments	Not concerned	4 (10.3%)	4 (4.9%)	-0.024	0.981
	Somewhat concerned	7 (17.9%)	20 (24.7%)		
	Moderately concerned	13 (33.3%)	27 (33.3%)		
	Very concerned	15 (38.5%)	30 (37%)		

Concern for Environmental Health Effects

As with the first part of the research question regarding environmental hazards, the Mann-Whitney U test did not demonstrate a statistically significant difference in relation to environmentally attributable health effects (see Table 3). However, frequencies were again investigated for the two educational groups on the four levels of the ordinal measurement scale and suggest there also may be slight qualitative differences between the two groups.

The health effect that garnered the most concern from both groups was cancer (e.g., breast, testicular, leukemia, brain). Of the respondents with less than a baccalaureate degree, 89.7% indicated they were either moderately concerned or very concerned about cancer. Conversely, 91.4% of PHNs with a baccalaureate degree or greater indicated they were moderately concerned or very concerned about this health effect. Both groups demonstrated similar concern for cancer, but the more educated PHNs indicated slightly more concern.

On the contrary, the health effect revealing the least amount of concern among both groups was infertility. A fair amount (41%) of PHNs with less than a baccalaureate degree indicated they were either not concerned or only somewhat concerned about infertility. Similarly, those with a baccalaureate degree or greater (50.6%) indicated they were either not concerned or only somewhat concerned about infertility. In this case, those with less than a baccalaureate degree actually demonstrated more concern for infertility than those in the other group.

Table 3
Level of concern for environmental health effects by educational level (n=120)

Please indicate your level of concern for the following environmentally related health effects in each broad category listed.		Non-baccalaureate degree n=39 (32.5%)	Baccalaureate degree or greater: n=81 (67.5%)	Mann-Whitney U standardized test statistic	p-value
Auto-immune conditions (e.g., lupus, multiple sclerosis)	Not concerned	2 (5.1%)	2 (2.5%)	-0.512	0.609
	Somewhat concerned	7 (17.9%)	21 (25.9%)		
	Moderately concerned	16 (41%)	32 (39.5%)		
	Very concerned	14 (35.9%)	26 (32.1%)		
Cancer (e.g., breast, testicular, leukemia, brain)	Not concerned	2 (5.1%)	0 (0%)	-0.100	0.920
	Somewhat concerned	2 (5.1%)	7 (8.6%)		
	Moderately concerned	11 (28.2%)	26 (32.1%)		
	Very concerned	24 (61.5%)	48 (59.3%)		
Cardiovascular disease	Not concerned	1 (2.6%)	2 (2.5%)	-0.181	0.856
	Somewhat concerned	4 (10.3%)	15 (18.5%)		
	Moderately concerned	16 (41%)	21 (25.9%)		
	Very concerned	18 (46.2%)	43 (53.1%)		
Dermatitis	Not concerned	3 (7.7%)	5 (6.2%)	-0.410	0.682
	Somewhat concerned	14 (35.9%)	27 (33.3%)		
	Moderately concerned	13 (33.3%)	29 (35.8%)		
	Very concerned	9 (23.1%)	20 (24.7%)		
Developmental disease (e.g., cerebral palsy, autism, mental retardation, learning disabilities)	Not concerned	2 (5.1%)	1 (1.2%)	-0.265	0.791
	Somewhat concerned	8 (20.5%)	21 (25.9%)		
	Moderately concerned	16 (41%)	29 (35.8%)		
	Very concerned	13 (33.3%)	30 (37%)		
Diabetes	Not concerned	2 (5.1%)	2 (2.5%)	-1.447	0.148
	Somewhat concerned	3 (7.7%)	12 (14.8%)		
	Moderately concerned	12 (30.8%)	34 (42%)		
	Very concerned	22 (56.4%)	33 (40.7%)		
Endocrine-disruptor related disease (e.g., early menarche, hypospadias)	Not concerned	5 (12.8%)	6 (7.4%)	-0.526	0.599
	Somewhat concerned	14 (35.9%)	28 (34.6%)		
	Moderately concerned	10 (25.6%)	28 (34.6%)		
	Very concerned	10 (25.6%)	19 (23.5%)		
Infertility	Not concerned	5 (12.8%)	6 (7.4%)	-0.941	0.347
	Somewhat concerned	11 (28.2%)	35 (43.2%)		
	Moderately concerned	13 (33.3%)	28 (34.6%)		
	Very concerned	10 (25.6%)	12 (14.8%)		

Table 3 (continued)
 Level of concern for environmental health effects by educational level (n=120)

Please indicate your level of concern for the following environmentally related health effects in each broad category listed.		Non-baccalaureate degree n=39 (32.5%)	Baccalaureate degree or greater: n=81 (67.5%)	Mann-Whitney U standardized test statistic	p-value
Kidney disease	Level of concern				
	Not concerned	3 (7.7%)	3 (3.7%)		
	Somewhat concerned	9 (23.1%)	34 (42%)		
	Moderately concerned	11 (28.2%)	26 (32.1%)		
	Very concerned	16 (41%)	18 (22.2%)	-1.811	0.070
Neurologic disease (e.g., Alzheimer's, Parkinson's, lead poisoning)	Level of concern				
	Not concerned	2 (5.1%)	2 (2.5%)		
	Somewhat concerned	5 (12.8%)	17 (21%)		
	Moderately concerned	10 (25.6%)	31 (38.3%)		
	Very concerned	22 (56.4%)	31 (38.3%)	-1.570	0.116
Reproductive outcomes (e.g., birth defects, premature birth, miscarriage)	Level of concern				
	Not concerned	2 (5.1%)	1 (1.2%)		
	Somewhat concerned	6 (15.4%)	8 (9.9%)		
	Moderately concerned	8 (20.5%)	25 (30.9%)		
	Very concerned	23 (59%)	47 (58%)	-0.343	0.732
Respiratory disease (e.g., asthma, bronchitis, occupational asthma)	Level of concern				
	Not concerned	1 (2.6%)	1 (1.2%)		
	Somewhat concerned	2 (5.1%)	7 (8.6%)		
	Moderately concerned	13 (33.3%)	27 (33.3%)		
	Very concerned	23 (59%)	46 (56.8%)	-0.277	0.782
Disease outbreaks attributed to food or water contamination	Level of concern				
	Not concerned	2 (5.1%)	1 (1.2%)		
	Somewhat concerned	4 (10.3%)	10 (12.3%)		
	Moderately concerned	9 (23.1%)	24 (29.6%)		
	Very concerned	24 (61.5%)	46 (56.8%)	-0.282	0.778

CHAPTER FIVE

DISCUSSION

The purpose of this thesis was to investigate the original research question: does level of educational preparation among Montana PHNs affect their level of concern for environmentally attributable hazards and health effects? Data from the 2005 EPHT survey was employed to examine this relationship. Montana PHNs provided responses regarding their levels of concern for environmentally attributable hazards and health effects on questionnaires using a four-point Likert scale. In addition, each PHN's level of educational preparation was obtained and assigned to one of two groups: less than a baccalaureate degree in nursing and greater than or equal to a baccalaureate degree in nursing. Statistical analysis was conducted using the Mann-Whitney U test.

General Discussion of the Findings

Results of the Mann-Whitney U test did not demonstrate any statistically significant differences with regard to level of educational preparation of surveyed PHNs and their levels of concern for either environmental hazards or health effects. However, qualitative differences were examined by producing frequencies on the four-point ordinal scale. This data demonstrated that most of the surveyed Montana PHNs were at least somewhat concerned about all the environmental hazards and health effects listed on the EPHT survey.

This general, qualitative concern among Montana PHNs highlights their awareness of many environmental hazards and potential health effects. PHNs often fulfill an array of duties in Montana, including immunization clinics, home visitation, and communicable disease tracking. Specifically, home visitation provides ample opportunities to assess for environmental hazards in the home and to educate families about potential health effects from hazards such as lead, mold, secondhand smoke, carbon monoxide, and contaminated drinking water. Communicable disease tracking provides management of real or potential disease outbreaks that are often related to the environment. For example, PHNs commonly monitor waterborne illnesses such as giardiasis and cryptosporidiosis that can occur in many areas of Montana.

In addition, nursing has a history of viewing the environment as a determinant of health. The core concepts of Florence Nightingale's theory include ventilation, warmth, quiet, diet, and cleanliness (Pfetscher, 2006). All of these components are foundations of nursing and are especially important in a PHN's assessment of a home or a communicable disease outbreak.

Concern for Environmental Hazards

No statistically significant differences were found between both educational groups and their levels of concern for all environmental hazards listed on the EPHT survey. However, when qualitative frequencies were examined, the highest level of concern across both education sets was tobacco smoke in homes with children. Both

educational groups demonstrated high concern for this environmental hazard, yet PHNs with a baccalaureate degree or higher were slightly more concerned.

Tobacco smoke is a well-known environmental hazard both in nursing practice and in the general public. According to the Centers for Disease Control and Prevention (2010), 18.5% of the Montana adult population smokes cigarettes, ranking Montana 28th in the nation for use of cigarettes. However, Montana has recently passed smoke-free ordinances to protect individuals against secondhand smoke in public places such as restaurants and day care centers, which demonstrates general, widespread acceptance that secondhand smoke may cause harm. Finally, 79.4% of homes in Montana report they have a smoke-free home (CDC, 2010). This example further protects children from exposure to secondhand smoke in the location where they spend most of their time.

Tobacco use is the leading preventable cause of death in the United States (CDC, 2010) and is a major public health issue. Most PHNs are aware of the detrimental effects of tobacco smoke and are in a prime position to educate families and the public about its potential health effects. Specifically, home visitation allows for assessment of residential secondhand smoke and provides opportunities for cessation support and assistance. Furthermore, cigarette smoking during pregnancy can cause pregnancy complications, premature delivery, low birth weight, or a stillborn infant (CDC, 2010). Findings from the research support the conclusion that Montana PHNs are generally aware of the risks for exposure and of the potential negative consequences from environmental tobacco smoke.

Conversely, the lowest level of concern for environmental hazards across both education sets was residences built in floodplains. Again, even though both groups

displayed low levels of concern for this hazard, PHNs with a baccalaureate degree or greater demonstrated slightly more concern.

It is unclear why both groups displayed lower levels of concern for residences built in floodplains. Although flooding can occur anywhere in the state (National Weather Service, 2010), many Montanans may not be concerned about flooding unless they live near a major body of water. In addition, flooding may not be a topic that PHNs frequently discuss with families or communities at home visits or in immunization clinics. Flooding does, however, have the potential to impact the safety of drinking water, especially water from household wells (U.S. EPA, 2010). In addition, flooding can contribute to mold growth, which can significantly impact indoor air quality until it is properly removed. Allergic rhinitis, asthma, sinusitis, pneumonia, and ocular pain are just a few of the health conditions known to occur with exposure to mold (Metts, 2008). Low levels of concern for flooding may reflect a more narrow focus of PHNs and indicate an opportunity to expand awareness of broader environmental health issues among nurses.

Concern for Environmental Health Effects

Qualitative differences were also examined with regard to environmentally attributable health effects. Again, most respondents indicated at least some level of concern for all the health effects listed on the survey. Thus, there were no health effects that did not display at least some concern among PHNs in both educational groups.

Cancer (e.g., breast, testicular, leukemia, brain) was identified as the health effect that elicited the most concern from both educational groups. Both groups demonstrated

high levels of concern for cancer, but the more educated PHNs indicated slightly more concern.

As with tobacco smoke in the homes of children, cancer is well recognized among both nurses and the general population. In fact, tobacco smoke is a well-known environmental hazard whose ingredients have been linked to cancers of the lung, esophagus, larynx, kidney, bladder, cervix, and other anatomical sites (National Cancer Institute, n.d.). Both lung cancer and mesothelioma have also been linked to prolonged exposure to asbestos, which has most notably occurred in the northwestern town of Libby, Montana (ATSDR, 2001). In addition, the majority of Montana counties demonstrate high levels of radon, which is a naturally occurring, odorless radioactive gas that can be found in the air, ground water, and surface water. This is another potentially significant risk, as radon exposure is the second leading cause of lung cancer (ATSDR, 2008).

Thus, many environmental hazards have demonstrated an increased risk of cancer with varying levels of exposure, and often these hazards are well known among both nurses and the public. Furthermore, many public health departments in Montana house comprehensive cancer programs that aim to provide affordable access to cancer screening and treatment programs. All of these issues may reflect the high level of concern for cancer among Montana PHNs.

Alternately, the health effect revealing the least amount of concern among both groups was infertility. Both educational groups indicated that they were not greatly

concerned about this health effect, yet in this case, those with less than a baccalaureate degree demonstrated more concern for infertility than those in the other group.

Infertility is defined as a lack of conception despite unprotected sexual intercourse for at least 12 months (Dunphy, Winland-Brown, Porter, & Thomas, 2007) and can often be caused by numerous and/or unknown factors. Known risk factors include advanced age, being overweight or underweight, lack of exercise, smoking, alcohol and drug use, sexually transmitted diseases, and poor nutrition; however, up to 10% of infertility cannot be explained medically (Barrett, 2006). Because infertility can be multi-factorial, studies are still ongoing to determine if particular environmental hazards may contribute to reproductive health concerns. In addition, the majority of respondents were in the age category of 45-54, perhaps suggesting they were not as concerned about reproductive health compared to their younger counterparts.

Health Belief Model

The HBM provided a theoretical framework to further understand which factors may impact risk perception of environmental hazards and health effects by Montana PHNs. This thesis specifically addressed level of educational preparation as one factor that may not actually impact risk perception. Other modifying factors may include age, race/ethnicity, sex, and years of experience as a PHN. In addition, personal experience may be a stronger indicator of risk perception for environmental hazards and health effects. For example, regardless of level of educational preparation, a PHN living in Libby, Montana may have a much higher level concern for air pollutants and respiratory

illnesses than a PHN living in another area of the state. Furthermore, a PHN whose own child developed severe gastrointestinal illness after drinking contaminated well water may demonstrate a higher level of concern for drinking water contamination and disease outbreaks attributed to food or water contamination.

Thus, these PHNs may display an increased degree of perceived susceptibility to environmental hazards as well as an increased degree of perceived severity of subsequent health effects. Due to these perceptions, the HBM states they will demonstrate greater risk perception and thus indicate greater levels of concern for specific environmental hazards and related health effects, regardless of level of educational preparation. These examples may help to understand why there was no statistically significant difference in levels of concern for environmental hazards and health effects related to level of educational preparation.

Implications for Practice

Even though the statistical analysis did not demonstrate a difference in level of concern for environmental hazards and related health effects based on level of educational preparation, findings indicate that PHNs generally perceived at least some risk for a broad array of environmental hazards and health effects. As mentioned previously, the Quad Council of Public Health Nursing Organizations indicates environmental health concepts under its core competencies for public health professionals. Thus, PHNs should have at least an awareness of environmental health concepts, especially those that may be relevant to their own communities. This study

supports this awareness in that very few PHNs of both educational groups expressed no concern for any environment hazards or health effects listed on the EPHT survey.

Study Limitations

The major limitation of this research study was its small sample size. With only 120 completed surveys to analyze, broad and general conclusions could not be extrapolated from this data that would apply outside of Montana. In addition, this study was conducted in 2005, and it is unknown how Montana PHNs' perceptions of environmental hazards and health effects may have changed since then. Finally, because cross-sectional survey data was collected, it cannot be concluded that educational preparation is not related to risk perception. Further research is needed to examine all of the potential influences of environmental health concerns among nursing populations.

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