

NURSING FACULTY'S KNOWLEDGE ON HEALTH IMPACTS  
DUE TO CLIMATE CHANGE

by

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A thesis submitted in partial fulfillment  
of the requirements for the degree

of

Master

of

Nursing

MONTANA STATE UNIVERSITY  
Bozeman, Montana

April, 2014

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## ACKNOWLEDGEMENTS

First, I would like to thank the chair of my thesis, Dr. Wade Hill, for his tremendous time, effort, and expertise he put into helping me complete this thesis. Next, my committee members, Laura Larsson and Steve Glow, for their time and extensive knowledge. Finally, my family, for their patience as I complete this challenge and begin the next chapter in life.

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## ABSTRACT

More than 150 thousand excess deaths occurred in 2000 from disease and injury related to climate change (Frumkin et. al, 2008). With the increase in climate temperature, the sea level is rising causing flooding, displacing people from their homes and damaging the water supply causing water-borne illnesses. Warm temperatures are extending the length of transmission seasons for vector-borne illnesses, and variable precipitation is causing damage to food crops affecting the source of nutrition (WHO, 2008). Nurses are often on the front lines of managing illness and injury related to climate change, but, it is unknown to what extent they are prepared to do so. Because basic nursing competencies are achieved in nursing schools, focus on preparation of nursing faculty to prepare nursing students in competencies related to climate change is logical. The purpose of this study is to evaluate professor's knowledge of health impacts due to climate change. In total, 103 nursing faculty were selected from the single university to participate in a survey designed to obtain a general baseline of faculty knowledge regarding health effects associated with climate change. Results: The most recognized health impact related to climate change reported by respondents was flooding-related displacement of residents. They viewed flooding as already increased (n=32, 84%) and expected flooding to continue increasing into the future. Other recognized health impacts due to climate change that respondents believe have already increased and will increase in the next 20 years included air quality related illnesses (already increased 83%, will increase 80%) and disruption of health care services during extreme weather events (already increased 70% will increase 68%) Discussion: In general, when comparing present-day health impacts to those that may occur 20 years from now, faculty believed the incidence of each health impact will increase and very few responses reported the health impacts not increasing over the next 20 years

## INTRODUCTION

Over the last 50 years there has been a steady increase of carbon dioxide and other greenhouse gases that has affected global climate causing an increase of temperature (World Health Organization, 2008). The fourth assessment report in 2007 of the Intergovernmental Panel on Climate Change (IPCC), reported that the temperature of the earth has risen 0.65 degrees centigrade in the lower atmosphere increasing deaths related to high heat and changing patterns of infectious diseases (WHO, 2008). More than 150,000 excess deaths occurred in 2000 from diseases related to climate change and five million illnesses occur each year (Frumkin et. al, 2008). The WHO stated that these rates will continue to rise in the future. Climate change is a growing problem within the healthcare community. With the increase in climate temperature, sea level is rising causing flooding, displacing people from their homes and damaging the water supply causing water-borne illnesses. Warm temperatures are extending the length of transmission seasons for vector-borne illnesses, and variable precipitation is causing damage to food crops affecting the source of nutrition (WHO, 2008).

Increase temperatures are leading to deadly heat strokes, aggravation of chronic diseases such as respiratory and cardiovascular disease. Chronic obstructive pulmonary disease (COPD), asthma and other respiratory diseases have increased in severity related to ground-level ozone concentration from heat and combustion of fossil fuels releasing particulate matter from use of, for example, air conditioners (Centers for Disease Control and Prevention, 2014). Extreme weather events cause drowning, injury, and structural collapse from floods (CDC, 2014). Mental health concerns increase from displacement

and chronic health issues increase related to disruption in health care service (CDC, 2014). Flooding has been known to mix salt water with freshwater causing contamination in drinking water leading to waterborne illnesses. Salt water also mixes into the soil causing problems with agriculture posing a threat to nutrition sources (CDC, 2014). Other health impacts due to climate change include neurological threats, vector-borne illnesses, foodborne illnesses, and cancer (CDC, 2014). Evidence has continued to show increased activity and trends in the health impacts from climate change (Barna, 2012). Each year more individuals are affected and are becoming more ill causing an increase in demand for provider visits and/or hospitalizations (Barna et al, 2012). Mathematical prediction models suggest that climate change may become the largest threat to population health in the 21<sup>st</sup> century (Banra et al, 2012). Understanding current and future climate threats causing trends in health issues is important for health care professionals in order to prevent and promote the health of communities. Most nurses should have a solid knowledge base of climate change effects on health to help educate the public with a goal of prevention.

Much of the current literature describes evidence surrounding the health effects of climate change. The Climate Institute reported on the increase of natural disasters, infectious diseases, high average temperatures, and longer pollen seasons adding to respiratory disorders (2010). Little evidence is found regarding nurses knowledge of health impacts due to climate change despite the fact that nurses occupy the largest segment of the healthcare workforce. Knowledge of climate change and its effect on health is important information for most healthcare workers so that a competent

workforce can effectively respond to the health challenges facing our world. Given this, little is known about nursing competency and readiness to act on health effects related to climate change and it is logical that preliminary work focuses on nursing student preparation via faculty competency in basic educational programs.

Nursing students may be the forefront of nursing's future and information regarding health impacts due to climate change would be logical information to obtain in nursing school. Because professors develop curricula as well as teach directly, it would be reasonable to have an introductory level of knowledge on the health risks associated with climate change if competencies among students are to be developed. The purpose of this study is to evaluate nursing professor's knowledge of health impacts due to climate change. For the purpose of this study climate change is evident and why climate change is happening is not important.

## REVIEW OF LITERATURE

### Definition of Climate

It is necessary to distinguish between climate and weather in order to understand the concept of climate change (IPCC, 2013). Weather refers to meteorological elements at a specific location and time. Climate refers to the average weather over a specific period of time. By using statistical tests the change in the state of the climate can be identified and generally the variability persists for an extended period of time (IPCC, 2013). Climate is the statistical description of a phenomena such as droughts (IPCC, 2013).

### Ozone

Perhaps no air contaminant related to climate change has much human health consequences as ozone. Ozone (O<sub>3</sub>) is created by man-made and natural products (EPA, 2014). Ozone is naturally formed in the upper layer (stratosphere), and is formed by the interaction of sunlight ultraviolet (UV) radiation and oxygen. This interaction protects the earth from harmful UV rays (EPA, 2014). The lower level (tropospheric) ozone or ground-level ozone is the air we breathe. It is produced by man-made products (pollutants) volatile organic compounds (VOC) and nitrogen oxide. The production of ground-level ozone is a result of a photochemical reaction between these two pollutants generally in a high temperature combustion (EPA, 2014). Examples include motor vehicles, gas pumps, chemical plants, and power plants (EPA, 2014).

Ground-level ozone is also viewed as “smog” or “haze” and is generally highest in the summer months however it has been reported in winter months (EPA, 2014). A quantitative study was conducted comparing ground level ozone concentrations to pediatric emergency room visits (Scheffield et al, 2011).The study assessed future number pediatric asthma ED visits by using baseline ED rates, dose-response relationship between ozone levels and pediatric asthma ED visits, and projected daily 8-hour maximum ozone concentrations for the 2020s as simulated by a global-to-regional climate change and atmospheric chemistry model. The results of this assessment suggest that, compared to the 1990s, by the2020s climate change could cause a median increase of 7.3% in regional summer ozone related asthma emergency department visits for children aged 0–17 years across the New York City metropolitan region. The study suggested that adaptation measures to climate change that work to reduce ozone levels should be coupled with asthma management for better disease control (Scheffield et al, 2011). A limitation to this study would include the use of computer models that are predicting future ozone levels.

### Health Impacts

Climate change is evident in the United States and around the world (CDC, 2010). It is observed with the increase of natural disasters including fires, floods, and tornados (CDC, 2010). Not only are natural disasters on the rise but also elevated pollen levels, vector-borne illnesses, and extreme heat (Climate Institute, 2010). With climate change, there are many health implications including various respiratory, cardiovascular, cancer,

infectious diseases, and mental health issues (Climate Institute, 2010). There have been several studies on awareness of climate change and the health implications but this is still an emerging topic. The following section explores the literature concerning health impacts of climate change.

### Natural Disaster

Seventy-five percent of natural disasters result from weather extremes from climate change. Between 1995 and 2004, 2.5 million people were affected by a natural disaster and 890,000 people died (Climate Institute, 2010). In the 1990's, 600,000 deaths worldwide were from natural disasters such as hurricanes, earthquakes, tsunamis, and forest fires (Climate Institute, 2010). Since the 1980's natural disasters have more than quadrupled. New Orleans was mostly underwater in response to Hurricane Katrina in 2005. Eight million people and over 7 million cattle were left with water shortages in China in response to a severe drought in 2006. In 1999, 30,000 people died in Venezuela in response to a flood (Climate Institute, 2010). There are many more examples of the vast destruction of natural disasters which affect the health and well-being of individuals. Floods cause increases in bacteria, viruses, and chemical contaminants; droughts cause favorable conditions for rodents and insects, and extreme weather causes many different water-borne illnesses (Climate Institute, 2010).

### Infectious Disease

Over three million deaths occurred in 2002 in response to climate-sensitive diseases worldwide such as diarrhea, malaria, and malnutrition. More disease-friendly

conditions are increasing in places that normally did not host diseases or host carriers (Climate Institute, 2010). Insects and microorganisms are carrying bacteria and viruses to previously uninhabited regions in response to the warmer climates. Insects and insect borne diseases are being reported at higher elevations related to the warming of glaciers, increasing sea level, and pushing the plants and vegetation to higher elevations (Climate Institute, 2010). For example, Dengue Fever carried by mosquitoes used to be only reported at 3300 feet but now are being reported at 7200 feet in the Andes Mountains of Columbia (Climate Institute, 2010). A decrease in the consumption of algae from plankton feeders such as crawfish has produced an increase in cholera affecting surrounding fish and those who consume those fish; an outbreak was reported in 2007 in Iraq (Climate Institute, 2010). The evidence of increasing infectious diseases is only a portion of the many health effects due to climate change.

West Nile first entered the United States in 1999 and by 2005 16,000 cases were reported. In 2002 a new strain of West Nile Virus emerged and can cause serious disease (EPC, 2011). At one point the thought was that infectious diseases were eliminated from the United States, however, the increasing temperatures and different rain patterns associated with climate change has expanded their range and made a comeback (NRDC, 2013). Dengue fever transmitted through the mosquito is now found in 28 states. Classical signs and symptoms of dengue fever, also known as “breakbone fever” includes high fever, headaches, bone and joint aches, and a rash (NRDC, 2013). In Florida 28 locally-transmitted cases were reported between 2009-2010, the first there in 40 years (NRDC, 2013). The growing number of mosquito’s can be related to the increasing warm

temperatures and wet climate. Not only is the number of mosquito's carrying infectious diseases growing but ticks as well. Lyme disease is continuously moving northward.

A quantitative study was conducted in 2007 in Europe on the vulnerabilities to infectious diseases due to climate change. It particularly looked at vector-borne, water borne, and rodent borne diseases. The study surveyed government officials in 30 European countries designated as competent bodies for scientific advice concerning infectious diseases to examine the degree to which they are concerned about potential effects of climate change on infectious diseases and their perceptions of institutional capacities in their respective countries (Semenza et al, 2012). Participants were surveyed about each infectious disease from the various groups and the subjects were to rank each disease on a five-item Likert scale regarding how likely the disease would be impacted by climate change. They were also asked about outbreaks within the previous ten years and which outbreaks could be attributed to climate change. For insect-, tick-, and rodent borne diseases they were asked if they have observed any seasonal or geographical changes in distribution. The survey also included information regarding preparedness, planning, and surveillance (Semenza et al, 2012). The survey results showed a large majority of the respondents agreed that climate change would affect vector-borne (86% of country representatives), food-borne (70%), water-borne (68%), and rodent-borne (68%) diseases in their countries. In addition, most indicated that institutional improvements are needed for ongoing surveillance programs (83%), collaboration with the veterinary sector (69%), management of animal disease outbreaks (66%), national monitoring and control of climate-sensitive infectious diseases (64%), health services

during an infectious disease outbreak (61%), and diagnostic support during an epidemic (54%) (Semenza et al, 2012). Although this study was conducted in Europe it shows that experts in infectious diseases do see a change in trends and have attributed some of the change from climate change.

Parham and Michael (2010) modeled the effects of weather and climate change and the transmission of malaria. They evaluated a model that permitted valuable insights into the effects of rainfall and temperature on mosquito population dynamics, malaria invasion, persistence and local seasonal extinction, and the impact of seasonality on transmission. They illustrated how large-scale climate simulations and infectious disease systems may be modeled and analyzed and how these methods may be applied to predicting changes in the basic reproduction number of malaria across Tanzania (Parham & Michael, 2010). Extinction was more strongly dependent on rainfall than temperature and identified a temperature range of around 32–33 C where endemic transmission and the rate of spread in disease-free regions is optimized. This range was the same for both *Plasmodium falciparum* and *P. vivax*, but mosquito density was the driving factor for the rate of malaria spread rather than the *Plasmodium* species. The study resulted in improved knowledge of temperature shifts and how they affect the global distribution of at-risk areas as well as the rapid rate of malaria outbreaks that take off in vulnerable populations. (Parham & Michael, 2010).

### Increase in Heat

The UK projected an increase in heat-related mortality of 257 % by the year 2050, with elderly being the most vulnerable (Hajat et al., 2014). In the American Journal

of Public Health a peer review was conducted on climate change and ecosystem disruption and its impact on health (2012). The authors stated that with the hotter summers and warmer winters the pine beetle that dominates most of the western United States and Canada, infestation has increased causing a tremendous amount of tree death. The destruction from the pine beetle, *Dendroctonus ponderosae*, is causing damage to large ecosystems increasing the water borne and respiratory diseases from the increase water runoff and water surface turbidity as well as forest fires (Embery et al, 2012).

On average an estimated 400 people die each year in the United States from heat. 1,800 people die from illnesses made worse from heat (NRDC, 2013). In eastern Montana temperatures could rise up to 7.5 degrees Fahrenheit warmer in the next 50 years (NRDC, 2013). With an increase in temperatures the elderly and children are at most risk. The U.S. population of people over age 65 is currently 12%, however this is projected to grow to 21% by 2050 increasing the vulnerable population. In California 16,000 people were seen in a two week time frame during a deadly heat wave in 2006 (NRDC, 2013). Also at risk are individuals who live in urban areas. This is because the heat creates a magnifying effect on paved surfaces and the urban areas generally have a limited amount of trees. Many people suffer from heat exhaustion and heat stroke but other illness are compounded by the heat such as cardiovascular disease and kidney disease (NRDC, 2013).

A quantitative study was completed and assessed the estimate of future heat wave mortality under global climate change. The study looked at a database comprising daily data from 1987 through 2005 on mortality from all non-accidental causes, ambient levels

of particulate matter and ozone, temperature, and dew point temperature for the city of Chicago, Illinois (Peng et al, 2011). The study estimated that under three different climate change scenarios for 2081-2100 and in the absence of adaptation, the city of Chicago could experience between 166 and 2,217 excess deaths per year attributable to heat waves, based on estimates from seven global climate models (Pen et al, 2011). Variation within the study included the choice of climate model (Peng et al, 2011).

It is known temperatures are increasing throughout the world. It is imperative to raise awareness to prevent increasing mortality related to rising temperatures. Many states have plans set forth to help with prevention. Some cities in California have a plan to protect and increase urban trees to help cool the city. Many states included an increase in emergency response providers during heat waves in their plans. Other states have a warning alert system (NRDC, 2013).

Increase in heat causes an increase in ultraviolet (UV) radiation exposure. Exposure to UV rays increases the risks of basal cell and squamous cell carcinomas (National Institute of Health and Environmental Science, 2010).

It would be logical for nurses to be aware of the increasing temperatures to help promote prevention of increasing heat mortalities and help communities devise plans in order to prepare for these changes. It is imperative that professors of nursing education know about extreme heat and how temperature is rising causing more and more mortality each year. Professors should teach nursing students this information so that the nurses of our future can help promote prevention within our communities.

### Respiratory

Respiratory diseases have continued to rise in relationship to climate change. There is an increase in incidence, prevalence, and morbidity of asthma (Beggs & Bambrick, 2005). The rapid increase of prevalence happened too quickly for it to be of a genetic cause. It is thought to be of environmental and lifestyle changes. With the increase of carbon dioxide causing a warmer climate it is thought that this may increase the amount of pollen (Beggs & Bambrick, 2005). The increase in temperature allows for a longer growing season, more plant production and thus more exposure to pollen. This all increases allergic asthma which in turn increases asthma prevalence and the burden of asthma (Beggs & Bambrick, 2005).

### Allergenic Pollens

An estimated 36 million Americans suffer from seasonal allergies and 17 million adults and children have asthma (NRDC, 2007). Both allergies and asthma are linked to environmental conditions. As carbon dioxide levels increase, air quality is threatened by an increase in allergenic pollens and ground-level ozone (NRDC, 2007). The two pollutants (ragweed and high ozone levels) compound respiratory health issues. Climate change has brought on a longer allergy season from increasing temperatures (EPA, 2009). Increasing temperatures and carbon dioxide levels allow ragweed, a fast spreading plant with high allergenic pollen, to produce more pollen compounding respiratory problems (EPA, 2009).

### Carcinogenic Agents

With increasing rainfall and flooding the risk of leaching toxic chemicals and heavy metals from storage sites may increase the risk of contaminated water and the possibility of increasing cancer risks. Although the direct etiology of cancer is unknown, there is an environmental factor that is believed to play a significant role (National Institute of Environmental Health Sciences, 2010). Increase in ultraviolet (UV) exposure in response to the depleting stratosphere ozone will increase the numbers of skin cancer (Environmental Health Sciences, 2010).

### Cardiovascular

In 2006, cardiovascular disease was the leading cause of death and stroke was the third, in the United States. Extreme weather, such as heat or cold, can exacerbate cardiovascular disease. Indirectly, pathophysiological changes occur in association with particulate matter. These changes include systemic inflammation, thrombosis, and compromised heart function (National Institute of Environmental Health Sciences, 2010). Extreme weather events can cause increased levels of stress and anxiety that can be associated with myocardial infarctions, stress-induced cardiomyopathy, and sudden cardiac death (National Institute of Environmental Health Sciences, 2010).

Other cardiac effects of climate change include vector-borne and zoonotic diseases. Chagas, a disease more prevalent in developing countries like South America, is an independent risk factor for stroke and leading cause of heart failure. In the United States, Lyme disease has been linked to various cardiac manifestations. These cardiac manifestations are less common than that associated with Chagas (National Institute of

Environmental Health Sciences, 2010). There are not many studies that provide evidence to the impact climate change has on cardiovascular disease. What is known is temperatures are increasing; weather is variable causing extreme weather events imposing an impact on the incidence of cardiovascular disease (National Institute of Environmental Health Sciences, 2010). Further research regarding the magnitude of these effects and how they can be minimized would be beneficial.

### Nutrition

It is anticipated that extreme weather and changes in temperature may disrupt food supply (US Food and Drug Administration, 2005). Currently this is seasonal; however this is projected to become more frequent as the climate changes. The weather can destroy crops and affect the transport of food. Other problems affecting nutrition in response to climate change includes foodborne illnesses. Illnesses result from food that is spoiled, contaminated with microbes, chemicals, or other toxic substances. A risk assessment conducted by the Food and Drug Administration (FDA) showed that increased water temperature influences the incidence of *Vibrio parahaemolyticus*. This particular foodborne illness can be found primarily in raw oysters and causes gastroenteritis. Lake and colleagues (2009) studied foodborne infections (campylobacteriosis, salmonellosis, *Salmonella* Typhimurium infections and *Salmonella* Enteritidis) in England and Wales and found that increases in water temperature could lead to an increase in foodborne illnesses. They suggested that this could be reversed with reducing pathogen levels in major food groups and proper food hygiene (Lake et al, 2009).

Drought has been shown to increase drought pests and the mold *Aspergillus flavus* which produces aflatoxin that may contribute to liver cancer in those who eat contaminated nuts and corn (National Institute of Environmental Health Sciences, 2010). An increase in crop pests may encourage farmers to increase the amount or strength of pesticides imposing a health risk to farmers, their families, and consumers (National Institute of Environmental Health Sciences, 2010).

It is estimated that climate change will lead to a relative increase in moderate growth restriction of 1-29 % in 2050 compared to an environment without climate change (Lloyd et al., 2011). The quantitative study looked at malnutrition related to climate change and crop yields. They utilized the current national availability and under nutrition data to create a global model, using a process-driven approach based on estimations of the relationship between lack of food and stunting (Lloyd et al, 2011). The study estimated that severe stunting will increase by 23% in Sub-Sahara Africa and by 62% in South East Asia in relation to climate change (Lloyd et al, 2011).

### Neurological

Alzheimer's and Parkinson's disease are occurring earlier and environmental factors are being examined (Lawler, 2008). Researchers are also looking at environmental factors that could be contributing to the increase of autism in children. Many studies are being explored regarding autism and the environmental risk factors, including metals, pesticides, medications, and infections (Lawler, 2008).

Harmful algal blooms are becoming more prevalent and more toxic as a result of climate change (National Institute of Environmental Health Sciences, 2010). Warmer ocean

temperatures and varying precipitation may be leading to the earlier seasonal occurrences and more potent algal blooms (National Institute of Environmental Health Sciences, 2010). Human consumption of seafood containing algal toxins, fresh water for drinking, and aerosol of toxins by surf breaking on the beach are a number of ways the algal toxins are affecting humans (National Institute of Environmental Health Sciences, 2010). Health effects include: respiratory distress, amnesia, diarrhea, numbness, liver damage, skin and eye irritation, and Alzheimer and Parkinson disease like symptoms which may be severe, chronic and even lead to death (National Institute of Environmental Health Sciences, 2010).

### Mental Health

Many psychological issues can be attributed to the devastation of extreme weather and other climate related changes. Hurricane Katrina and Rita were two of the most damaging hurricanes in United States history impacting 90,000 square miles and impacting 1.5 million people causing many of them to relocate from their homes (National Institute of Environmental Health Sciences, 2010). The threat to human health and wellbeing from extreme weather is projected to continue and possibly become worse. It is estimated that 26.2% of Americans over the age of 18 suffer from a mental health disorder in a given year (National Institute of Environmental Health Sciences, 2010). Many psychological issues can be attributed to the devastation of extreme weather and other climate related changes. These problems can be compounded with repeated exposure to natural disasters causing displacement from homes, loss, and social displacement. These extreme events can cause added stress and anxiety about the future.

Individuals who are already vulnerable to a mental disease may experience exacerbations during extreme weather events. Psychotropic medication can increase the chances of heat-related illnesses in these individuals related to the medications ability to interfere with thermoregulation. The severity of the mental health event may depend upon the ability of the individuals coping mechanisms, support system, and the cause of the stress. Mental illnesses that usually result from an extreme weather event include acute traumatic stress to post-traumatic stress disorder as well as anxiety and depression to name a few. Repeated stress may cause other health related problems such as cardiovascular disease, gastrointestinal disease, some forms of cancer, or progression of cancer in an individual who is already diagnosed.

The role of educating the public about the numerous and diverse health consequences of climate change is an appropriate challenge for the nursing profession to address. Knowledge is the most important tool to help reduce health problems, allowing us to understand what is harmful, why, and how to avoid such harm (National Institute of Environmental Health Sciences, 2010). Effective communication and educational strategies are imperative to increase public awareness and the risks involved of climate change (National Institute of Environmental Health Sciences, 2010). Few studies have examined public health nurses awareness of climate change and its effect on health. Many nurses are aware of the implications, but to a limited degree. Studies have also examined the public's awareness.

Awareness

Bedsworth examined California's public health officers in 2007, particularly looking at three variables: their concerns about the public health impacts of climate change, programs in place that could help to mitigate these health effects, and information and resource needs for better coping with a changing climate. The results of this survey show most public health officers feel that climate change poses a serious threat to public health but that they do not feel well equipped in terms of either resources or information to cope with that threat. The article points out that currently public health agencies have implemented a number of programs that will help these agencies handle some of the challenges posed by a changing climate (Bedsworth, 2007).

Polivka conducted a quantitative study with Ohio public health nurses. The study was a computer based survey inquiring about the knowledge and attitudes of public health nurses concerning climate change. Those who participated in the on-line survey were mostly female, public health administrators with greater than five years of experience and represented the full-spectrum of political views. (e.g. moderate, conservative, and liberal). Most agreed that the earth is experiencing climate change and identified on average five of the twelve health-related impacts of climate change. They perceived public health nursing as responsible for addressing the health-related impacts of climate change but voiced they didn't have the resources to do so. Polivka concluded with recommendations for public health nurses to educate, inform, and mobilize the community to develop policies and programs that address the potential consequences of climate change (Polivka et al, 2012).

In a Canadian study, Plotnikoff et al, reported that Albertans are highly concerned about health problems related to environment and air pollution but are only moderately informed about environmental issues (Plotnikoff et al, 2004). The quantitative study examined 600 households in the province of Alberta Canada by utilizing a computer based survey. The study investigated people's awareness and concern of environmental issues, perceived confidence of undertaking environmental friendly behaviors, and self-reported environmental protective behaviors. The results showed that they are concerned with health problems, are engaging in environmental behaviors at home, but a small percentage do not consider energy saving goods when purchasing, and an even smaller percentage do not make environmental friendly decisions regarding transportation. Plotnikoff suggested the public health sector to partner with the media for an educational campaign (Plotnikoff et al, 2004).

Semenza and colleagues (2008) examined the perceptions of citizens in Portland, Oregon and Houston, Texas regarding climate change, voluntary mitigations, and barriers to behavior change. The study was a telephone survey that took place June 6 – September 11, 2006. The samples from each city were similar with regard to age, gender, and home ownership but differed in demographics including income, race/ethnicity, education, and employment (Semeza et al, 2008). The results showed that both Portland and Houston were aware of climate change with the vast majority reporting some concern. The analysis showed that significant predictors of behavior change is related to: individuals with a heightened concern about climate change, higher level of education, and younger

rather than older. Portlanders are more likely to change than Houstonians. Qualitative data of the study showed many obstacles to voluntary mitigation (Semeza et al, 2008).

The awareness of climate change and its impact on health is beginning to increase however; it is far from reaching common knowledge. Nurses may help increase the awareness to communities through education. Once communities become more aware, the management process may become smoother. This may all start with the knowledge of nursing professor's and the material presented to the nursing students.

### Management

It is important to understand what is currently being done to help the health system improve and become more competent to manage the health effects of climate change. The following paragraphs are a few recent studies exploring management of climate change.

In a review of literature Hess, McDowell, and Luber (2012) explained the need for public health capacity to take on the health changes associated with climate change. In doing so they concluded that increasing adaptive capacity in some areas, education to institutions, and utilizing adaptive management will help public health systems become more resilient to climate change. They recommend utilizing the adaptive management cycle for managing climate changes effect on healthcare. The adaptive management cycle is comprised of six steps and is similar to the nursing process. The six steps include: assessment (the vulnerabilities), plan (prepare for real world implementation), implement (depending upon the geographic and administrative scales), monitor (provides data for

learning), evaluate (efficacy of the intervention), and adjust (decisions regarding management and research; crucial phase) (Hess et al, 2012). This systematic approach can help nurses manage many of the health issues related to climate change and how to set up a plan to handle the wide variety.

In 2006 the CDC established the climate and public health framework related to the evidence surrounding climate change and the implications it may have on the health in the United States and the world (CDC, 2010). The program's mission statement is to, "lead efforts to identify vulnerable populations to climate change, prevent and adapt to current and anticipated health impacts, and assure that systems are in place to detect and respond to current and emerging health threats" (CDC, ¶ 2, 2010). The program aims to, "translate climate change science to inform states, local health departments, and communities; create decision support tools to build capacity to prepare for climate change; and to serve as a credible leader in planning for the public health impacts of climate change" (CDC, ¶3, 2010).

Mitigation of climate change would greatly improve our health and well-being, however, there is great controversy over how climate change is evolving and thus the importance lies on the adaptation. Spreading awareness throughout communities on adaptation plans would greatly promote prevention to the numerous health risks associated with climate change. Adaptation to climate change includes education about building homes that can withstand strong weather, understanding the signs and symptoms of heat related illnesses, how to protect oneself from vectors, and educating individuals on air quality. In order to get information to community members, it is logical to teach

the health effects of climate change in baccalaureate nursing programs. Once the professors have a knowledge base it can be passed on to the nursing students who can then provide education and awareness to community members.

### Curriculum

It is one duty of a nurse to promote health and prevent illness. In 2013 Goodman argued that nurses can take action by integrating their public health roles to help mitigate the effects climate change has on health by raising awareness about climate change (Goodman, 2013). In order for nurses to help manage the health implications arising from climate change they to receive introductory information in their educational programs. Community and public health professors may need to achieve competence on this topic to better prepare future nurses for managing, promoting, and possibly preventing health implications from climate change.

Climate change is affecting health. With climate change compounding health issues nurses need to be prepared to treat the increasing patient population, help educate individuals on the health impacts, and know how to prevent possible exacerbations. Although, according to some articles, nurses are aware of the health implications of climate change, the resources are lacking. Baccalaureate prepared nurses are expected to have an understanding of environmental health (Goodman, 2013). Many articles found on climate change and health include the various health effects caused by climate change, estimated measures of future health risks, ways certain towns and organizations are

attempting to mitigate the effects of climate change, and a few articles pertaining to the knowledge of healthcare providers.

The American Association of Colleges of Nursing (AACN) published a faculty toolkit titled, *The Essentials of Baccalaureate Education for Professional Nursing Practice*. The toolkit was established in 2009 to help enhance nursing curriculum. One of the essentials mentioned (essential number VII), is, clinical prevention and population health for optimizing health. It encompasses suggestions for improving and integrating environmental health into nursing education. The publication is the result of a consensus-building process that included nursing educators, clinicians, executives, and researchers, as well as numerous nursing organizations. Teaching objectives including heat related illness, flooding-related displacement of residents, vector-borne infectious disease, waterborne disease, water availability related illness, air quality related illness, malnutrition, disruption of health care services during extreme weather events, mental health conditions, cold related illness, and other climate change related health impacts may be appropriate for the undergraduate curriculum.

To date, little is known about how nurses are prepared to manage health effects of climate change. Nursing students represent the basic pool for nurses and bring with them knowledge and competencies of their primary educational programs. Because of this, it is logical to begin the exploration of nursing competency with an examination of how nursing faculty are prepared to educate nursing students. Therefore, the purpose of this thesis is to examine the knowledge of nursing faculty with a baccalaureate nursing program related to health effects of climate change.

### Knowledge of Climate Change

Merriam-Webster defines knowledge as, “information, understanding, or a skill you get from education or experience; awareness of something, the state of being aware of something” (Merriam-Webster, ¶ 1, 2014). Nursing has had a significant role in promoting the health of individuals and communities (Barna et al, 2012). A study was conducted on public health nurses perceptions of climate change and their roles in addressing the health issues. 786 online surveys were sent out to nursing directors at health departments and 176 responded. Most of the participants were white female administrators with more than five years of experience. The participants mostly agreed that the earth has experienced climate change, they were able to list five of the twelve health related impacts, and they perceived themselves as having the responsibility to address the health related issues but state they lack the ability to do so. Their issue is the limited means (resources) and personnel to produce a substantial impact (Polivka, 2012). If knowledge regarding health risks of climate change was spread effectively at the baccalaureate level, possibly more knowledgeable nurses would be prepared to address the issue to create a larger impact.

## METHODS

### Population and Sample

This study used a convenience sample of baccalaureate nursing faculty at one university in the Rocky Mountain region. In total, 103 nursing faculty were selected from the single university to be invited to participate in the survey. The study was approved and monitored through the Institutional Review Board at Montana State University and subjects consent to participate was implied through return of the survey.

### Design

The study was a pilot descriptive study designed to obtain a general baseline knowledge of what faculty know regarding health effects associated with climate change. The instrument utilized for this study was a modified version of the data collection tool used by Polivka (2012) with some additional items tailored to nursing faculty associated with sample description (e.g. nursing specialty, years teaching). The instrument included 22 items that measured a number of different constructs associated with how nursing faculty feel about climate change, what they know about health effects, and readiness to take action within their curriculum to incorporate more instruction about climate change. Because the Polivka instrument was collecting the same data as proposed here but in a Public Health Nurse population, some item wording changes were necessary to change the context from “public health departments” to “schools of nursing”. The root and meaning of each item remained unchanged. For this study, the only data analyzed

concerned knowledge related to health effects associated with climate change. A single item in the survey was used to address the research question and asked “The following are a list of health-related impacts that may increase as a result of climate change. Please think about whether each of these issues: A. has already increased due to climate change. B. will increase within the next 20 years as a result of climate change.” The survey in its entirety is included in appendix A and the item used for this study was number 14 section A and B. The survey instrument was converted to a web based version for ease of delivery and email invitations were sent to the 103 potential participants informing them that a survey was to follow. A second contact containing the link to the electronic survey was sent two days later, and a follow-up reminder was sent to non-responders three days following. Survey methods were in compliance with Dillman’s “Tailored Design Method” in the attempt to encourage quantity and quality responses (Dillman et al, 2009). The method, developed from perspective on human behavior, suggests, “respondent behavior is motivated by the return that behavior is expected to bring, and in fact, usually does bring, from others” (Dillman et al, p. 16. 2009). The method encompasses three fundamental considerations: 1) scientific approach to reducing sample survey errors; coverage (an inadequate coverage of the sample), sampling (collecting data from small sample groups, selecting only a portion of the population sample), nonresponse (imbalance of characteristics from sample population), and measurement (inaccurate answers, inappropriate survey wording), which may affect the quality of the data; 2) developing a set of survey procedures encouraging people to respond; 3) developing survey procedures that encourage response by considering the sample population and

content of the survey (Dillman et al, 2009). The timeline for the study was approximately one year.

## RESULTS

Some data were available for 41 of 103 nursing faculty invited to participate in the survey (response rate = 40%). Faculty were mostly female (93%), white (94%), held a master's degree (52%) or doctoral degree (39%), with nursing specialties primarily held in other specialties not listed (26%), medical-surgical (23%), and community/public health (16%). Average age of the faculty was 51 and consider themselves leaning toward a Democratic Party political view point.

A single item in the survey asked respondents, “The following are a list of health-related impacts that may increase as a result of climate change. Please think about whether each of these issues: A. has already increased due to climate change. B. will increase within the next 20 years as a result of climate change.” Complete data was available for 32 respondents for this item and treatment for missing data was likewise deleted on the advice of a statistical consultant.

Figure 1 shows responses associated with health impacts that have already increased due to climate change. Each health impact of climate change was analyzed based on the faculty responses. 52% think that heat related illness has already increased where as 35% do not know and only 13% do not think heat related illness has increased already. Flooding-related displacement of residents had the highest recognition of faculty (84%) reporting an increase has already occurred, only 3% reported they did not know, and 13% of respondents do not think that this health impact has increased already. Vector-borne illness responses was comparable to heat-related illness. 58% of

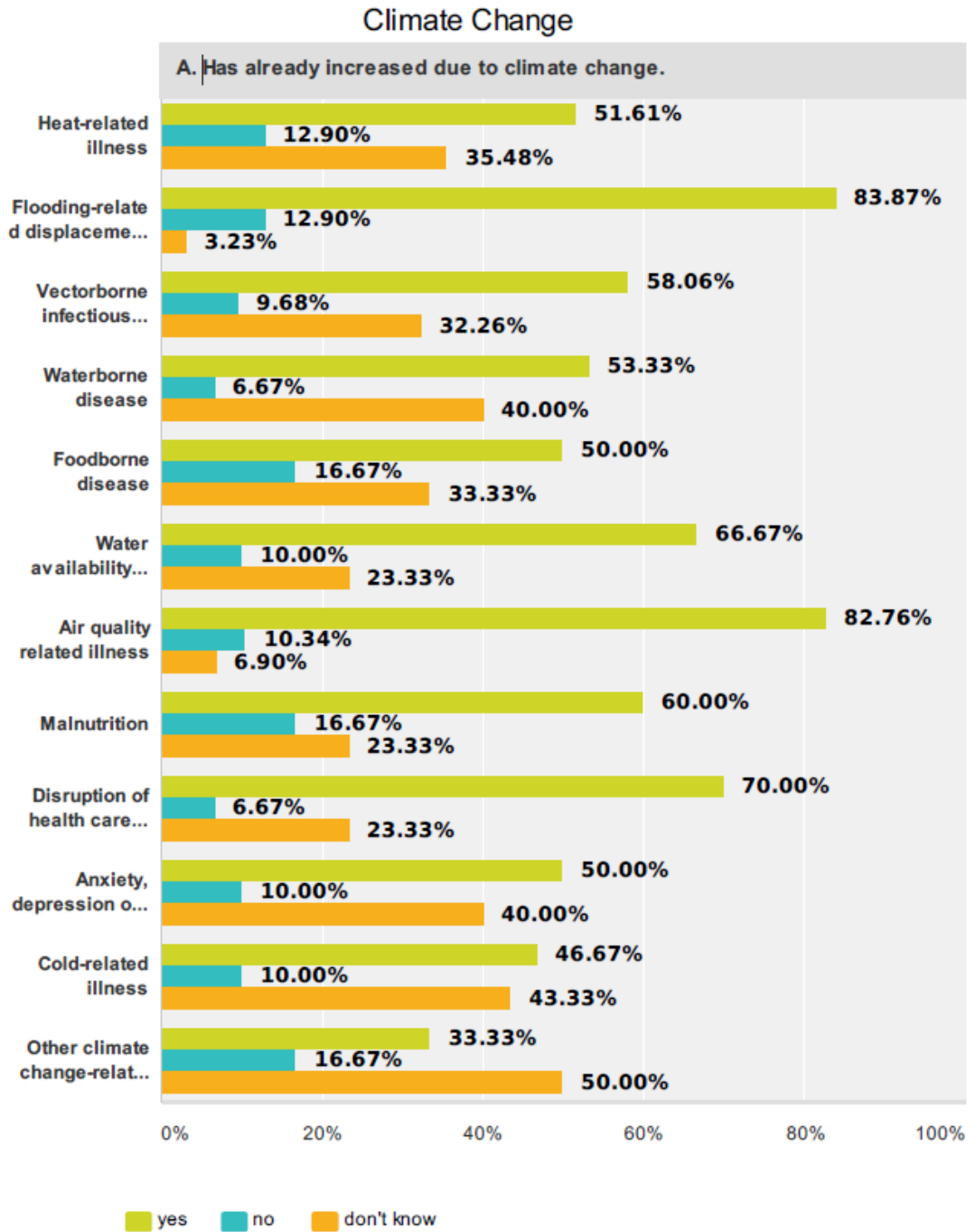


Figure 1. Health impacts already increased.

respondents believe that vector-borne illness has increased already with 10% reporting that vector-borne illnesses have not increased, and 32 % don't know.

Many respondents reported that they did not know (40%) of waterborne illness has increased related to climate change already, however 53% believe that it has already increased and only 7% do not think waterborne illness has already increased. Many respondents do not think that foodborne illness has increased already in response to climate change (17%), half of the respondents do think foodborne illness has already increased with 33% reporting not knowing if foodborne illness has increased already. 67% of respondents believe that water availability related illness has increased already in response to climate change, 23% are not sure, and 10 % report this has not increased already. Most respondents (83%) recognize air quality related illness as already impacted by climate change. Only 7% are unsure and 10% do not think air quality related illness has already increased. Many do not think that malnutrition (17%) has increased already related to climate change, however, over half (60%) do think malnutrition has increased and 23 % don't know. A large portion (70%) of the respondents agree that the disruption of health care services during extreme weather events has increased already due to climate change, 23% are unsure, and only 7% do not think disruption has already increased. When analyzing anxiety, depression, or other mental health conditions, only 50% of respondents believe this has increased already, 40% are unsure, and 10% do not think this health impact has increased already. Cold-related illness showed similar results to mental health conditions. 47% recognize cold-related illness as a health impact that has already increased, 43% do not know, and 10% do not think this health impact has

increased. The highest amount of uncertainty (50%) reported by faculty respondents is regarding other climate change-related impacts in their jurisdiction. 33% do believe there are other climate change-related impacts and 17% do not think there are other climate change-related impacts that have increased already.

The majority of faculty respondents reported “yes” to: “flooding-related displacement of residents” (84%), “air quality related illness” (83%), and “disruption of health care services during extreme weather events (70%) as health impacts that have already increased due to climate change. Very few of the respondents report “cold-related illness” (47%) and “other climate change-related health impacts in your jurisdiction” (33%) as already increased due to climate change. Half (50%) reported “anxiety, depression and other mental health conditions”, “foodborne disease (50%), and heat related illness (52%) as impacts that have already increased. Analysis of the top three health impacts that respondents do not believe have increased already shows a three way tie (17%), to: “foodborne disease”, “malnutrition” and “other climate change-related health impacts in your jurisdiction;” indicating that 17% of respondents do not believe these health impacts have already increased. The health impacts of “other climate change-related health impacts in your jurisdiction” (50%), “cold-related illness” (43%), and “heat-related illness” (35%), held the highest reported uncertainty related to health impacts that have already increased related to climate change. Figure 2 shows responses associated with health impacts increasing within the next 20 years. Faculty respondents believe that heat related-illness will increase (69%) in the next 20 years due to climate

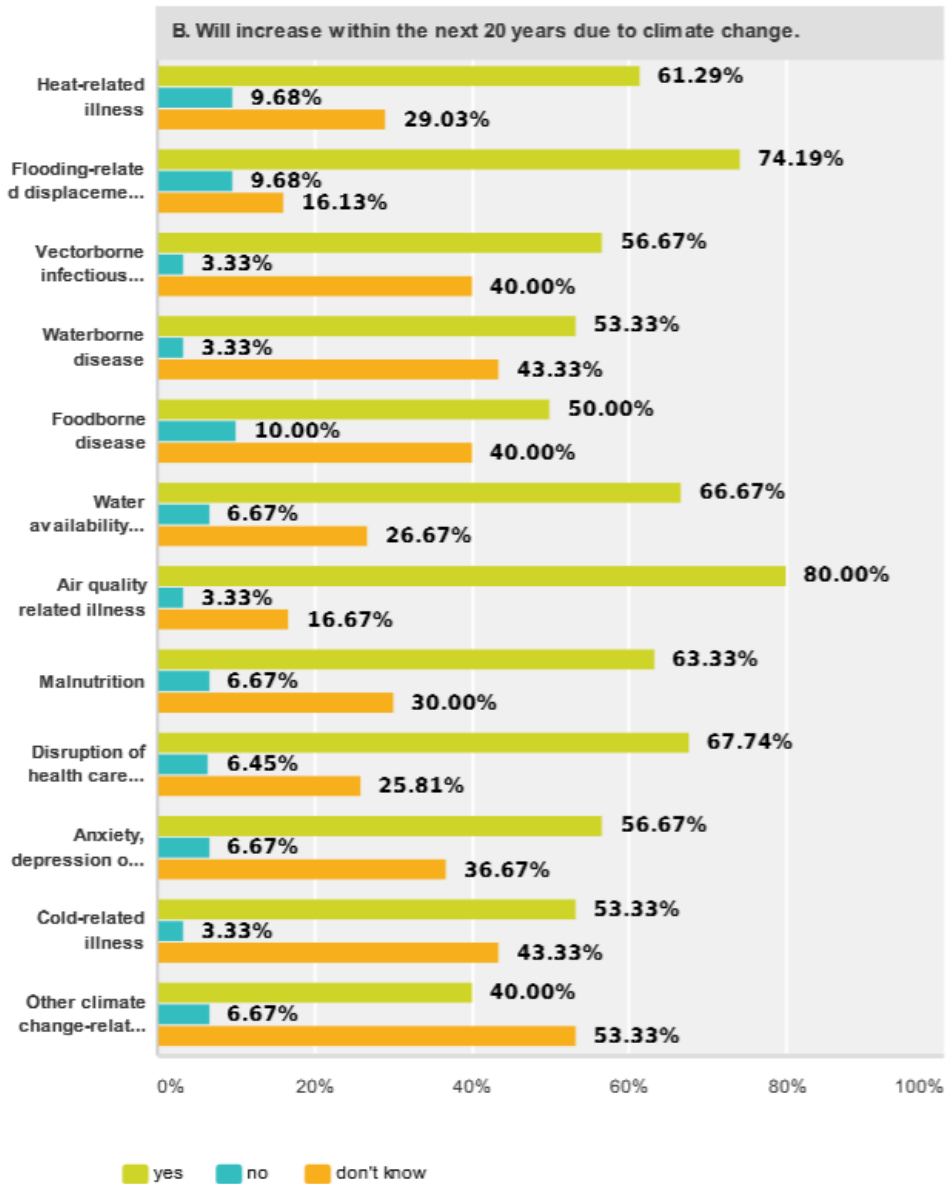


Figure 2. Health impacts that will increase in the next 20 years.

change, 10% disagree, and 29% are uncertain. Flooding-related displacement of residents received a high percentage of faculty respondents believing this health impact will increase in 20 years, few (16%) are uncertain, and 10% do not think flooding-related displacement is a future health impact due to climate change.

Over half of the respondents (57%) believe that vector-borne illnesses will increase in 20 years, 40% are uncertain, and only 3% do not believe vector-borne illness will increase in the future due to climate change. There was a high amount of uncertainty regarding the future increase of waterborne disease (43%) however over half of the respondents (53%) report they believe that waterborne disease will increase over the next 20 years, and very few (3%) do not think this will be an issue in the future. Food-borne disease was recognized by half of the respondents (50%) as a health impact that will increase within the next 20 years, 40% are uncertain, and 10% do not think this will be a growing problem in the future. Water-availability related illness is one health impact that respondents believe will increase over the next 20 years (67%), 27% are uncertain, and only 7% disagree. Most (80%) of respondents think that air quality related illness will increase over the next 20 years, only 3% disagree, and 17% are uncertain. Malnutrition had a high percentage of responses who view this as a health impact that will increase (63%), 30% are unsure, and 7% do not think this health impact will increase over the next 20 years. 68% of respondents believe there will be an increase of disruption of health care services during extreme weather events in the next 20 years due to climate change, 6% do not view this health impact as increasing in the future, and 26% are unsure. More than half of the faculty respondents (57%) believe that anxiety, depression, and other mental health conditions will increase in the future due to climate change, 37% are uncertain, and 7% do not think this health impact will increase in the next 20 years. Cold – related illness showed a high response rate of uncertainty (43%) however, 53% of respondents believe this health impact will increase over the next 20 years and only 3% do not think

this health impact will increase in the future. Most respondents (53%) report the highest amount of uncertainty in other climate change-related health impacts in their jurisdiction, 40% believe other health impacts will increase over the next 20 years related to climate change, and only 7% do not think other health impacts will increase in the future.

High percentage of responses were analyzed. The top three health impacts that received the highest percentage of response with regards to the respondents believing health impacts will increase in the next 20 years due to climate change include: Air quality-related illness (80%), flooding-related displacement of residents (74%), and Disruption of health care services during extreme weather events (68%). Although low number of responses were reported regarding each of the health impacts as not increasing over the next 20 years, 10% (highest percentage) do not believe heat-related illness and flooding-related displacement of residents will increase over the next 20 years. The top three health impacts of uncertainty reported were: other climate change-related health impacts in your jurisdiction (53%), cold-related illness (43%), and waterborne disease (43%).

## DISCUSSION

The purpose of this study was to examine knowledge of health effects of climate change among nursing faculty teaching at a baccalaureate program in the Rocky Mountain Region.

Results reveal the majority of responses of each health impact were predominately reported as having already increased. Generally if there was a lower percentage of response as having already increased there was a higher number of uncertainty responses. Few respondents believe that the health impacts selected for the survey have not already increased related to climate change as reported by the low amount of “no” responses for each health impact. This suggests a fairly high level of familiarity with health issues from climate change among the sample. In general, when comparing present-day health impacts to those that may occur 20 years from now, faculty believed that incidence of each health impact will increase and very few responses reported the health impacts not increasing over the next 20 years.

The majority of nursing faculty (84%) recognized flooding-related displacement of residents, out of all health impacts listed in the survey, as already increased due to climate change. Findings related to air quality-related illness were similar and most faculty recognized that this health impact is currently happening (83%). This could possibly be related to the recent hurricane activity such as hurricane Katrina and hurricane Sandy, both of which caused dramatic destruction and devastation to New Orleans, Louisiana and New Jersey. Media played a large role during these two events, broadcasting of the impact was made over television.

Demographically, the faculty respondents considered themselves leaning more toward a Democrat Party view point. When looking at politics, President Barack Obama, democrat, has recognized the need and push for renewable energy to reduce greenhouse gas emission. Each year, the United States is producing more energy efficient products including electric cars to decrease air pollution all of which have been portrayed in the media therefore possibly increasing awareness of mitigation efforts. In 2013, President Barack Obama stated in his Second Inaugural Address:

“We, the people, still believe that our obligations as Americans are not just to ourselves, but to all posterity. We will respond to the threat of climate change, knowing that the failure to do so would betray our children and future generations. Some may still deny the overwhelming judgment of science, but none can avoid the devastating impact of raging fires and crippling drought and more powerful storms. The path towards sustainable energy sources will be long and sometimes difficult. But America cannot resist this transition, we must lead it. We cannot cede to other nations the technology that will power new jobs and new industries, we must claim its promise. That’s how we will maintain our economic vitality and our national treasure -- our forests and waterways, our croplands and snow-capped peaks. That is how we will preserve our planet, commanded to our care by God. That’s what will lend meaning to the creed our fathers once declared.” (President Obama Second Inaugural Address, in The President’s climate action plan, p. 4, 2013).

This information possibly increased awareness of climate change to individuals who are familiar with the Inaugural Address in 2013. In June of 2013, President Barack Obama compiled a “Climate Action Plan” where he highlighted important pieces to mitigation by cutting carbon pollution, preparing the United States for the impacts of climate change, and to lead international efforts to address global climate change (Executive office of the President, 2013). Although most of the information given here

appears to be giving a more broad awareness about climate change, the actual scientific aspects, illness and diseases, that have been or will increase due to climate change is information that many do not know. These are the issues that health care providers should understand to better serve communities.

Over half of respondents are unsure of other climate change-related health impacts in their jurisdiction that may already be increased due to climate change. This could imply that over half of the faculty respondents are only aware of a few health impacts due to climate change and would then benefit from a more extensive knowledge base regarding a more global perspective on the health impacts of climate change.

It appeared that the majority of faculty members do agree that there are many health impacts due to climate change that have already increased and will increase in the next 20 years. Most health issues had a 50% or higher response rate for health impacts that are currently increased and will increase over the next 20 years due to climate change or they are uncertain if the health impact is or will increase due to climate change. A very low response percentage was found regarding health impacts that have not already increased due to climate change. Displacement of residents in response to flooding (Figure 1, 84%, Figure 2, 75% ) and the disruption of health services in response to extreme weather related events(Figure 1, 70%, Figure 2, 68% ) were two health impacts that faculty mostly recognized as already increased or will increase in the next 20 years. It is interesting to note that the top three recognized health impacts that respondents think have already increased and will increase in the next 20 years in response to climate change are the same.

It is apparent through this research that the faculty are aware of the larger idea of health impacts due to climate change, however, many do not know about the specific health impacts related to climate change. For example, the majority of respondents view flooding-related displacement of residents as already increased (84%) and will increase in the future (75%) as a health impact due to climate change but do not know if anxiety, depression and other mental health conditions have already increased (40%) or will increase in the next 20 years (37%). This is interesting because the evidence shows an increase amount of mental health conditions related to extreme weather. Hurricane Katrina showed a vast amount of individuals displaced from their homes, targeting an already vulnerable population. Many mental health illnesses can be attributed to devastation of extreme weather. Most respondents recognize the larger health impacts, those that are more broad and systematic rather than the linkage between the systematic health impact and other diseases/illnesses. For example, one of the most recognized health impacts due to climate change currently and likely to increase in the future was air quality related illness (Figure 1, 83%, Figure 2, 80%), however, a little over half of faculty respondents view heat related illness as a health impact that has currently increased (52%) or will increase (61%) in the next 20 years. Increase in temperatures have been shown to cause a longer growing season, increasing levels of pollen which aggravates respiratory illnesses (CDC, 2014).

Although this was a small sample it is important to understand the results of the survey. The survey showed that faculty do think there are health impacts related to climate change but many do not know of the particular health impacts. It may be safe to

say that the faculty have an awareness of health impacts related to climate change but are uncertain regarding the specifics of these health impacts. To increase nursing faculty's knowledge it is important to understand how adults learn best. There are six core principles for successful adult learning they include: the need for information, self-concept, past experiences, readiness to learn, orientation to learning, and motivation (Brady, 2013). In addition to these six principals the learning session should include enough time, enough information with interactive participation, and scheduling options (Brady, 2013). Increasing nursing faculty's knowledge in areas where they are uncertain should be included as nursing faculty's continuing education so information can be taught to future health care professionals and hopefully expand to public knowledge.

### Limitations

The limitations of the study included the small sample size, location of participants, and time. The sample size was small, only 41 faculty members responded to the survey out of 103 and only 32 responded to the question that was analyzed for the study. It is unknown to what extent our results may be different if more faculty had responded to the survey. The participants were all located at one university in the Rocky Mountain region and this limited our ability to make generalizations about more diverse populations of nursing faculty. Because health consequences of climate change are highly associated with geography, it would be important to survey populations of faculty in diverse regions to gain a more complete understanding of the research question. Future research should examine more diverse populations as well as other variables aside

from knowledge associated with preparing nursing students to address health effects of climate change in their practice (e.g., population advocacy, barriers to curricular revision).

### Conclusion

In conclusion, nursing faculty participating in this study have an awareness of some health impacts due to climate change but indicate some uncertainty as well. Areas where faculty have a general awareness appear to be those that are highly covered by media or perhaps are more familiar such as natural disasters or heat waves. Because of uncertainty, such as psychological consequences, continuing education for nursing faculty is warranted to improve their ability to teach students about the full range of anticipated health effects from climate change. Curricular change may be another important dimension to improving nursing student's experience with understanding climate change. The national league for nursing (NLN) defines "hallmarks of excellence" or characteristics/traits of outstanding performance or service (2014). Several hallmarks are suggested by the NLN to help faculty strive for excellence in performance or service. One of the hallmarks of excellence that is suggested is related to curriculum, "The curriculum is flexible and reflects current societal and health care trends and issues, research findings and innovative practices, as well as local and global perspectives" (NLN, ¶12, 2014). This hallmark of excellence asks "Is the curriculum regularly refined to incorporate current societal and health care trends and issues, research findings, innovative practices, and local as well as global perspectives" (NLN, ¶12, 2014).

It is imperative that nursing faculty gain more knowledge regarding illnesses such as waterborne illnesses, vector-borne illness, and mental health illnesses due to climate change so future nursing professionals gain knowledge on health care trends and a global perspective to increase their ability to educate the public and better serve communities.

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APPENDICES

APPENDIX A

SURVEY

## Climate Change

Knowledge of Nursing Faculty about the Health Effects of Climate Change : A pilot study

Survey Purpose: Our goal is to collect information regarding the knowledge of nursing faculty about health effects and climate change. The study is in partial fulfillment of a Masters of Nursing student's thesis.

Your input will help us to understand possible gaps in knowledge regarding health effects from climate change. This information may help to develop strategies for possibly enhancing the current nursing curriculum in order to inform and prepare future nurses on the current and future nursing trends regarding climate change. Moreover, through your advice, our efforts will be directed towards your knowledge and perception of climate change and issues that you feel are important in regards to education and nursing.

For this survey, climate change is known and evident.

If you have any questions during the course of completing this survey please do not hesitate to email us at [jenny.streich@montana.msu.edu](mailto:jenny.streich@montana.msu.edu) and [whill@montana.edu](mailto:whill@montana.edu). Thank you very much for your time and input.

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## Climate Change

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Climate Change

**2. Listed below are statements about the relationship between humans and the environment. There are no right or wrong answers; we are only interested in your opinion. Please indicate to what extent you agree or disagree with each statement.**

	Strongly Disagree	Somewhat Disagree	Mildly Disagree	Neither Agree nor Disagree	Mildly Agree	Somewhat Agree	Strongly Agree
We are approaching the limit of the number of people the earth can support.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When humans interfere with nature it often produces disastrous consequences.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Humans are severely abusing the environment.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Plants and animals have as much right as humans to exist.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Despite our special abilities humans are still subject to the laws of nature.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The earth is like a spaceship with very limited room and resources.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The balance of nature is very delicate and easily upset.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If things continue on their present course, we will soon experience a major	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

ecological  
catastrophe.

Strongly Disagree	Somewhat Disagree	Mildly Disagree	Neither Agree nor Disagree	Mildly Agree	Somewhat Agree	Strongly Agree
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## Climate Change

This next set of questions has to do with your opinions about climate change. Please read each question carefully and fill in the appropriate response that best represents your opinion.

### 3. Which one of the five statements below best represents your understanding of how the climate system works?

- A) Climate is stable within certain limits. If the changes are small, climate will return to equilibrium. If they are large, there will be abrupt and catastrophic impacts.
- B) Climate is random. We do not know what will happen.
- C) Climate is slow to change. Climate change will gradually lead to dangerous impacts.
- D) Climate shows a delicate balance. Small changes will have abrupt and catastrophic impacts.
- E) Climate is very stable. Climate change will have little to no impact.

### 4. Scientific consensus indicates that climate is changing. Please indicate the number that best represents where your opinion of the cause of climate change falls on this scale from completely natural to completely human.

Completely natural		Balance of natural and human		Completely human
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 5. Please indicate to what extent you agree or disagree that your community:

	strongly disagree	somewhat disagree	mildly disagree	neither agree nor disagree	mildly agree	somewhat agree	strongly agree
Has experienced climate change in the past 20 years.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Will experience climate change in the next 20 years.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 6. Please indicate to what extent you feel climate change is bad or good.

bad	neither good nor bad	good
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**Climate Change**

This next set of questions has to do with your opinions about the health-related impacts of climate change. Please read each question carefully and respond by either selecting or typing in the response that best represents your opinion.

**8. Please indicate to what extent you feel addressing the potential health-related impacts of climate change through nursing practice is worthless or valuable.**

Worthless Valuable

**9. Please indicate to what extent you feel addressing the potential health-related impacts of climate change through nursing practice is harmful or beneficial.**

Harmful Beneficial

**10. On a scale of 0-100, 0 being no knowledge at all, and 100 being knowing everything there is to know, what would you say is your level of knowledge about the potential health-related impacts of climate change?**

0-100

**11. Using the same scale of 0-100, where do you think your knowledge should be about the potential health-related impacts of climate change associated with nursing practice?**

0-100

**12. The remaining questions in this section will require you to indicate to what extent you agree or disagree with each statement.**

	Strongly Disagree	Somewhat Disagree	Mildly Disagree	Neither Agree nor Disagree	Mildly Agree	Somewhat Agree	Strongly Agree
I am concerned about the health-related impacts of	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Strongly Disagree	Somewhat Disagree	Mildly Disagree	Neither Agree nor Disagree	Mildly Agree	Somewhat Agree	Strongly Agree
climate change in my community.							
In the next 20 years, the health-related impacts of climate change will be serious in my community.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the next 20 years, the health-related impacts of climate change will be serious in the United States.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the next 20 years, the health-related impacts of climate change will be serious around the world.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In my position, it is expected that I seek information about the potential health-related impacts of climate change.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am easily able to locate information on the potential health-related impacts of climate change.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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**Climate Change**

The following set of questions asks your opinions on the role of nursing education in addressing the health-related impacts of climate change.

**13. Please read each question carefully and respond by indicating to what extent you agree or disagree with each statement.**

	Strongly Disagree	Somewhat Disagree	Mildly Disagree	Neither Agree nor Disagree	Mildly Agree	Somewhat Agree	Strongly Agree
My college has a responsibility to address the health-related impacts of climate change by preparing informed nurses.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My college has the ability to address the health-related impacts of climate change by preparing informed nurses.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My colleges's actions can decrease the health-related impacts of climate change in Montana.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My college is prepared to address the health-related impacts of climate change in Montana.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Addressing the public health consequences of climate change is a priority in my College.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**14. The following are a list of health-related impacts that may increase as a result of climate change. Please think about whether each of these issues:**

**A. has already increased due to climate change. B. will increase within the next 20 years as a result of climate change. C. Is included in the basic nursing curriculum in my college. D. Will be an area of curricular activity in my college within the next 5 years.**

**Please check yes, no, or don't know (DK) for each of columns A, B, C, and D.**

	A. Has already increased due to climate change.	B. Will increase within the next 20 years due to climate change.	C. Is included in the basic nursing curriculum in my college.	D. Will be an area of curricular activity in my college within the next 5 years.
Heat-related illness	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Flooding-related displacement of residents	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Vectorborne infectious disease	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Waterborne disease	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Foodborne disease	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Water availability related illness	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Air quality related illness	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Malnutrition	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Disruption of health care services during extreme weather events	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Anxiety, depression or other mental health conditions	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Cold-related illness	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Other climate change-related health impacts in your jurisdiction	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

**15. Please list the three most important resources that your college needs in order to improve your ability to address the health-related impacts of climate change. These resources could be, but are not limited to: staff, staff training, equipment, funding. Please provide as much detail as possible (e.g., What type of staff? How much money? What type of training?)**

**16. This concludes the first part of the survey on climate change and related health impacts. Is there anything else you would like to add that would help us understand how your department is currently engaged in addressing the health-related impacts of climate change, or what your college might need in the future to engage in these activities?**

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## Climate Change

### Demographics

#### 17. What's your age

years

#### 18. What is your highest level of education

- bachelor's degree
- master's degree
- doctoral/professional degree (PhD, DNP, etc.)

#### 19. What is your nursing specialty?

- Medical/Surgical
- Community/Public Health
- Mental Health
- Critical Care
- OB/GYN
- Pediatrics
- Palliative/Hospice
- Home Health
- Case Management

#### 20. What is your gender

- male
- female

#### 21. What is your race

- White
- Black / African American
- American Indian / Alaska Native
-

Asian

Hawaiian Native / Other Pacific Islander

Other (please specify)

**22. What is your ethnicity**

Hispanic origin

Not of Hispanic origin

**23. In politics today, do you consider yourself a Republican, Democrat, or Independent?**

Strong  
Democrat

Independent  
no leaning

Strong  
Republican

This completes the survey, thank you again for taking the time to provide us with your insight on these issues! If you have any remaining questions, or would like to see the results of this research, please contact Jenny Streich at [jenny.streich@gmail.com](mailto:jenny.streich@gmail.com)

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Done

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APPENDIX B

CONTACT LETTERS

Dear MSU Nursing Faculty Member,

A few days from now you will receive an email request to fill out a brief survey for an important study being conducted in Montana.

The study is to fulfill the requirements for a Masters in Nursing thesis. The student is surveying Montana State University College of Nursing Faculty to determine their knowledge of climate change.

I am writing in advance because we have found many people like to know ahead of time that they will be contacted. The study is important as it will help us to understand the nursing faculty's knowledge on the health effects of climate change and how these issues are integrated into the curriculum.

Thank-you for your time and consideration. It's only with the generous help of people like you that our efforts to improve the health of Montanans can be successful.

Sincerely,

Jenny L. Streich, RN, BAN  
Family Nurse Practitioner Student  
MSU College of Nursing

Wade G. Hill PhD, PHCNS-BC  
Assistant Professor

MSU College of Nursing

Dear SAMPLE:

I am writing to ask your help with a study being conducted for a student's Masters in Nursing thesis at Montana State University. This survey is part of an effort to understand the nursing faculty's knowledge of climate change.

You were selected to be contacted because you work as a valuable member of the Montana State College of Nursing faculty. By nature of your occupation, you have a valued and important perspective of the nursing curriculum.

Results from this survey will be used to help fulfill the requirements of a Masters of Nursing student's thesis and to gather important information regarding the knowledge of Montana State University College of Nursing faculty's knowledge of health effects of climate change. We would like to hear from you about your knowledge and perceptions of climate change and the Montana State University College of Nursing curriculum.

Your answers are completely confidential and no individual's answers can be identified. When you complete the survey on-line, your name will be deleted from our email list and never connected to your answers in any way. This survey is voluntary. However, you can help us very much by taking a few minutes to share your experience and observations.

Please select the link and complete the survey as soon as possible. Thank you very much for helping with this important study.

Survey link: [https://www.surveymonkey.com/s/climatechange\\_health](https://www.surveymonkey.com/s/climatechange_health)

Personal Access Code: ###

Sincerely,

Jenny L. Streich RN, BAN

Family Nurse Practitioner student

Montana State University

Wade G. Hill PhD, PHCNS-BC

Assistant Professor

MSU College of Nursing

Dear SAMPLE:

The middle of the semester is always busy, and I understand how valuable your spare time is. I am hoping you may be able to give about 20 minutes of your time to help me collect important information for my Masters of Nursing thesis regarding climate change by completing a short survey.

If you have already completed the survey, I really appreciate your participation; your information is extremely valuable. If you have not yet responded, I would like to encourage you to complete the survey. I plan to end this study on Thursday February 20<sup>th</sup>, 2014, so I wanted to email everyone who has not responded to make sure you had a chance to participate.

Please click on the link below to go to the survey website (or copy and paste the survey link into your internet browser) and then enter the personal access code to begin the survey.

Survey link: [https://www.surveymonkey.com/s/climatechange\\_health](https://www.surveymonkey.com/s/climatechange_health)

Personal Access Code: ###

Thank you in advance for completing the survey. Your responses are important! Nursing faculty are the best source of information to help shape the educational experience for the College of Nursing.

Sincerely,

Jenny L. Streich RN, BAN  
Family Nurse Practitioner student  
Montana State University

Wade G. Hill PhD, PHCNS-BC  
Assistant Professor  
MSU College of Nursing