

SIGNIFICANT CONCERN ABOUT CLIMATE AND HEALTH AMONG MONTANA  
PUBLIC AND ENVIRONMENTAL HEALTH PROFESSIONALS

by  
Lori Griffin Byron, M.D.

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## **Abstract**

A survey of Montana public and environmental health professionals conducted during September and October 2019 revealed that these health professionals not only largely accept climate change but also have significant concerns about climate and health. Eighty-nine percent accepted that global warming is occurring and 69% accepted human causation. They expressed much stronger climate change risk perceptions compared to the general public in recent surveys and in most surveys of health professionals, and similar perceptions to vulnerable health care providers working with vulnerable populations. In addition, most felt that their own health was already being affected by climate. Most felt that mental health effects from climate change would be a concern in the future (89%). Political ideology was found to be the demographic most highly correlated with acceptance of global warming's occurrence, human causation, and risk perception. Three-fourths of respondents felt that health departments should be preparing to deal with the public and environmental health effects of climate change. Almost all felt that multiple entities in Montana, including public and environmental health professionals, should be working to address climate change. Environmental health and public health professionals did not differ significantly in their acceptance of global warming and human causation and risk perception. Compared to a separate cohort of students, professionals were less likely to accept global warming and had lower risk perceptions, but acceptance of human causation did not differ between the two groups. Very few studies have looked at these populations with these questions.

## Executive Summary

As a physician who practiced public health for an entire career, the realization of climate change's immense threat to the advances in public health made over the last century caused an alteration in my career course. Like with many other public health threats, this one requires education of the public and changes in policy, law and lifestyle, all within the purview of a physician. Literature has increased during this time on the appropriateness of climate advocacy for health care providers. Extensive climate advocacy, along with the coursework to become a Masters' Candidate in Energy Policy and Climate, conveyed the importance of appropriate climate communication. Professionals in climate and health advocacy have surveyed various medical groups. I also had questions that have never been studied in previous surveys such as comparing the environmental health and public health professionals' attitudes, and concerns from these two groups on the mental health effects of climate change.

Unlike most health and climate advocates, I reside in a rural, conservative state where action on and talk about climate has been limited. There has been no surveying of health professionals in Montana. During 2019, a group of scientists and physicians have been researching and writing the Health Section of the Montana Climate Assessment. I experienced the rollout of the first section of the Montana Climate Assessment and the care used to present its findings to Montana groups; appropriate climate communication was key. This will be true for the rollout of the new health section also. Funding sources for the assessment require evaluations of attitudes of affected populations, pre and post release of the assessment, and this research on public health professionals will be part of that appraisal.

My graduate schooling, profession, and climate advocacy work to expand coverage of and action on climate in Montana all led to planning this survey of public health professionals. Research shows that we can be effective and trusted messengers to further climate conversations and action. Knowing the current perceptions of this group will be helpful in enlisting their support for the cause of climate action in Montana.

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## Introduction

### Overview

*“Climate change is one of the most serious public health threats facing our nation, yet few Americans are aware of the very real consequences of climate change on the health of our communities, our families and our children.”*

Georges Benjamin, immediate past director, American Public Health Association  
(Benjamin 2008).

Global warming, caused by anthropogenic release of heat trapping “greenhouse” gases since the industrial revolution began (late 1800’s), has resulted in changes to the earth’s climate. These changes are altering weather patterns, wildlife habitat, sea levels, and human health. Scientists have voiced increasing concern in recent decades, contending that continued emission of such gases increase the heat projections for the future and urging a rapid reduction in emissions (Nunez 2019). This study aims to survey Montana environmental and public health professionals regarding their opinions on the changing climate, its effect on human health, and the need for urgent mitigation.

Climate change, and the air pollution that causes it, has been linked to heart attacks and strokes, asthma and allergies, diabetes, obesity, and certain cancers (Fourth National Climate Assessment 2017). Injuries and deaths increase due to severe weather events. The geographic range of many vector-borne illnesses such as Dengue, Zika, Malaria, Lyme, and Chikungunya increases due to warming temperatures. Diarrheal illnesses and other bacterial and parasitic disease increase from increased flooding events. Mental health effects are myriad and profound – post traumatic stress; anxiety; depression; increased suicides and violence. For fetuses and children, preterm birth, negative effects on fetal health, deficits in intelligence, memory and



behavior, and ADHD have been associated with or linked to air pollution (Perera 2014).

Estimates are that air pollution alone is currently killing over 100,000 Americans annually (Tessum 2019).

Americans' acceptance of science as it relates to climate change has been distressingly constrained (Collumb 2014). The discrediting of science by certain industries has stymied meaningful action to mitigate climate change in the United States. Yet, the authors of the landmark report by the UN Intergovernmental Panel on Climate Change (IPCC), IPCC Special Report on Global Warming of 1.5, released late in 2018, say that “urgent and unprecedented changes are needed to keep temperature rise between 1.5C and 2C” (Summary for Policy Makers of IPCC Special Report on Global Warming of 1.5 degrees 2018).

### **Why survey Montana?**

Montana is a frontier state, with less than 7 people per square mile (IndexMundi 2010). It is ranked as a “highly conservative” state according to 2018 Gallup polls (Jones 2019a). There has been little policy work on clean energy and Montana’s main investor owned utility and most of the rural electric cooperatives are largely resistant to renewable energy (Hedges 2017). A member of the Public Service Commission was caught on mic, after draconian measures against solar energy were passed, to say that those measures should “kill future development [of solar]” (Lutey 2019 p.1). That being said, some actions regarding health and climate are already occurring in Montana. A health section of the Montana Climate Assessment is set for release in 2020; the agencies involved in producing the report – the university systems, Institute on Ecosystems, physician and science researchers – offered a climate and health symposium in the Spring of 2019 in two Montana cities (Climate Change and Human Health in Montana 2019). The non-profit Montana Health Professionals for a Healthy Climate was created in 2019,

montanahhc.org. Several medical societies including the Montana Medical Association, the Montana Primary Care Association, the Montana Chapter of the American College of Physicians, and the Montana Chapter of the American Academy of Pediatrics have had continuing education on climate and health at annual meetings. The American Lung Association in Montana has offered webinars on air pollution and climate and health. The Montana Public Health Association has provided regular information on climate change in its newsletters.

The Montana public has been minimally surveyed on climate change. A bipartisan research team assessed Montanans opinions on energy and conservation in 2016: 51% of respondents felt that action should be taken on climate (Metz 2016). The 2019 Yale Climate Opinion Maps for Montana estimate that 60% accept that global warming is happening, 45% (of the total population) believe it is mostly human caused (Marlon 2019). But whereas in Missoula, a more liberal and urban environment, Yale estimates that 55% accept in human causation, in rural NE Montana's Garfield County, only 39% are estimated to do so. Thirty four percent of Montanans are estimated to feel that climate will hurt them personally in the future – a concept known as risk perception (Slovic 1987).

Climate change is frequently seen to be distant in time and effect – people often see it happening elsewhere, to other people, or in the future--creating a low risk perception. Climate seems to be an abstract risk for many, depicted with confusing graphs and tables. (Ropiek 2010). Risk perception is a measure of how much a person cares about climate change and, therefore, a predictor of how likely they are to act or support action on climate.

However, acceptance of climate change has improved in the last couple of years and the majority of Americans now worry about climate change (60%), with 53% accepting human-causation, according to the Yale Climate Polls (Leiserowitz 2019). The Gallup polls on climate,

conducted for 30 years, show little change in people's perception of the seriousness of climate change (they use the term "global warming") – 65% now vs 63% 30 years ago who worry about it, and 66% believe it to be human-caused compared with 61% 30 years ago; a minority (45%) see it as a threat within their lifetime (up from 25% 30 years ago). We see over longer periods of time there have been cycles of increased and decreased concern (Jones 2019b).

### **Why survey public health and environmental health professionals?**

Increasingly in the past 5-10 years, some researchers and communicators have found the topic of climate and health to be a bridge, something that most people care about (Meyers 2012). Because health affects everyone and is less polarizing than some topics, human health has replaced the polar bear as the 'face of climate change' (Platt 2018). Nurses and doctors are 'trusted messengers'; nurses have been the most trusted messenger for the past 17 years in the Gallup Polls, with doctors usually ranking second (Brenan 2018). In Montana in particular, a 2017 "Deep Canvass" (a survey involving listening and a conversation with the participant to invoke change behavior) of 8,000 registered voters in Billings Montana by the grassroots organization Northern Plains Resource Council found that the health message was much better received and the participant's acceptance of climate as an issue was much higher after a conversation compared to the talking point of wildfires (that were enveloping Montana in smoke at that time) and the '97% of scientists/ scientific consensus' concept (Newman 2017).

Health professionals practicing public health tend to be generalists in that they practice holistically with the realization that multiple factors affect human health, including environmental and geographic conditions and social determinants of health. They work on programs to address local conditions affecting the populations they serve, and policies to effect system change. They work disproportionately with vulnerable populations (Polivka 2012). A

tenet central to the practice of public health is that the public should be informed about threats to their health and well-being (Kass 2001). Climate change affects multiple vulnerable populations such as indigenous communities [6.2 % of Montana (Census Viewer 2010), 1.3% of U.S. (United States Census Bureau 2018)], rural communities [Montana 7.0 people per square mile (States 101 2018) versus U.S. 87 persons per square mile (US Census Bureau 2018)], and outdoor occupation employees (Jay 2018)[Montana 65/1000 jobs in Farming, Fishing, Forestry, Construction, Extraction versus U.S. 44/1000(U.S. Bureau of Labor Statistics)] all of which are overrepresented in the frontier state of Montana. Montanans have already seen significant flooding and other extreme weather, wildfire, and drought – all worsened by climate change – that has affected jobs, property, crops, mental well-being, and family life in rural Montana (Whitlock 2017). Hence, preparedness by our rural health professionals would benefit their community members' health. Conversations by these professionals with colleagues and clients would also be helpful. Public health professionals are intimately involved with these issues – both caring for the patients and safeguarding health in their communities. Climate change threatens to increase the public health needs in communities and public health professionals assist with adaptation plans and, mitigation falls into the public health role in disease prevention.

Health professionals have a long history of advocacy for their patients. As integral as the Hippocratic Oath (Do No Harm), members of the health profession have fought and continue to fight for health care coverage, destigmatizing certain medical conditions, disease prevention – through smoking cessation, weight loss, avoidance of harmful exposures, to name but a few. Advocacy includes patient education, public awareness, legal challenges, and legislative avenues. Given that the Lancet Commission has called tackling climate change the greatest

public health opportunity of the 21<sup>st</sup> century (Watts 2018), advocacy in the realm of climate change and public health is not only natural, but arguably necessary.

The writers anticipate a 2020 release of the health section of the Montana Climate Assessment, after which professionals will be speaking on climate at the meetings of the medical organizations in the state. Since pre and post evaluation of various sectors of Montanans is required, and since public health professionals are historically excellent advocates for their patients, this was an opportunity to raise climate and health awareness in this body of Montanans and discover whether they might be an audience ripe for climate activism. Therefore, this study of Montana public health professionals was conducted to address the following research questions.

*RQ1: What are the opinions on climate among public and environmental health professionals in a rural and conservative state (Montana)?*

*R21: Among these health professionals, do opinions vary based on the population density of the town wherein they work?*

*RQ3: What is the relationship between values orientation of those surveyed and their perceptions of climate change?*

*RQ4: Are the climate concerns of public health and environmental health employees similar, and do they differ from students in these fields?*

*RG5: How do the opinions of public health professionals about climate vary from the general population of Montana, and from other health professionals nationally?*

## Methods

A anonymous survey was conducted using the Qualtrics Survey Platform between September 26, 2019 and October 30, 2019. It received Johns Hopkins University IRB approval (Study #: HIRB00009679), and Montana State University and University of Montana accepted their IRB, to allow for distribution to select students in their institutions. Average time for completion of the survey was under 5 minutes. The first question of the survey tool established informed consent (Appendix B, Climate Communication Survey Tool).

Tabling was conducted at the Montana Public Health Association/Montana Environmental Health Association (MtPHA/MEHA) meeting September 18-19, 2019. Interested meeting attendees were given the option of completing the survey on site in hard copy form, or waiting for an upcoming survey link to be released the following week.

This was a ‘sample of the whole.’ The presidents of both organizations sent a survey link to their entire membership. These professionals, employed in Montana’s Public Health Departments, completed a survey to determine their acceptance of and concern about climate science. These are largely nurses, nutritionists, researchers, physicians and other licensed health practitioners, and health educators from the Montana Public Health Association (MtPHA), and sanitarians, food inspectors, and disaster management personnel from Montana Environmental Health Association (MEHA). MtPHA has 379 members and MEHA, 100.

A cohort of students planning to enter public health or environmental health professions at the University of Montana and Montana State University were also surveyed and compared to the professionals. They were not included in the overall data, only in the comparison of themselves to the professionals.

Independent variables in this project are the characteristics of respondents – age, sex, student vs professional, population density of the region of Montana where the respondent works, political ideology, values orientation, race, and sex. The dependent variables are their responses to questions regarding climate and health. So, do they accept global warming (*“Global warming refers to the idea that the world’s average temperature has been increasing over the past 150 years, may be increasing more in the future, and that the world’s climate can change as a result. Do you think that global warming is happening”?*) and agree that it is human caused (*“Assuming global warming is happening, do you think it is mostly human caused?”*) do they think it will affect or is affecting their community (*“Do the following types of events harm the public or environmental health in other countries, the United States, Montana, your community, you, both now and in the future”?*) , and do they think that climate requires urgent action (*“In Montana, who should be working to address the causes and potential effects of climate change?”*, and *“At my workplace, preparing to deal with the public health and environmental health effects of climate change should be a priority”*).

The survey included a question aimed to discover the individuals’ ‘values orientation’ that may be relevant for understanding environmental beliefs and behavior. De Groot measured the egoistic, altruistic, and biospheric values orientations and there has been validation that these values play a role in our beliefs and behavior, attitudes and intentions. (de Groot 2008, 331). The altruistic and the biospheric values produce similar environmental concerns, distinctly different from people who value egoism. De Groot found that the more respondents subscribe to egoistic values, the lower their environmental concern and the more respondents subscribe to altruistic and biospheric values, the higher their environmental concern (de Groot 2008,

339). To evaluate if a briefer version compared to a longer tool used in previous studies could potentially predict attitudes, one question was posed (#1, Appendix B).

All analyses were completed in the statistical programming language R, with analysis of subcategories done using multiple logistic regression models and comparisons of students to professionals done with Fisher's Exact Test.

### **Analysis**

Response rate was 46%, with 271 total respondents. One hundred eighty three of the Montana Public Health Association's 379 members (48%) and 41 of the Montana Environmental Health Association's 100 members (41%), total response for both organizations combined: 46%; additionally, 47 students of public and environmental health. The number of students to which the survey tool was sent is not known.



**Table 1: Demographics**

<b>Total Professionals Surveyed: 222</b>	
<b>Sex</b>	
Female	82%
Male	16%
Other	2%
<b>Education</b>	
Some College	15%
Bachelor's Degree	47%
Master's Degree	29%
Doctorate	8%
<b>Occupation</b>	
Environmental Health:	
Sanitarian	20%
Health Fields:	
RN	37%
Health Researcher	5%
Nutrition	4%
Health Education	29%
Physician/PA/NP	4%
Retired	1%
<b>Age</b>	
18-44	47%
45-64	49%
65-over	5%
<b>Race</b>	
American Indian	4%
Asian	2%
Caucasian	89%
Other	5%
<b>Population</b>	
under 2500	10%
2500-50,000	50%
50,000-over	40%
<b>Political Ideology</b>	
Conservative	23%
Centrist	27%
Liberal	50%

In comparison to Montana demographics: Montana is 50/50 female/male, whereas the respondents were 82/16. Montana's racial distribution is 89% Caucasian, 6% Native American, 5% other; the respondents were 89% Caucasian, 4% Native American, 7% other. Twenty-five percent of Montana's population lives in towns over 50,000; one-third in towns of 2500-50,000; for these respondents, 40% worked in towns over 50,000 and one half in towns of 2500 to 50,000 (United States Census Bureau 2012).

### **Acceptance of climate change and human causation**

Overall, 86% of respondents said that changes in their community that are known to be worsened by climate change were already occurring – any combination of extreme heat days, late summer drought, flooding, forest fires, and extreme precipitation events.

88% of respondents accepted global warming, with 69% believing that it is mostly human caused (table 2). (Note: responses from those who said they did not accept global warming were included in the subsequent data.) Regarding perceived risk, 67% felt that climate change was hurting their health already, and 79% felt that it would hurt their personal health in the future. Mental Health effects of climate change in the future were a concern for 89%, not a concern for 11%.

It had been discussed at their workplace for 30%, and 72% felt that it should be a priority at their workplace (agree or strongly agree).

### **Demographical variations in acceptance of global warming and human causation (Table 2)**

**Table 2: Acceptance of Global Warming and Human Causation**

**“Global warming refers to the idea that the world’s average temperature has been increasing over the past 150 years, may be increasing more in the future, and that the world’s climate can change as a result.**

**What do you think: Do you think that global warming is happening?**

**Assuming global warming is happening, do you think it is mostly human caused?”**

<b>Acceptance of Global Warming: Yes</b>		<b>Acceptance of Mostly Human Causation: Yes</b>
<b>Overall Acceptance:</b>	86%	67%
<b>Acceptance by Sex</b>		
Female	88%	74%
Male	94%	68%
<b>Acceptance by Education</b>		
High School	100%	100%
Some College	85%	70%
Bachelor’s Degree	85%	61%
Master’s Degree	94%	81%
Doctorate	87%	67%
<b>Acceptance by Occupation</b>		
Sanitarian	91%	70%
Health Care	84%	67%
<b>Acceptance by Age</b>		
18-44	93%	76%
45-64	82%	60%
65-over	87%	73%
<b>Acceptance by Population Density*</b>		
Under 2500	78%	50%
2500-50,000	83%	64%
50,000 and over	96%	81%
<b>Acceptance by Political Ideology*</b>		
Conservative	64%	44%
Moderate	86%	59%
Liberal	96%	84%

For acceptance of global warming, the demographics with a  $p$ -value  $< .05$  were age, population density, and political ideology when considered independently of all other variables (Table A, Appendix C). But these variables are not independent of each other. Multiple logistic regression was completed to estimate the individual group effects for the demographic variables (Table B, Appendix C). Thus, although population density appears significant: if they live in a town with a population over 50,000 their estimated odds of accepting climate change increase by 417.5% as compared to if they lived in a town of less than 2,500 people for two people in this study with the same age, gender, occupation, conservatism, education, and value orientation, the  $p$ -value of 0.125 is only weak evidence of an effect on the response of climate change acceptance. Population density only looks significant when considered independently of other demographics (variables). Thus, for global warming acceptance, the only significant variable was political ideology (RQ 1). Political ideology was measured on a 1-9 scale with 9 being most conservative: for each one unit increase in a person's conservatism, their odds of accepting climate change decrease by 64.7% as compared to if they stayed at the same level of conservatism for two people with the same age, gender, occupation, town population, education, and value orientation ( $p$ -value  $< .001$ ).

Regarding human causation, population and political ideology appear significant based on  $p$ -values  $< .05$  when considered independently of all other variables (Table C, Appendix C). For human causation, if they live in a town with a population over 50,000, their odds of thinking global warming is mostly anthropogenic increase by 320.3% compared to if they live in a town of less than 2,500 people controlling for all other variables. But with a  $p$ -value of 0.0676, we have only moderate evidence of an effect of population on the response of human causation after multiple logistic regression. For each one unit increase in a person's conservatism (on the 1-9

scale with 9 as the most conservative), their odds of believing that global warming is mostly human in this study caused decreased by 34.8% as compared to if they stayed at the same level of conservatism for two people with the same age, gender, occupation, town population, education, and value orientation with strong evidence of significance after multiple logistic regression ( $p$ -value < .001) (RQ 1). (Table D, Appendix C).

Age, sex, and education (all were above high school) did not affect acceptance of global warming and human causation.

### **Risk perception (Tables 3,4,5)**

Risk perception results among these professionals showed that 69% felt their own health was being affected now (Table 3).

For risk perception (Table 4), political ideology is again the only demographic with strong evidence. Conservatism was measured on a scale of 1-9 with nine being the most conservative. For each one unit increase in a person's conservatism, their odds of believing that climate change is currently harming their health now decreased by 31.1% as compared to if they stayed at the same level of conservatism for two people with the same age, gender, occupation, town population, education, and value orientation ( $p$ -value = .004, Table E, Appendix C) (RQ 1).

Among the conservative respondents, 50% felt that their health was being affected now (Table 5).

**Table 3: Do the following types of events harm the public or environmental health?  
(Results of all public and environmental health professionals)**

<b>Currently</b>		<b>In the future</b>	
Harms human health in other countries	83%	Harms human health in other countries	84%
Harms my health	69%	Harms my health	79%

**Table 4: Do you think climate change harms, benefits, or has no effect on human health now for the people below?**

<b>Risk Perceptions: Yes, Harms my health now</b>	
<b>Overall:</b>	69%
<b>Sex</b>	
Female	68%
Male	77%
<b>High School</b>	100%
Some College	52%
Bachelors	60%
Masters	85%
Doctorate	87%
<b>Occupation</b>	
Env Health	75%
Public Health	67%
<b>Age</b>	
18-44	74%
45-64	63%
65-over	69%
<b>Population Density</b>	
Town under 2500	56%
Town 2500-50K	64%
over 50K	78%
<b>Political Ideology</b>	
Conservative	50%
Centrist	55%
Liberal	84%
<b>Professionals vs Students</b>	
Practitioner	69%
Student	89%

**Table 5: Risk Perceptions, all professionals vs conservative professionals**  
**Do you think climate change harms, benefits, or has no effect on human health now for the people below?**

**All professional respondents**

<b>Currently</b>		<b>In the future</b>	
Harms human health in other countries	83%	Harms human health in other countries	84%
Harms my health	69%	Harms my health	79%

**Conservative professional respondents only**

<b>Currently</b>		<b>In the future</b>	
Harms human health in other countries	62%	Harms human health in other countries	65%
Harms my health	50%	Harms my health	55%

**Comparison of environmental health and public health professionals (Tables 2 and 4, above)**

Environmental health (EH) professionals did not differ significantly from their health professional peers with 91% of EH professionals and 84% of public health workers accepting the science ( $p$ -value = .50); 70% of EH professionals accepted human causation, while 67% of public health workers did so ( $p$ -value = .99). Risk perception was similar also with EH professionals responding that their health was currently affected by climate change at 75% and would be in the future at 84% while public health workers were 67% and 77%, respectively ( $p$ -values = .48 and .38, respectively) (RQ 4).

**Comparison of Public Health Professionals to Students (Table 6, below)**

Fisher's Exact tests were used to compare the above data on professionals to the student cohort. 100% of students accepted global warming compared to 88% with professionals ( $p$ -value .0097, strong evidence of a difference in global warming acceptance); 76% felt it is mostly human caused compared to 69% of professionals, not a significant difference ( $p$ -value = .371). 89% felt that their health was affected now (risk perception) compared to 69% of professionals,

$p$ -value = .00515, strong evidence of a difference. Ninety-six percent felt that it would affect their health in the future compared to 69% of practitioners,  $p$ -value = .005, or strong evidence of a difference (RQ 5).

**Table 6**

<b>Students vs Professionals</b>	
Acceptance of Global Warming: Yes	
Students	100%
Professionals	88%
Human Causation: Yes	
Students	74%
Professionals	69%
Risk Perception: Climate is hurting my health now: Yes	
Students	89%
Professionals	69%

### **Values Orientation (Table 7)**

Values orientation also showed possible variance . Of the respondents, 91% of these health professionals identified as altruists or biospheric people and only 9% as egoists. Regarding acceptance of Global Warming, and comparing altruistic/biospheric vs egoistic, the  $p$ -value was .73, evidence that their values orientation did not affect acceptance in this study. With human causation, the difference in these two groups was non-significant, again indicating that values orientation did not affect acceptance of human causation. With risk perception, with a  $p$ -value of .16 was also non-significant; the difference appears large (69% altruists.biospherics vs 45% egoists), but the numbers of respondents were small. (Appendix C, Table 6)(RQ 2).



**Table 7: Career reasoning** What was the main reason you chose your current occupation? (choose one)

To help people/community (altruist)  
 It is an influential position in my community (egoist)  
 To study in a field I loved (neither)  
 To be in the community where I now am (neither)  
 To protect our environment (biospheric)  
 It is a good way to make a living (egoist)  
 Other (please fill in) (neither)

Values Orientation		
	Altruists, Biospherics	Egoists
Acceptance of Global Warming: Yes	87%	92%
Acceptance of human causation: Yes	66%	64%
Risk Perception: My Health is being affected now	69%	45%

## **Mental Health**

*‘Are you concerned about the effects of climate change-related mental health problems in your community, in the future?’* (Appendix A, question #9). The Mental Health effects of climate change in the future was a concern for 89%, and was not a concern for 11%.

## **Public Health Department Action**

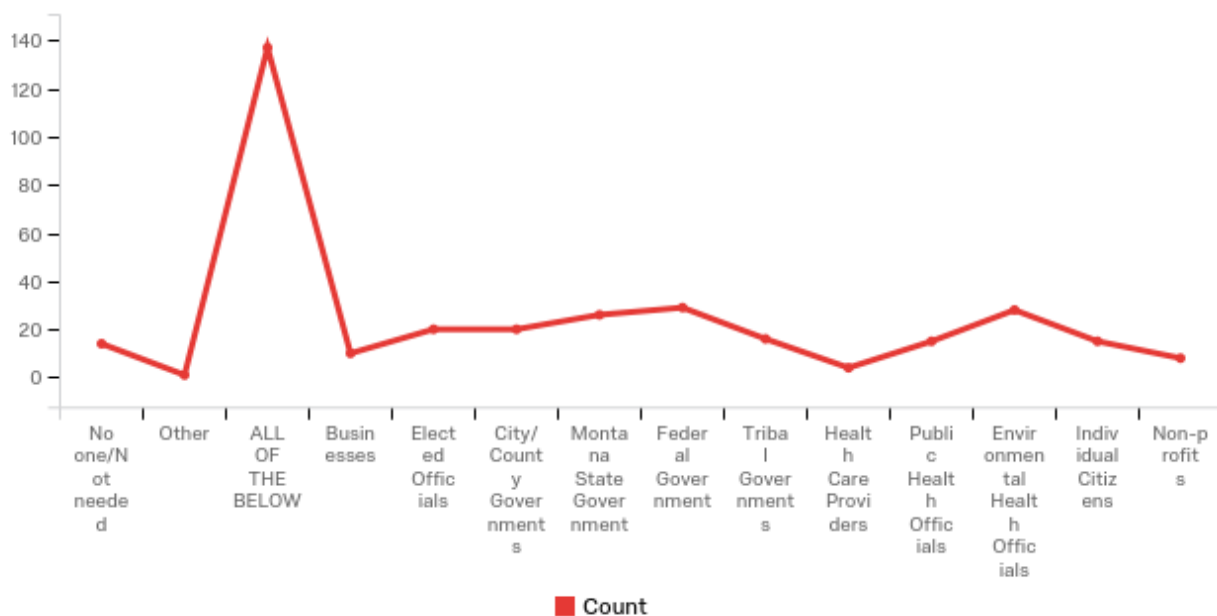
*‘At my workplace, preparing to deal with the public health and environmental health effects of climate change should be a priority’* (Appendix A, Question 10). Seventy-two percent of respondents agreed or strongly agreed that preparing to deal with the public health and

environmental health effects of climate change should be a priority. There had been discussion of or work on climate at 29% of workplaces.

### Climate Action (Graph 1)

The majority of respondents felt that ‘everyone’ (from a long list) should be working to address climate (Graph 1, below).

**Graph 1: In Montana, who should be working to address the causes and potential effects of climate change? (check all that apply): No one/Not needed, Other, ALL OF THE BELOW, Businesses, Elected Officials, City/County Governments, Montana State Government, Federal Government, Tribal Governments, Health Care Providers, Public Health Officials, Environmental Health Officials, Individual Citizens, Non-profits**



### Discussion

#### In comparison to research on Montanans and Americans

Other health provider studies have shown the respondents to have very different views on climate change compared to the general public, and this survey, even completed in a highly conservative state (Jones 2019a), shows similar trends.

Can this data be compared to Montana as a whole? In total, no since Montana is highly conservative (39% versus 18% liberal) in 2018 Gallup Polls (Jones 2019a); this Montana sub-population was 23% conservative and 50% liberal. Additionally, 80% of these professionals were female versus 50/50 in Montana (Montana Gender Ratios 2019). Also, these are public health professionals who spend their careers assisting disadvantaged people and advocating for public health, so it might be inferred that they would have more ‘climate-friendly’ attitudes. But comparing them to other Montanans is a useful exercise for climate-concerned Montanans; again, if results are favorable to climate acceptance and concern, they are a group worth focusing on, even as climate organizations have spotlighted religious groups as religious persons are more likely to act when they are concerned about a topic (Janson 2011).

Can these results be compared to the U.S. as a whole? Again, not really. Overall acceptance of climate science and climate change among the U.S. Public varies by study. Nationally, 2019 Gallup Polls showed that 66% of Americans accepted human causation (this survey had 67%) (Jones 2019b), but with much lower risk perceptions (discussed below).

But if we simply look at the conservatives in this study and their risk perceptions (Table 5), some fair comparison might be made. Only one quarter of the Gallup Poll’s conservatives were concerned believers (Jones 2019b, 12), while this survey found twice that number (50%) of conservatives in health departments who felt their own health was currently affected and 46% felt addressing climate should be a priority at their health department; so, even conservatives had significantly higher concern in this population. Risk perception, that climate will affect me, varied the most in this survey compared to other surveys. Yale’s 2018 Climate Opinions Maps (Marlon 2018) predict that 30% of Montanans (combination of liberals and conservatives) feel that global warming will hurt them personally in the future, while 55% of just the conservatives

in my cohort felt their health would be affected in the future. Pew in 2018 found that 31% of Americans thought they were being affected now while 50% of conservatives in this study felt their health was being affected now (Funk 2019). In this survey, 44% of conservatives of all ages accepted human causation.

### **In comparison with other studies of health care providers**

A study of National Environmental Health Association (NEHA) members in 2017 found that 86% accepted global warming and 32% attributed the changes to humans (American Climate Metrics Survey, 2017); the current survey found 91% acceptance and 70% human causation amongst the environmental health specialists. With NEHA, 49% felt they would personally be harmed in the future, while in this Montana survey, 84% felt they would be harmed in the future (with the opinions of public health and environmental health professionals not differing significantly).

A 2015 study of the American Thoracic Society (largely lung specialist physicians) found 89% accepted climate change and 68% accepted human causation, versus 86% and 67% in this survey; 77% felt their (respiratory) patients were being affected now, 76% of these respondents felt their community's health was being affected now; African American physicians in the National Medical Association (NMA) were surveyed in 2014. These are both a vulnerable population themselves and largely serving vulnerable populations. 97% accepted global warming, and 62% felt it was human caused, again similar to the 89% and 67% in this survey. Regarding risk perception, 88% of those NMA members in 2014 felt they had personally experienced effects of climate (compared to 35% of the general American public in 2014) and 69% felt their *health* had already been affected in this survey. The survey of NMA members was the only survey I found with higher rates of risk perception.

Other researchers have noted that vulnerable populations have higher rates of risk perception (Akerlof 2015, Mullainathan 2004, Flynn 1994). In addition, public health officials, though not vulnerable themselves, are notoriously aware of issues risking the health of vulnerable populations of their community. One might surmise that they recognize climate as such a risk, more so than the general population.

Very few studies have been completed on public health officials asking similar questions. A 2012 national study of public health department employees (Polivka 2012), these also largely Caucasian and female, found that 46% accepted human causation and 65% felt there would be local impacts in the next 20 years (67% and 79% in my survey); given the changes of the last 7 years, seeing an increased awareness in 2019 is understandable. Studies nationally of public health department directors in 2008 (Balbus 2008) then in 2012 (Roser-Renouf 2016) both found that 60% felt that health would be affected in their community within 20 years compared to 79% in my survey.

### **Demographic Variations**

Overall, political ideology affected acceptance of global warming and human causation and risk perceptions. Sex, age, education, population density, values orientation and profession (public health versus environmental health) did not. There were clear trends in the population data and values orientation data, but due to low numbers, this did not reach statistical significance. The separate student cohort accepted human causation at a higher rate and had higher risk perceptions than the practitioners, as has been seen in many surveys just looking at age trends (Funk 2019).

### **The Importance of Risk Perception**

This study group had much higher risk perceptions than previous studies of Americans, of conservatives, and most studies of health professionals. Several reasons may account for this. This is a more current study. Climate change has been in national news and several severe weather events (probably worsened by climate change) have occurred since many of the other studies. Although there were no severe events in Montana in 2019 (our worst fire season and our worse drought event was 2017, and the most recent two seasons have been more normal). In addition, public health and environmental health professionals really care. Their acquaintance with social disparities and tragedy might cause conservatives to realize the effects of climate on health, more so than the general population of conservatives.

Much of the work on risk perception has focused on individuals' risk perceptions regarding the potential impacts of climate change on themselves, their families and their communities, which in turn influence individuals' policy preferences, civic engagement, adaptation behavior, and other important responses (Lee 2015). Given that public health personnel historically have advocated for their concerns over health, "Public Health Nurses carry out system coordination and change at local, state, national, and international levels" (APHA 2013), this population in Montana may be ripe for climate advocacy.

### **Values Orientation**

The majority (91%) of participants were altruists/biospherics. The single question used to indicate values orientation showed that egoists and altruists/biospherics had similar acceptance of global warming and human causation but the altruists/biospherics had far higher risk perceptions, 69 versus 45% (these numbers did not reach statistical significance either, with the small numbers in this study). The 45% level for risk perception in the egoists was the lowest value of risk perception compared to all other demographic divisions. Roser-Renouf and van der

Linden found that values orientation contributed strongly to the explanation of environmental concern and was less strongly related to specific environmental beliefs (Roser-Renouf 2012) (van der Linden 2014), which could explain how these respondents accepted global warming and human causation as well as others did, but did not perceive risk. For egoists, according to Knez, “it is too difficult and that there is no point in doing much about environmental issues” (Knez 2016). The brief value instrument used by de Groot might be shortened even more and tested for validity; it might be worthwhile in the future to consider inclusion of an abbreviated, validated tool in climate and environmental research as these beliefs correlate with pro-environmental behavior.

## **Mental Health**

Concern over mental health and climate change is a newer topic than general health and climate change; I found no studies that queried respondents’ concern about mental health. 89% of these respondents felt mental health will be a future concern, while 88% felt that general human health would be a future concern. This data is valuable given the newness of the focus on mental health and climate change.

## **Climate Action**

In 2018, at least half of registered voters – including Democrats, Independents, and liberal/moderate Republicans, but not conservative Republicans – thought that citizens, the U.S. Congress, President Trump, their own member of Congress, and/or their local government officials should do more to address climate (Leiserowitz 2018b). Most of my participants felt that action on climate was needed by multiple or all listed societal entities (see graph below). For participants that separated out the entities, the order of importance as to which entities should act on climate was: Federal Government> Environmental Health Officials> State Government >

City/County Government> Tribal Officials> Citizens> Businesses> Non-Profits> Health care providers. Of note, health care providers were least expected to act on climate. That is a mold that many in health care are attempting to break since providers are trusted and respected messengers in our society (Brenan 2018) and health is a topic of concern for most people.

### **Respondents who did not think global warming is happening**

Of respondents that responded ‘no’, global warming is not happening, 6% still said it was human caused and 6%, human and naturally caused. 41% of the deniers of global warming felt health in other countries was currently harmed by climate change, and 12% felt their personal health was being harmed. Deniers were largely in the 45-64 age group and all were moderates or conservatives. While some surveyors had found that allowing deniers to continue in a survey on climate change is pointless, one can argue that even though ‘tribalism’ emerged when the initial question is posed and the immediate response is “no”, a significant portion of these people still have concerns; perhaps their denial cannot be taken at face value.

### **Study limitations**

Although the survey response rate was high (46%), the number of public and environmental health professionals in Montana is relatively small. And this population, not unlike nationally where 70% in public health are female (Siegel, 2006), was largely female (82%); however, rates of risk perception were similar in the males versus females in this study. Also, the survey was offered in paper at the public health annual meeting for Montana and 17% of responses were obtained there. The fact that some respondents did know the surveyor and the table at the health conference did have information on climate change could have influenced some to take the survey. (The online survey was sent out by public health leaders and their



advertisement and the IRB did not mention climate or global warming.) Also, people who give of their time to take a survey might be more altruistic.

### **Conclusion**

A larger U.S. study of public and environmental health professionals would be valuable. This study helps confirm that health professionals are potentially good climate advocates – because they really care about human health, they already advocate on issues, and (here we see that they) sense the risk of climate change to human health.

Conversations about climate are infrequent: only forty percent of Americans discuss climate even occasionally as of 2019, improved but still a low figure (Leiserowitz 2019b). Most people are unaware that the majority of Americans are concerned about this issue. Awareness of health professionals that a large number of them - even in rural conservative states - care can potentially open up conversation with their patients and increase their climate advocacy on behalf of their patients.

### **Acknowledgements**

A special thanks to my mentor, Dr. Karen Louise Akerlof of George Mason University, and Department Chair Dr. Daniel Zachary. I am grateful to the public health department personnel in Montana who generously respond to my surveys, in addition to the many hats they juggle so well. Thanks to the wisdom, editing skills, and patience of my husband, Rob; also, the theses experiences of our daughters Robin and Elizabeth.

## **Appendices**

### **Appendix A: Disclaimers**

Participants who did not accept global warming were included in the statistics of further questions.

Due to rounding, some percentages do not add up to 100%.

Any errors are the responsibility of the author.

### **Appendix B: CC Communication Survey**

I am requesting your help in an important study about public and environmental health in Montana. Your expertise as leaders in public health in your communities in Montana is valued by many. By taking this time to share your thoughts, you will help us understand how to better develop future health services for Montanans, such as programs that assist communities during forest fires, heat waves, and other extreme weather events, with a long range goal of supporting broader public and environmental health measures in Montana to address these health risks. This topic has been highly researched elsewhere but never in Montana. This survey is for my Masters' Thesis from Johns Hopkins University and is done in collaboration with researchers from Montana State University. Please contact me with any questions at [lori.byron@gmail.com](mailto:lori.byron@gmail.com). This survey is anonymous unless you choose to share identifiers to receive information at the end of the survey.

By completing this survey or questionnaire, you are consenting to be in this research study. Your participation is voluntary and you can stop at any time.

- ☐ I have read this form and agree to participate in this study.
- ☐ I do not wish to participate in this study. {Skip To End of Survey}

**1. Career reasoning What was the main reason you chose your current occupation? (choose one)**

- ☐ To help people/community
- ☐ It is an influential position in my community
- ☐ To study in a field I loved
- ☐ To be in the community where I now am
- ☐ To protect our environment
- ☐ It is a good way to make a living
- ☐ Other (please fill in) \_\_\_\_\_

**2. Would you say there has been a change over time in the frequency of these events in your community (the population you serve in your professional position)?**

	Yes	No	Not sure
Extreme Heat Days	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Late Summer Drought	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Flooding	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Forest Fires	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Extreme Precipitation Events (microbursts, storms, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**3. Do the following types of events currently harm the public or environmental health in your community?**

	Yes	No	Don't know
Extreme Heat Days	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Late Summer Drought	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Flooding	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Forest Fires	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Extreme Precipitation Events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Food/Water Borne Illness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vector Borne Illness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**4. Do you anticipate that the following types of events will harm the health of your community in the future?**

	Yes	No	Don't know
Extreme Heat Days	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Late Summer Drought	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Flooding	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Forest Fires	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Extreme Precipitation Events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Food/Water Borne Illness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vector Borne Illness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

*Over the last 50 years, Montana scientists have observed changes in Montana's climate (for example, the 2017 Montana Climate Assessment). We would like to hear from public health leaders like you about potential health effects of these changes.*

**5. Global warming refers to the idea that the world's average temperature has been increasing over the past 150 years, may be increasing more in the future, and that the world's climate can change as a result.**

What do you think: Do you think that global warming is happening?

☐ Yes ☐ No ☐ Don't Know

**6. Assuming global warming is happening, do you think it is...**

- ☐ Caused mostly by human activity
- ☐ Caused mostly by natural causes
- ☐ Neither, because it isn't happening
- ☐ Other: \_\_\_\_\_

**7. Do you think climate change harms, benefits, or has no effect on human health now for the people below ?**

	Harms	No Impact	Benefits	Don't know
In other countries	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the United States	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
in Montana	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
For your patients	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
For yourself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**8. Do you think climate change harms, benefits, or has no effect on human health in the future for the people below?**

	Harms	No impact	Benefits	Don't know
in other countries	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
in the United States	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
in Montana	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
For your patients	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
For yourself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**9. Are you concerned about the effects of climate change-related mental health problems in your community, either now or in the future? (check all that apply)**

- ☐ At present, yes
- ☐ At present, no
- ☐ In the future, yes
- ☐ In the future, no
- ☐ Not sure

**10. At my workplace, preparing to deal with the public health and environmental health effects of climate change should be a priority**

- ☐ Strongly agree
- ☐ Somewhat agree
- ☐ Neither agree nor disagree
- ☐ Somewhat disagree
- ☐ Strongly disagree

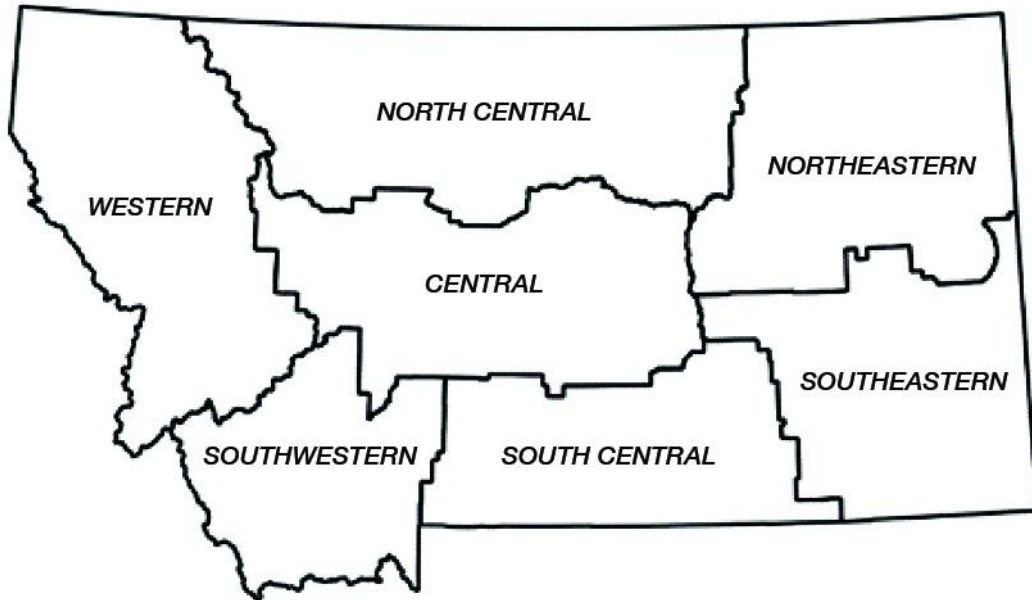
**11. At your workplace have there been any discussion, or work, around climate change?**

\_\_\_ Yes, Details: \_\_\_\_\_ \_\_\_ No

**12. In Montana, who should be working to address the causes and potential effects of climate change? (check all that apply)**

- ☐ No one/Not needed
- ☐ Other \_\_\_\_\_
- ☐ ALL OF THE BELOW
- ☐ Businesses
- ☐ Elected Officials
- ☐ City/County Governments
- ☐ Montana State Government
- ☐ Federal Government
- ☐ Tribal Governments
- ☐ Health Care Providers
- ☐ Public Health Officials
- ☐ Environmental Health Officials
- ☐ Individual Citizens
- ☐ Non-profits

**13. On this map, what region are you in? (use your best guess if you think you are near a border between these divisions) Click on your region.**



**14. Please check the highest degree you have earned. (check one)**

- ☐ High School
- ☐ Some college education
- ☐ Bachelor's Degree
- ☐ Master's Degree
- ☐ Doctorate

**15. Please check your current occupation (check all that apply)**

- ☐ RN
- ☐ WIC employee
- ☐ Registered Dietician
- ☐ Sanitarian
- ☐ Researcher
- ☐ PA/NP/APRN
- ☐ Physician
- ☐ Administrator
- ☐ Other, or clarification: \_\_\_\_\_
- ☐ Retired, past career: \_\_\_\_\_
- ☐ Student, intended career: \_\_\_\_\_

**16. Please check your gender:**

\_\_\_ Male    \_\_\_ Female    \_\_\_ Prefer not to answer    \_\_\_ Other: \_\_\_\_\_

**17. Please check your age group:**

\_\_\_ 18 - 44    \_\_\_ 45-64    \_\_\_ 65 and older

**18. Please check your race and/or ethnicity (check all that apply)**

- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Latino or Hispanic
- ☐ Native Hawaiian or Pacific Islander
- ☐ White or Caucasian
- ☐ Other: \_\_\_\_\_

**19. What is the size of the population of your community? (The population that you serve in your professional capacity)**

\_\_\_\_ Under 2500                      \_\_\_\_ 2500-50,000                      \_\_\_\_ Over 50,000

**20. Would you like to receive (check all that apply):**

- ☐ a link to the Health Section of the Montana Climate Assessment when it becomes available
- ☐ information on climate and health
- ☐ patient information - brochures - on climate and health
- ☐ slide decks on climate and health
- ☐ information on the Montana Health Professionals for a Healthy Climate
- ☐ other information: \_\_\_\_\_

PLEASE PROVIDE YOUR EMAIL TO RECEIVE INFORMATION: \_\_\_\_\_

**21. Where would you place yourself on a scale of 1 to 9**

- ☐ 1 (most liberal)
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ 9 (most conservative)

**Thank you for your time and knowledge. Please contact me with any comments or questions. [lori.byron@gmail.com](mailto:lori.byron@gmail.com)**  
**Do you have any comments for me?**

## **Appendix B: Statistics**

For a number of surveys questions, not all questions were answered so depending on the section, one of two procedures for missing data are follow. In the summaries of questions, each question was considered on its own and surveys missing responses were excluded on a question by question basis. For the subcategory analysis though, regression analysis requires complete observations for all observations (here an observation is a survey). So, only surveys that were 100% completed for the questions and demographics of interest are included.



## Appendix C: Tables

**Table A, Survey Question 5, Analysis in Deviance / p-values for various demographics re: Acceptance of Global Warming**

Global warming refers to the idea that the world's average temperature has been increasing over the past 150 years, may be increasing more in the future, and that the world's climate can change as a result.

What do you think: Do you think that global warming is happening?

\_\_\_ Yes                      \_\_\_ No                      \_\_\_ Don't Know

	Df	Deviance	Resid. Df	Resid. Dev	Pr(>Chi)
NULL			163	104.86	
Gender	1	0.28	162	104.58	0.5040
Sanitarian_F	1	0.29	161	104.28	0.4948
Age	2	5.30	159	98.98	0.0149
Population_F	2	5.33	157	93.65	0.0145
Conservatism	1	18.86	156	74.79	0.0000
Education_F	3	3.63	153	71.16	0.1242
ValueOrientation	2	0.39	151	70.77	0.7320

Note: Age, Population, and Conservatism (political ideology) are potentially significant, with *p* – value in rightmost column.

**Table B, Survey Question 5, Effects Estimate Table / Multiple Logistic Analysis for demographics and Acceptance of Global Warming**

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	9.0086	1.8904	4.77	0.0000
GenderMale	-0.3954	0.8741	-0.45	0.6517
Sanitarian_F1	0.6294	0.7799	0.81	0.4209
Age45-64	-0.2853	0.5441	-0.52	0.6009
Age65 and older	18.5211	1727.1678	0.01	0.9915
Population_F2500-50,000	-0.9214	0.8009	-1.15	0.2518
Population_FOver 50,000	1.6438	1.0655	1.54	0.1250
Conservatism	-1.0417	0.2153	-4.84	0.0000
Education_FBachelor's Degree	0.1254	0.6852	0.18	0.8550
Education_FMaster's Degree	-1.7000	0.8747	-1.94	0.0538
Education_FDoctorate	-1.2752	1.1515	-1.11	0.2699
ValueOrientationNeither	-0.7883	1.1565	-0.68	0.4965
ValueOrientationAltruist	-0.8070	1.0831	-0.75	0.4574

Note: Only conservatism is significant after Multiple Logistic Analysis.

**Table C, Survey Question 6, Analysis in Deviance/ p-values for various demographics re: Acceptance of Mostly Human Causation**

Assuming global warming is happening, do you think it is...

- Caused mostly by human activity
- Caused mostly by natural causes
- Neither, because it isn't happening
- Other: Both equally

	Df	Deviance	Resid. Df	Resid. Dev	Pr(>Chi)
NULL			163	200.02	
Gender	1	0.39	162	199.63	0.5498
Sanitarian_F	1	0.00	161	199.63	0.9907
Age	2	3.45	159	196.18	0.2089
Population_F	2	8.14	157	188.04	0.0248
Conservatism	1	14.26	156	173.78	0.0003
Education_F	3	1.75	153	172.03	0.6619
ValueOrientation	2	1.15	151	170.88	0.5926

Note: Population and Political Ideology (Conservatism) are potentially significant, with  $p$  – value in rightmost column.

**Table D, Survey Question 6, Effects Estimate Table / Multiple Logistic Analysis for demographics and Acceptance of Human Causation**

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	2.5857	1.2478	2.07	0.0399
GenderMale	0.2874	0.6287	0.46	0.6482
Sanitarian_F1	-0.1157	0.5445	-0.21	0.8319
Age45-64	-0.2408	0.4333	-0.56	0.5792
Age65 and older	0.0137	0.8592	0.02	0.9873
Population_F2500-50,000	0.3798	0.6930	0.55	0.5844
Population_FOver 50,000	1.4358	0.7800	1.84	0.0676
Conservatism	-0.4273	0.1256	-3.40	0.0009
Education_FBachelor's Degree	-0.8457	0.6091	-1.39	0.1670
Education_FMaster's Degree	-0.7390	0.7091	-1.04	0.2990
Education_FDoctorate	-0.8035	1.0137	-0.79	0.4292
ValueOrientationNeither	0.5870	0.8389	0.70	0.4851
ValueOrientationAltruist	0.1315	0.7713	0.17	0.8649

Note: Only conservatism is significant after Multiple Logistic Analysis.

**Table E, Survey Question 7, Analysis in Deviance / p-values for various demographics re: Risk Perception (Concern that climate is affecting my health now)**

	Df	Deviance	Resid. Df	Resid. Dev	Pr(>Chi)
NULL			163	201.70	
Gender	1	0.49	162	201.21	0.5024
ValueOrientation	2	3.96	160	197.25	0.1653
Sanitarian_F	1	0.55	159	196.70	0.4782
Age	2	2.07	157	194.63	0.3899
Population_F	2	3.18	155	191.44	0.2353
Conservatism	1	16.68	154	174.77	0.0001
Education_F	3	4.34	151	170.43	0.2667
Gender:ValueOrientation	2	1.59	149	168.84	0.4861

Note: Values orientation (weakly) and conservatism (political ideology) are potentially significant, with  $p$  – value in rightmost column.

**Table F, Survey Question 7, Effects Estimate Table / Multiple Logistic Analysis for demographics and Risk Perception**

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	1.3709	1.2646	1.08	0.2801
GenderMale	-15.0336	925.4837	-0.02	0.9871
ValueOrientationNeither	1.0359	0.9174	1.13	0.2606
ValueOrientationAltruist	0.5705	0.8297	0.69	0.4928
Sanitarian_F1	0.3165	0.5726	0.55	0.5812
Age45-64	-0.2438	0.4399	-0.55	0.5802
Age65 and older	-0.2850	0.8955	-0.32	0.7507
Population_F2500-50,000	-0.0115	0.7119	-0.02	0.9871
Population_FOver 50,000	0.3742	0.7920	0.47	0.6373
Conservatism	-0.3723	0.1273	-2.92	0.0040
Education_FBachelor's Degree	0.1460	0.5670	0.26	0.7972
Education_FMaster's Degree	0.9697	0.7067	1.37	0.1721
Education_FDoctorate	1.7571	1.2640	1.39	0.1665
GenderMale:ValueOrientationNeither	15.0928	925.4842	0.02	0.9870
GenderMale:ValueOrientationAltruist	15.1171	925.4842	0.02	0.9870

Note: only conservatism is significant

## Appendix D: Bibliography

### Bibliography

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## **Appendix E**

### **Biographical Sketch**

Born October 28, 1958, Dr. Lori Byron graduated Summa Cum Laude with a B.A. in Religion and Philosophy and a B.S. in Mathematics from Kentucky Wesleyan in 1980. She received her M.D. from University of Louisville in 1984. A pediatric internship and residency at University of Alabama Birmingham extended from 1984 to 1987. She served the Crow Indians on Southeast Montana for 27 years as a pediatrician, retiring 4 years ago. She has spent the last 6 years in climate and health advocacy as Co-Chair of the Citizens Climate Lobby Health Team. She help found the Montana Health Professionals for A Healthy Climate in 2019 and currently chairs this group.