The Relationship between Socioeconomic Factors and Climate Denial in the United States

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ABSTRACT

We are currently facing a climate crisis, and inaction to address this crisis will have devastating consequences. One reason for climate inaction is the pervasive culture of climate denial in the United States. According to the Yale Program on Climate Change Communication, only 53% of Americans believe in anthropogenic climate change. To address climate denial, we need to know who is denying climate change. My research looks at the relationship between socioeconomic factors and climate change denial, specifically gender, race, age, political party, religious affiliation, income, education, geographic location, and physical vulnerability. Few studies have looked specifically at social factors influencing climate change denial in the United States. Past research measured climate or environmental concern, and focused on one input variable. Race, age, and physical vulnerability have been overlooked in past research. Using data collected by Gallup, I ran multiple regression models to measure these relationships. The most important variables in predicting climate change belief are age, political party, and geographic location. The effect of age on belief has decreased over the past 10 years while the effect of political party on belief has increased over the past 13 years. Physical vulnerability is not a significant variable in predicting climate change belief. Climate change education should be targeted at those denying it: older people, Republicans, and those living in small cities and rural areas.

KEYWORDS

INTRODUCTION

The climate crisis is the most pressing and overlooked issue of the century. In 2018, the Intergovernmental Panel on Climate Change (IPCC) released a special report detailing the catastrophic effects of 1.5 degrees of warming above pre-industrial levels. About 14% of the world population would be exposed to severe heat waves at least once every five years (Hoegh-Guldberg et al. n.d.). Nearly 350 million more people will be exposed to severe drought, which can result in more deaths and conflicts over water (Hoegh-Guldberg et al. n.d.). Anywhere from 31 to 69 million people would be exposed to flooding from sea level rise in 2100, with small island nations and coastal cities primarily affected (Hoegh-Guldberg et al. n.d.). Unfortunately, 1.5 degrees of warming is the best case scenario. Even worse impacts will be seen if the Earth reaches 2 degrees of warming, which is more likely. Climate change was first brought to the attention of Congress in 1988 by NASA scientist Dr. James Hansen. He sat in front of the Senate Energy and Natural Resources Committee and stated that it was 99% certain that global warming trends were not natural and in fact caused by human activity ("Global Warming Has Begun, Expert Tells Senate - The New York Times" n.d.). It's been more than 40 years since his testimony, and the United States federal government has done very little to address climate change. One of the main reasons for inaction on climate change in the United States is the magnitude of climate change denial.

Climate change denial is pervasive in American society. A 2008 survey conducted by the Yale Program on Climate Change Communication found that only 57% of Americans believed the Earth was warming due to human activity (Ballew et al. 2019). They found that 77% of liberal Democrats, 65% of moderate Democrats, 65% of Independents, 52% of moderate Republicans, and 28% of conservative Republicans believed in anthropogenic climate change (Ballew et al. 2019). A 2017 survey conducted by the same group found that 56% of Americans believed that the Earth is warming due to human activity (Ballew et al. 2019). They found that 83% of liberal Democrats, 64% of moderate Democrats, 49% of Independents, 46% of moderate Republicans, and 28% of conservative Republicans believed in anthropogenic climate change (Ballew et al. 2019). Belief among Democrats has increased, while belief among Independents and Republicans has decreased, but overall belief has stayed about the same from 2008 to 2017. If there is to be any movement on tackling the climate crisis in the United States, the issue of climate denial needs to be addressed.

To address climate denial, we need to know who is denying climate change. There are other factors besides political party that influence a person's belief in climate change. Few studies have looked specifically at social factors influencing climate change denial in the United States. Substantial literature has focused on the role that one factor, such as gender, plays in climate change belief, but few evaluate multiple factors collectively. People have complex identities: they aren't just a woman or just Asian, so it's imperative that we evaluate all these factors together. Also, when people are looking for research on climate change denial, they shouldn't have to read six different papers to understand the relationship between socioeconomic factors and denial. That's why my research will analyze multiple factors together. Past studies have used a narrow lens to look at race, as white versus non-white, which isn't representative of racial identities, so my research further stratifies race (Aaron M. McCright 2010, Hornsey et al. 2016). There have been some conflicting findings regarding the relationships between belief and income level and belief and education level, something my research aims to clarify (Brody et al. 2007, Liu et al. 2014). Many studies have overlooked the role that age plays, and in our current political climate, with young people leading the charge on climate change, age is an important factor. None of the studies I've looked at included religious affiliation or physical vulnerability in their analyses, two factors I'll be including in my research. Filling in these gaps will give a more holistic view of the relationship between socioeconomic factors and climate change denial.

My research looks at what socioeconomic factors influence a person's belief in anthropogenic climate change. I look at the association between climate change belief and the following eight factors: gender, race, age, political party affiliation, religious affiliation, income level, education level, and geographic location. Based on past studies, I hypothesize that women, people of color, younger people, Democrats, non-Christian people, lower-income people, more educated people, and city dwellers believe in climate change more. Women, people of color, younger people, and lower-income people tend to see more risk in the world due to their vulnerability in our white, male-dominated society, making them more likely to see climate change as a threat. Religious Christians tend to align with the Republican party, so I think they'll deny climate change more than their Jewish, Muslim, Atheist, and non-religious counterparts. City dwellers tend to be more diverse, and Democrats, so I expect them to believe in climate change more than those living in suburban or rural areas. I expect income level and religious affiliation to not be statistically significant due to their multicollinearity with other variables, specifically race

and political party, but I think these are still important variables to include. I also look at trends in the effect of age and political party on climate change belief over the past 10-15 years. Finally, I look at the relationship between physical vulnerability and climate change denial. Not much research has been done on this relationship, but I hypothesize those in more physically vulnerable areas will believe in climate change more since they are being impacted by it.

EXTENDED INTRODUCTION

Background

Climate change denial manifests in five main arguments (Mann 53). The first is that carbon dioxide levels aren't actually increasing. The second is that even if there is global warming, it's due to natural causes. The third argument is that even if global warming is caused by humans, the impact will be small. Fourth, the changes due to global warming are generally going to be good for us. And lastly, even if global warming is real, and caused by humans, it's too late to do anything about it. The type of climate denial I'll be focusing on in my research is the third one, denying that climate change is caused by human activities. If someone attributes climate change to natural causes, they are less likely to think anything needs to be done to address it.

People view climate change information through cognitive filters, biases that influence a person's choice to accept or reject ideas (Hoffman 3). Our cognitive filters reflect our cultural identity. We tend to develop worldviews that are consistent with the values held by others within the groups with which we self-identify. We are the product of our surroundings. The following literature review will further explore how identity influences climate change denial.

Literature Review

Climate Denial and Gender and Race

There is a consensus that white males are more likely to deny climate change than their female and non-white counterparts. A couple of theories were offered to explain this difference, one of them being the white male effect. The white male effect refers to the atypically high levels

of technological and environmental risk acceptance among white males (Flynn et al. 1994, Finucane et al. 2000, McCright and Dunlap 2011b). Risk is the possibility of damage, injury, loss, or any other negative occurrence that is caused by vulnerability. A study found that the white male effect was caused by about 30% of the white male sample that judged risks to be extremely low (Finucane et al. 2000). White men perceive less risk than their female and non-white counterparts because they are "more involved in creating, managing, controlling, and benefitting from technology (Finucane et al. 2000). This feeds into the next theory, the vulnerability thesis. Due to white males' dominant position in society, they feel less vulnerable and are therefore more accepting of risks (McCright and Dunlap 2011b). Women and non-white men are more vulnerable than white men, and therefore see more risk in the world. Due to white males' high risk acceptance, they are less likely to view climate change as a risk, and therefore are more likely to deny its existence (McCright and Dunlap 2011b).

Climate Denial and Age

There is competing evidence and theories when it comes to the relationship between age and climate change denial. A number of studies have found a negative correlation between age and climate change concern, meaning younger people are more likely to care about climate change than older people (Aaron M. McCright 2010, Hornsey et al. 2016). One theory offered to explain this relationship is that young people are less integrated into the American economic system or dominant social order, so they're more likely to support reforms to it, such as environmental regulations (D. Van Liere and Dunlap 1980). I think this relationship might be because younger people are more threatened by climate change as many older people won't be around to experience the damage they have caused. This is the rhetoric that many youth climate activists have been using over the past couple years. However, a 2014 study found that age was not a statistically significant predictor of climate change concern, and found a positive relationship between age and climate change concern (Liu et al. 2014). Not much research has been done on the relationship between climate denial and age.

Climate Denial and Political Party

There is a strong partisan divide over climate change, and that divide has grown over the past couple decades. It is well known that Democrats tend to believe in climate change while Republicans tend to deny climate change. Conservatives exhibit system-justification tendencies, which lead them to defend the status quo and resist change (McCright and Dunlap 2011a). Due to these system-justification tendencies, they are likely to favor protection of the current industrial capitalist order (McCright and Dunlap 2011a). Acknowledging climate change poses a threat to this order, as addressing it would require regulating industry and losing profits. Their "commitment to an anti-regulatory view of government" is a crucial motivator of their opposition to climate change (Dunlap et al. 2016). On the other hand, liberals are more amenable to critiques of the established order. They can be expected to "accommodate evidence of climate change and the necessity of dealing with it, as employing governmental regulations in an effort to reduce the danger of climate change is likely to seem quite legitimate to them" (McCright and Dunlap 2011a). The large partisan divide is a result of trends of increased party polarization, or party sorting. Party sorting refers to "how groups of people in a population sort out in ways that heighten their partisan differences" (Dunlap and McCright 2008). Party sorting occurs when "visible and active members of a party, especially its elected officials sort first and provide cues to voters that party positions are evolving" (Dunlap and McCright 2008). Over the past couple decades, the public has become more and more polarized as they take not of what their elected officials do. And when their party takes a stance on climate change, they adopt that stance.

Climate Denial and Income

There are mixed beliefs when it comes to income level's effect on climate change denial. Maslow's theory of hierarchy of human needs posits that those with "higher social class should be more concerned about environmental problems than those with lower social class" because they have their basic needs, like food and housing, met and therefore have the ability to become more concerned with higher level needs like the environment (Liu et al. 2014). Higher income people also tend to be more educated and therefore better equipped to understand climate change. However, others suggest that lower-income people are more likely to perceive climate change as

a threat due to their heightened risk perception (Brody et al. 2007). Similar to women and non-white men, low-income people are more vulnerable and therefore see more risk in the world. Low-income and working class people also tend to live in highly polluted areas and work in poor physical environments, so they should be expected to express concern about poor environmental conditions (D. Van Liere and Dunlap 1980). Empirical studies have also had conflicting results. A 2015 study found that the average income of climate change believers was 10 points lower than the average income of climate sceptics (Bliuc et al. 2015). However, a 2016 study found a statistically significant positive correlation between income and climate change belief (Hornsey et al. 2016).

Climate Denial and Education

Although early researchers found education level to be one of the most consistent predictors of citizen concern about climate change, education now shows inconsistent effects depending on political orientation. For Democrats, as education level increases, the probability of seeing global warming as a threat increases (Hamilton 2011). But for Republicans, as education level increases, the probability of seeing global warming as a threat decreases (Hamilton 2011). This phenomena is known as the political moderator effect, whereby partisan identification statistically moderates the relationship between educational attainment and belief in climate change (Dunlap et al. 2016). The political moderator effect is caused by motivated cognition, the "tendency for citizens to selectively accept information that reinforces, or reject information that opposes, their political beliefs or identity (Dunlap et al. 2016). So even if educated Republicans are presented with evidence of climate change, they will disregard the information because it goes against their political beliefs. This relationship also reflects the efficacy of media campaigns that provide scientific-sounding arguments against climate change, which "disproportionately reach educated but ideologically receptive audiences" (Hamilton 2011).

METHODS

Statistical Regression

Data Collection

I emailed Gallup, a well-known analytics company, to gain access to the data from their yearly survey on American attitudes on the environment. They sent me the dataset and codebook for their Gallup Poll Social Series: The Environment, which is collected from telephone interviews with nationally representative samples of adults in the United States. The dataset contains data from 2000-2019, but I just used data from 2019 for this part. They asked respondents questions on a range of general topics and then focus in on environmental issues. I focused on two sections of the survey: global warming beliefs and demographics. For global warming beliefs, I looked at their response to the cause of climate change- human activity or natural causes. For demographics, I looked at gender, race, age, political party, religious affiliation, income level, education level, and geographic location. I deleted all variables that weren't those listed above as well as zip code and year. I deleted all the "don't know" and "refused to answer" entries. I re-categorized and re-coded some of my variables, the results of which can be seen in Table 1. I re-coded my continuous variables- gw_cause, gr, and party- to start at 0 rather than 1. I decreased the number of categories in my religion, income, education, and geographic location variables to make interpretation easier and more relevant.

Table 1. Summary of variables used in the study. Data was downloaded from Gallup, an American analytics company.

Variable	Coding	Mean	SD
Cause of global warming (gw_cause)	0 (natural causes) to 1 (caused by human activity)	0.66	0.47
Gender (gr)	0 (male) to 1 (female)	0.47	0.50
Race (race)	1 (Non-Hispanic White), 2 (Non-Hispanic Black), 3 (Hispanic), 4 (Asian), 5 (Other)	1.55	1.03
Age (age)	18-97	53.67	18.91

Political Party (party)	0 (Republican) to 4 (Democrat)	2.06	1.66
Religious Affiliation (relig)	1 (Protestant), 2 (Catholic), 3 (Other Christian), 4 (Jewish), 5 (Muslim), 6 (Atheist/Agnostic), 7 (Other), 8 (None)	3.12	2.66
Income Level (inc)	1 ($0-50k), 2 ($50-99k), 3 ($100-249k), 4 ($250-499k), 5 ($500k+)	1.89	0.91
Education Level (edu)	1 (less than hs), 2 (hs graduate), 3 (college degree), 4 (graduate degree)	2.68	0.84
Geographic Location (geo)	1 (big city), 2 (small city), 3 (suburbs), 4 (town), 5 (rural area)	2.99	1.36
Physical Vulnerability (overallrisk)	0 (low) to 1 (high)	0.42	0.11

Data Analysis

To determine the relationship between climate change belief and my selected socioeconomic factors, I ran a multivariate statistical regression in Stata. This was my equation:

$$gw\_cause = \beta_0 + \beta_1 gr + \beta_2 race + \beta_3 age + \beta_4 party + \beta_5 relig + \beta_6 inc + \beta_7 edu + \beta_8 arealive$$

Specifically, I ran a logistic regression (logit) model because I was regressing a binary variable. I used the logit model rather than the linear probability model because a logit model bounds responses between 0 and 1.

Trends in Effects of Age and Political Party

Data Collection

I used the same dataset from my initial regression for this part of my analysis. For my analysis of age, I used data from 2010 to 2019 because this is where we start to see a trend. For my analysis of political party, I used data from 2006 to 2019, excluding 2009 because the dependent variable

was not measured in 2009. I recoded party to Republican, Independent, and Democrat to make interpretation easier and more relevant.

Data Analysis

I used a linear probability model to regress climate change belief and an age x year interaction term. I also used a linear probability model to regress climate change belief and a party x year interaction term. I decided to use a linear probability model rather than a logit model because they are easier to interpret.

Physical Vulnerability

Data Collection

To include physical vulnerability in my analysis, I found a climate risk index to add to my regression. The University of Notre Dame's Global Adaptation Initiative developed an Urban Adaptation Assessment, which assigned overall climate risk scores to 278 United States cities. The risk score incorporates exposure, sensitivity, and adaptive capacity. Exposure refers to the number of individuals and critical infrastructure exposure to a climate hazard event. Sensitivity refers to the degree to which the population of the city is affected by climate hazards. Adaptive capacity refers to the city's ability to respond to the consequences of climate hazards. The risk scores were assigned by city, so I went through and manually entered all the zip codes for each city. I then merged this data with my previous dataset through zip code.

Data Analysis

To determine the relationship between physical vulnerability and climate change belief, I ran another linear probability model. I included data from 2016 to 2019. First I regressed climate change belief against physical vulnerability, and then I added geographic location, and then I added political party and year fixed effects.

RESULTS

Statistical Regression

There was a positive correlation between gender and climate change belief (Table 2). Women were about 3% more likely to believe in climate change than men, however this difference was not statistically significant. Non-Hispanic Black people were about 1% less likely than white people to believe in climate change, though this difference was not statistically significant. Hispanic people were 12.5% more likely and Asian people were 12.1% more likely than white people to believe in climate change, though only the difference between Hispanic and white people was statistically significant. Age was negatively correlated with climate change belief; the probability of believing in climate change decreased by 1.5% with every year increase in age. People who lean Republican were 13.5% more likely to believe in climate change than Republicans, while Independents were 37% more likely. People who lean Democrat and Democrats were 49% and 53%, respectively, more likely to believe in climate change than Republicans. These partisan differences were all very statistically significant. Those with an income of $500k+ were 48% less likely to believe in climate change than those making less than $50k, a difference that's very statistically significant. Those with a graduate degree were 12% more likely to believe in climate change than those who did not finish high school, which was statistically significant. People who live in small cities, suburbs, towns, and rural areas were all less likely to believe in climate change than those living in big cities, though only the differences with small cities and rural areas were statistically significant. Those living in small cities and rural areas were 9.5% and 10.4%, respectively, less likely to believe in climate change than those living in big cities.

Table 2. Logistic regression model explaining climate change belief. Marginal effects and standard errors for each variable are displayed (N=897)

Variable	dy/dx	SE
Gender	0.028	0.028
Race		
Non-Hispanic Black	-0.074	0.051
Hispanic	0.125***	0.046
Asian	0.121	0.080
Other	0.052	0.069
Age	-0.0015*	0.001
Party		
Lean Republican	0.135**	0.054
Independent	0.370***	0.063
Lean Democrat	0.491***	0.045
Democrat	0.530***	0.038
Religion		
Catholic	0.022	0.038
Other Christian	0.010	0.039
Jewish	0.003	0.097
Muslim	0.116	0.165
Atheist/Agnostic	-	-
Other	0.048	0.077
None	0.059	0.043
Income		
$50-99k	0.043	0.032
$100-249k	-0.061	0.040
$250-499k	-0.026	0.079
$500k+	-0.481***	0.148
Education		
HS Graduate	0.054	0.062
College Degree	0.099	0.065
Graduate Degree	0.123*	0.070
Geographic Location		
Small City	-0.095**	0.044
Suburb	-0.033	0.043
Town	-0.019	0.046
Rural Area	-0.104**	0.045

* $p<0.10$, ** $p<0.05$, *** $p<0.01$

Trends in Effects of Age and Political Party

The marginal effect of age on climate change belief has decreased over the past nine years (Table 3, Figure 1). In 2010, a 10 year increase in age showed a 4.6% decrease in climate change belief while in 2019 a 10 year increase in age showed a 1.9% decrease in climate change belief. The biggest change was between 2015 and 2016 when the marginal effect dropped from   -3.9% to -2.4%. All results were significant. While the effect of age didn't decrease every year, it showed an overall positive trend (Figure 1).

Party polarization over climate change has increased over the past decade (Table 4, Figure 2). There has been a steady decline in the percent of Republicans that believe in climate change. In 2006, about 46% of Republicans believed in climate change. In 2019, that number dropped to about 38%, with the lowest point being in 2010 at just under 30%. In 2006, the percent of Independents who believe in climate change was 65%. In 2007, it dropped to 55% and then 49% in 2008. In 2019, about 74% of Independents believed in climate change. The percent of Democrats who believe in climate change has steadily increased over the past decade. In 2006, 77% of Democrats believed in climate change. In 2019, almost 91% of Democrats believed in climate change. Trends in belief among political party over the past decade can be seen in Figure 2.

Table 3. Effect of Age on Climate Change Belief from 2010 to 2019 (N=11,175)

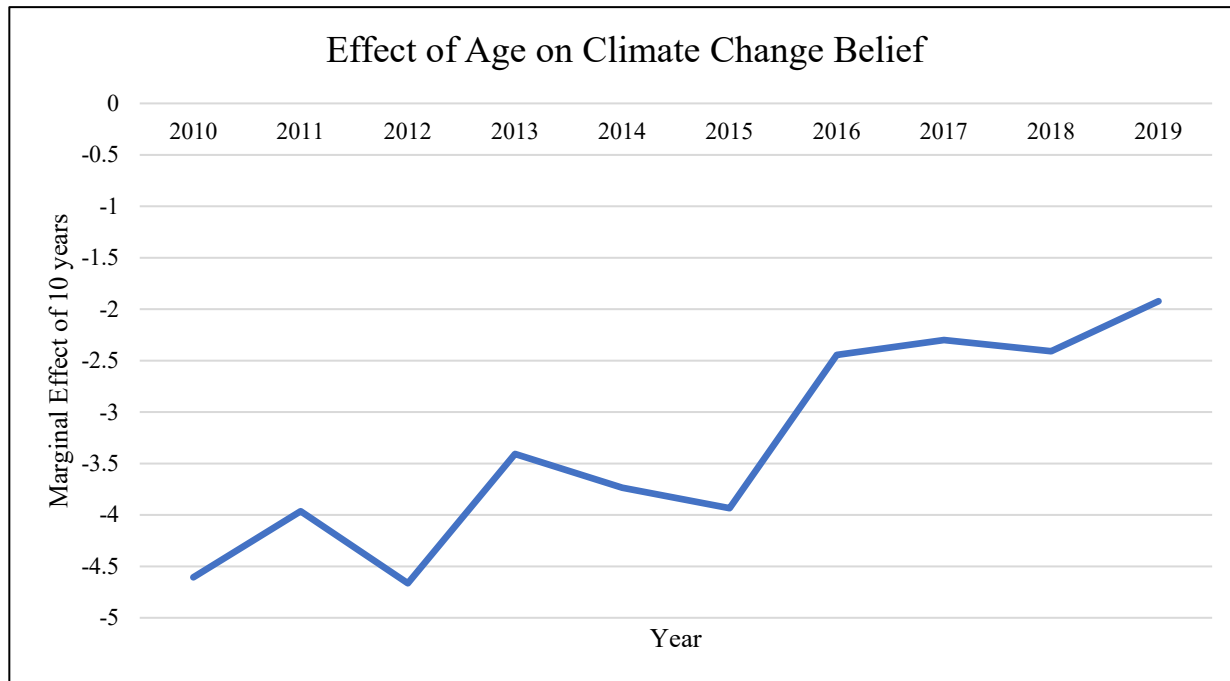| Year	Marginal Effect of 10 years	SE
2010	-4.6066***	0.0003691
2011	-3.9646***	0.0003678
2012	-4.6644***	0.0003651
2013	-3.4075***	0.0003807
2014	-3.7354***	0.0003721
2015	-3.935***	0.0003654
2016	-2.4441***	0.0003805
2017	-2.2998***	0.0003773
2018	-2.4088***	0.0003783
2019	-1.9228***	0.0003677

 * p<0.10, ** p<0.05, *** p<0.01

Figure 1. Trend in Effect of Age on Climate Change Belief from 2010 to 2019

Table 4. Climate Change Belief by Political Party from 2006 to 2019 (N=12,150)

| Year	Republican	Independent	Democrat
2006	0.4646739	0.6494845	0.7731277
2007	0.4327628	0.5542168	0.7947019
2008	0.424	0.4929577	0.7876288
2010	0.2979215	0.5	0.715311
2011	0.3414634	0.5735294	0.7621483
2012	0.3129584	0.5243902	0.7028985
2013	0.3333333	0.6052631	0.8109339
2014	0.3560439	0.4942528	0.7966101
2015	0.3148936	0.67	0.7984293
2016	0.40625	0.6666666	0.8690744
2017	0.3981043	0.7301587	0.9051918
2018	0.3574879	0.6888889	0.9105145
2019	0.3847981	0.7375	0.9067245
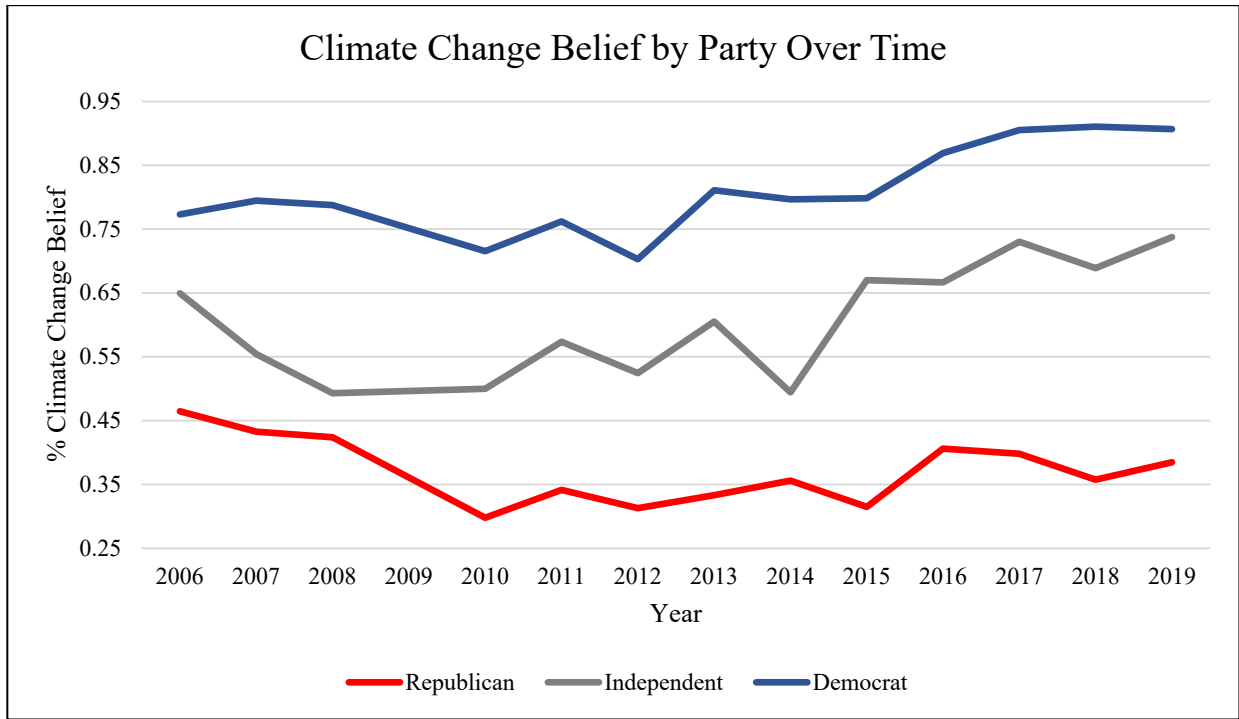
Figure 2. Trend in Climate Change Belief by Political Party from 2006 to 2019

Physical Vulnerability

There is no significant relationship between physical vulnerability and climate change belief (Table 5). When controlling for geographic location, year, and political party, the effect of physical vulnerability on climate change belief is not statistically significant.

Table 5. Linear Probability Models relating climate change belief and physical vulnerability (N= 1,058)

Variables	A	B	C
Overall Risk	0.376***	0.360***	0.036
	-0.121	-0.122	-0.108
Geo		-0.013	-0.002
		-0.014	-0.012
Party			0.141***
			-0.008
Year			
2017			0.060*
2018			0.029
2019			0.047
Constant	0.569	0.601	0.33

* p<0.10, ** p<0.05, *** p<0.01

DISCUSSION

My research investigated the effect of socioeconomic factors on climate change belief in the United States. I found age, political party, and geographic location to be significant variables in predicting climate change belief. In contradiction to past research, gender and race were not significant variables. The effect of age on climate change belief has decreased over the past decade while the effect of political party has increased. Contrary to my hypothesis, physical vulnerability is not a significant variable affecting climate change belief. The rest of the discussion will further explore and offer explanations for these findings. First, I will interpret the findings of my preliminary statistical regression. Then, I will explain the trends in the effects of age and political party on climate change belief. Finally, I will look at the relationship between physical vulnerability and climate change belief.

Statistical Regression

Age, political party, and geographic location significantly influenced climate change belief in 2019, while gender and race were not as important.

Gender

Gender was not statistically significant, which contradicts past studies that found gender to be a statistically significant predictor of environmental and climate concern (Aaron M. McCright 2010, McCright and Dunlap 2011, Liu et al. 2014, Hornsey et al. 2016). This finding also contradicts theories about perceived risk in relation to gender (Savage 1993, Finucane et al. 2000, McCright and Dunlap 2011). This could be because differences in climate change belief were better accounted for by race and political party. Race and class solidarity seem to be stronger than gender solidarity (Kinder and Dale-Riddle 2012). When looking at the 2008 Democratic Primary election between Barack Obama and Hillary Clinton, racial solidarity was more powerful in building support for Barack Obama than gender solidarity was in building support for Hillary Clinton (Kinder and Dale-Riddle 2012). In 2016, 53% of white women voted for Donald Trump over Hillary Clinton (Ruiz n.d.). This challenges the concept that gender is a good predictor for climate change belief.

Race

Race was also relatively insignificant. I had predicted that Black people, Hispanic people, and Asian people would all have significantly higher rates of climate change belief than white people. However, the only statistically significant difference was between white people and Hispanic people, with Hispanic people being 12.5% more likely to believe in climate change. Asian people did have a higher rate of belief than white people, but Black people had a lower rate of belief than white people. This contradicts risk perception theories that state that people of color, especially Black people, see more risk in the world due to their marginalized position in society (Savage 1993, Finucane et al. 2000, McCright and Dunlap 2011). Using this line of thinking, one would hypothesize that people of color, especially Black people, would believe in climate change

more than white people (Finucane et al. 2000, McCright and Dunlap 2011). A large majority of people of color identify as Democrats, so perhaps there is some collinearity between political party and race, making political party a better predictor. Past studies have only looked at race as white versus non-white, so I can't compare them to my findings, but they did find race to be a statistically significant variable in predicting environmental and climate concern (Aaron M. McCright 2010, McCright and Dunlap 2011, Liu et al. 2014, Hornsey et al. 2016).

Age

Age had a significant negative effect on climate change belief, which means older people are more likely to deny climate change. This supports past studies that found a similar relationship between age and environmental and climate concern (Aaron M. McCright 2010, Hornsey et al. 2016). This correlation might be because younger people see climate change as more of a threat than older people since younger people will bear the brunt of the consequences of climate change. Another theory offered is that young people are less integrated into the American economic system and dominant social order. Since solutions to environmental issues are seen as threatening to the existing social order, it is logical to expect younger people to support reform (D. Van Liere and Dunlap 1980). Climate change curriculum has also recently been introduced in some schools, meaning younger people are generally more educated about climate change than other people (Johnson n.d., Liu et al. 2014).

Political Party

Political party was the most impactful variable on climate change belief. Independents were almost 37% more likely to believe in climate change than Republicans while Democrats were 53% more likely. This supports past studies that found a significant positive relationship between political party and climate change concern and belief (Aaron M. McCright 2010, Hornsey et al. 2016).

Geographic Location

Those living in small cities and rural areas were significantly less likely to believe in climate change than those living in big cities. This supports findings from other studies that look at geographic variation in climate change belief (Howe et al. 2015). Democrats and people of color are more likely to live in big cities while Republicans are more likely to live in rural areas (Parker et al. 2018). This relationship may explain why those in big cities believe in climate change more than others. While looking at a snapshot of climate change belief is helpful, looking at trends in climate change belief is also important.

Trends in Effects of Age and Political Party

The effects of age and political party on climate change belief have significantly changed over the past decade. The marginal effect of age on climate change belief has decreased from 4.6% to 1.9% since 2010. This could be because older people who did not believe in climate change in 2010 have passed away, younger people who did believe in climate change in 2010 have grown older, and new young people believe in climate change. As a result, the age gap in climate change belief has decreased over the past decade. There isn't any literature looking at this relationship.

The importance of political party on climate change belief has increased over the past 15 years. Belief among Republicans has decreased by 8% over the past 15 years, while belief among Independents and Democrats has increased by 9% and 13%, respectively. This supports literature on the politicization of and polarization over climate change (Dunlap and McCright 2008, Dunlap et al. 2016). Conservative figures have elevated climate change to the "status of a litmus test of cultural politics in the U.S." along with abortion and guns (Dunlap et al. 2016). The largest drop in belief among Republicans was by 12% from 2008 to 2010, likely in response to election of Barack Obama (Benegal 2018). The largest rise in belief among Democrats was by 11% from 2012 to 2013, likely in response to Hurricane Sandy, one of the most devastating hurricanes to hit the Northeast. The largest drop in belief among Independents was by 11% from 2013 to 2014, but it then rose by 17% from 2014 to 2015. Further research into the reasons for these drops, rises, and fluctuations may give better insight into factors influencing climate change belief.

Physical Vulnerability

Physical vulnerability did not have a significant effect on climate change belief. I had hypothesized that there would be a significant positive relationship between physical vulnerability and climate change belief. I believed that if a person was at higher risk of being affected by climate change, they would be more likely to believe in climate change. My findings contradict a past study that found a significant positive relationship between physical vulnerability and climate change belief (Brody et al. 2007). This regression model however didn't include political party, the most consistent predictor of climate belief and risk perception, which may have affected their results. My findings are supported by a study done in rural Nevada that found physical vulnerability to not be significant (Saleh Safi et al. 2012). I believe physical vulnerability was not significant because it is about perceived risk. Theories and studies suggest that risk perception is highly influenced by gender, race, and income (Savage 1993, Finucane et al. 2000). Based on these findings, I hypothesize that gender, race, income, and political party were better predictors of climate change belief than physical vulnerability to climate change. I also acknowledge there were some limitations in my study of this relationship. I only had vulnerability scores for 258 cities in the United States, which means rural and suburban areas were not included. The data I used was only a small snapshot of physical vulnerability in the United States. My results are important because they show that physical vulnerability is not a significant factor in determining climate change belief, however, they may not be generalizable to the United States population.

Limitations and Future Directions

My study design did have some limitations. My sample size for my first regression was 897, which is relatively small when compared to the size of the United States population. My study results therefore may not be generalizable to the United States population. Due to study design limitations, I can only observe correlations between variables. I cannot attribute climate change belief to one variable or another. Correlation does not imply causation. While the causation issue can't necessarily be fixed, future research should use larger sample sizes to ensure the reliability of results.

There is still research to be done on climate change denial. My model had an R-squared value of 0.28, meaning the variables I included in my model only accounted for 28% of the variation in climate change belief. Future research should work to find other variables that affect climate change belief, such as media exposure, family environment, and early childhood education. Media portrayal of climate change has a strong influence on people's perception of climate change. However, I was not able to include it in my model due to a lack of accessible data. Future research should work to measure this relationship. A lot of political and core beliefs are formed during childhood, and are highly influenced by family environment and childhood education. If your parents don't believe in climate change, you are likely to adopt that same lack of belief. Young children are easily influenced and likely to believe their teachers if they tell them climate change is not real (Stevenson et al. 2016). On the other hand, if climate change education were introduced into curricula, children would be more likely to believe in climate change and carry that belief into adulthood (Stevenson et al. 2016). More research should look at how family environment and early childhood education influence climate change belief. Studying these relationships will give more insight into how to tackle climate denial. And finally, climate belief is not enough to tackle the climate crisis. Climate belief does not necessarily translate into direct action. Future research should work on a way to measure willingness to act to avoid climate catastrophe.

Conclusion

To address climate change denial in our society, we need to know who is denying climate change. The most impactful variables when looking at climate change belief are age, political party, and geographic location. Since climate change education is an effective tool for increasing climate change belief, climate change education and messaging should be focused on those denying it: older people, Republicans, and those living in small cities and rural areas. Tackling the culture of climate denial in the United States should aid in addressing government inaction on climate change.

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