

The Formation of Belief: An Examination of Factors That Influence Climate Change Belief Among Hurricane Katrina Survivors

Anaïs Teyton and David M. Abramson

ABSTRACT

Differences in population-level climate change beliefs have been identified, which are often attributable to coastline proximity, urban–rural classifications, race, ethnicity, political affiliation, gender, education, socioeconomic status, and age. This study assessed the impact of spatial, experiential, and demographic-related characteristics on climate change beliefs among a population of Hurricane Katrina survivors. Participants from the Gulf Coast Child and Family Health Study who answered climate change belief questions were included in this analysis. Race was found to be the most critical contributor to climate change belief, where the adjusted odds of white individuals believing in climate change were 0.2 times the odds of Black individuals believing in climate change (confidence interval: 0.1–0.4). Other sociodemographic factors, such as age, gender, income, and education, were not found to be significant. Several theoretical perspectives were considered to explain the variation in climate change beliefs, including social vulnerability, environmental deprivation, and political ideology. Future research as to why these racial differences exist should be conducted. By doing so, climate change communication, education, and mitigation and adaptation strategies may be improved.

Keywords: climate change, belief system, risk perception, Hurricane Katrina

INTRODUCTION

CLIMATE CHANGE AFFECTS health indirectly, through extreme fluctuations of temperature, rain, sea-level rise, and other weather events, as well as the cascading

consequences emanating from these events.¹ For people to be motivated to act upon such risks, the threat of climate change has to be salient. Institutional change is necessary to achieve climate action, whereas individual agency and climate change belief are precursors to climate action.²

Ms. Anaïs Teyton is a Graduate Student in the Epidemiology Department at School of Global Public Health, New York University, New York, New York, USA. Dr. David M. Abramson is a Clinical Associate Professor in the Social and Behavioral Sciences Department at School of Global Public Health, New York University, New York, New York, USA.

¹Anthony J. McMichael. “Globalization, Climate Change, and Human Health.” *New England Journal of Medicine* 368 (2013): 1335–1343; Nick Watts, Markus Amann, Nigel Arnell, Sonja Ayeb-Karlsson, Kristine Belesova, Helen Berry, Timothy Bouley, Maxwell Boykoff, Peter Byass, Wenjia Cai, Diarmid Campbell-Lendrum, Jonathan Chambers, Meaghan Daly, Niheer Dasandi, Michael Davies, Anneliese Depoux, Paula Dominguez-Salas, Paul Drummond, Kristie L. Ebi, Paul Ekins, Lucia Fernandez Montoya, Helen Fischer, Lucien Georgeson, Delia Grace, Hilary Graham, Ian Hamilton, Stella Hartinger, Jeremy Hess, Ilan Kelman, Gregor Kiesewetter, Tord Kjellstrom, Dominic Kniveton, Bruno Lemke, Lu Liang, Melissa Lott, Rachel Lowe, Maquins Odhiambo Sewe, Jaime Martinez-Urtaza, Mark Maslin, Lucy McAllister, Slava Jankin

Mikhaylov, James Milner, Maziar Moradi-Lakeh, Karyn Morrissey, Kris Murray, Maria Nilsson, Tara Neville, Tadj Oreszczyn, Feridoon Owfi, Olivia Pearman, David Pencheon, Steve Pye, Mahnaz Rabbaniha, Elizabeth Robinson, Joacim Rocklöv, Olivia Saxer, Stefanie Schütte, Jan C. Semenza, Joy Shumake-Guillemot, Rebecca Steinbach, Meisam Tabatabaei, Julia Tomei, Joaquin Trinanes, Nicola Wheeler, Paul Wilkinson, Peng Gong, Hugh Montgomery, and Anthony Costello. “The 2018 Report of the Lancet Countdown on Health and Climate Change: Shaping the Health of Nations for Centuries to Come.” *The Lancet* 392 (2018): 2479–2514.

²Wouter Peeters, andries Smet, and Sigrid Sterckx. “Individual Agency and Responsibility in Mitigating Climate Change.” In Darian McBain (ed). *Power, Justice and Citizenship*. (Inter-Disciplinary Press, 2014), 3–17; Thomas Princen and Princen Michael F. Maniates. “Confronting Consumption.” *Electronic Green Journal* 1 (2003): 1–10; Andrew Szasz. “Is Green Consumption Part of the Solution?” In John S. Dryzek, Richard B. Norgaard, and David Schlosberg (eds). *The Oxford Handbook of Climate Change and Society*. (Oxford University Press, 2012).

Climate change belief has been described as the belief that climate change is occurring and is caused by human activities.³ Such a belief in climate change has been shown to be associated with increased climate action, such as personal lifestyle changes and political engagement.⁴ A range of climate action at various scales is needed to ameliorate climate change effects, including preparedness, adaptation, and mitigation strategies from the community level to the individual level.⁵ Although climate change belief is not necessary to drive these actions, those who believe are more likely to engage in these protective and preventative actions. By studying the factors that contribute to climate change belief, climate change communication and education may be improved, and actionable climate solutions may be more widely implemented.

Past research has shown that experiential, spatial, and demographic characteristics impact individuals' climate change beliefs. Studies have highlighted that personal experience, particularly disaster- and weather-related experiences, influences climate change belief.⁶ Personal experiences have been demonstrated to promote climate change belief among individuals who are less engaged with climate change-related issues.⁷ A study of Hurricane Irma survivors found that individuals were more inclined to believe in climate change and to pursue environmental action after experiencing the disaster as they were before the experience.⁸

The relationship between climate change belief and spatial factors such as proximity to the coastline have also been assessed. Individuals who live closer to the shore were shown to be more likely to believe in climate change than those living further from the coast.⁹ The authors theorized that individuals who live closer to the shore are likelier to experience such climate change impacts as sea-level rise and flooding.¹⁰ It has additionally been shown that individuals who are di-

rectly impacted by flooding events are more likely to become concerned about climate change and believe that their climate action will make a difference in climate change impacts.¹¹

Climate change belief also varies by sociodemographic factors, including race and ethnicity. A comparison of climate change belief and denial in both white, conservative men and the general U.S. population has been assessed.¹² In what has been termed the "white male effect," a number of studies have consistently found that the conservative white men's belief system significantly contributes to U.S. climate change denial, which aligns with previous studies' findings in the literature on the risk that white men are less likely to perceive risk posed by a variety of environmental hazards (such as nuclear energy, hurricanes, coal emissions, etc.) than are women or men of color.¹³ It is critical to note that climate change belief is highly associated with climate change risk perception.¹⁴ Non-white minorities, specifically Hispanic Americans as well as Black Americans, are more likely to believe in and be concerned about climate change.¹⁵

Other associations between climate change belief and sociodemographic characteristics have also been observed. Individuals who identify as women are younger, and they are politically liberal and more likely to believe in climate change.¹⁶ Further, those with a higher income are more likely to have both a higher understanding and a lower risk perception of climate change.¹⁷ Globally,

³Teresa A. Myers, Edward W. Maibach, Connie Roser-Renouf, Karen Akerlof, and Anthony A. Leiserowitz. "The Relationship between Personal Experience and Belief in the Reality of Global Warming." *Nature Climate Change* 3 (2013): 343–347; Magnus Bergquist, Andreas Nilsson, and P. Wesley Schultz. "Experiencing a Severe Weather Event Increases Concern about Climate Change." *Frontiers in Psychology* 10 (2019): 220.

⁴Nicole Mazur, Allan Curtis, and Maureen Rogers. "Do You See What I See? Rural Landholders' Belief in Climate Change." *Society and Natural Resources* 26 (2013): 75–85; Tien Ming Lee, Ezra M. Markowitz, Peter D. Howe, Chia-Ying Ko, and Anthony A. Leiserowitz. "Predictors of Public Climate Change Awareness and Risk Perception around the World." *Nature Climate Change* 5 (2015): 1014–1020; Robert E. O'Connor, Richard J. Bord, and Ann Fisher. "Risk Perceptions, General Environmental Beliefs, and Willingness to Address Climate Change." *Risk Analysis* 19 (1999): 461–471.

⁵IPCC. *Climate Change 2014, Climate Change 2014: Synthesis Report*. (Cambridge University Press, 2014).

⁶Myers et al. (2013). Op. cit.

⁷Ibid.

⁸Bergquist et al. (2019). Op. cit.

⁹Milfont et al. (2014). Op. cit.

¹⁰Ibid.

¹¹Elizabeth A. Albright and Desera Crow. "Beliefs about Climate Change in the Aftermath of Extreme Flooding." *Climatic Change* 155 (2019): 1–17; Charles Adedayo Ogunbode, Yue Liu, and Nicole Tausch. "The Moderating Role of Political Affiliation in the Link between Flooding Experience and Preparedness to Reduce Energy Use." *Climatic Change* 145 (2017): 445–458; A. Spence, W. Poortinga, C. Butler, and N.F. Pidgeon. "Perceptions of Climate Change and Willingness to Save Energy Related to Flood Experience." *Nature Climate Change* 1 (2011): 46–49.

¹²Aaron M. McCright and Riley E. Dunlap. "Cool Dudes: The Denial of Climate Change among Conservative White Males in the United States." *Global Environmental Change* 21 (2011): 1163–1172.

¹³McCright and Dunlap (2011). Op. cit.; Paul Slovic. "Trust, Emotion, Sex, Politics, and Science: Surveying the Risk-Assessment Battlefield." *Risk Analysis* 19 (1999): 689–701; Christina G.S. Palmer. "Risk Perception: Another Look at the 'White Male' Effect." *Health, Risk and Society* 5 (2003): 71–83; Dan Kahan, Donald Braman, John Gastil, Paul Slovic, and C.K. Mertz. "Culture and Identity-Protective Cognition: Explaining the White-Male Effect in Risk Perception." *Journal of Empirical Legal Studies* 4 (2007): 465–505.

¹⁴Lee et al. (2015). Op. cit.; O'Connor et al. (2015). Op. cit.

¹⁵Adam R. Pearson, Matthew T. Ballew, Sarah Naiman, and Jonathon P. Schuldt. "Race, Class, Gender and Climate Change Communication." In *Oxford Research Encyclopedia of Climate Science*. (Oxford University Press, 2017); James Flynn, Paul Slovic, and C.K. Mertz. "Gender, Race, and Perception of Environmental Health Risks." *Risk Analysis* 14 (1994): 1101–1108.

¹⁶Catherine Happer and Greg Philo. "The Role of the Media in the Construction of Public Belief and Social Change." *Journal of Social and Political Psychology* 1 (2013): 321–336.

¹⁷Pearson et al. (2017). Op. cit.

education has also been shown to be positively associated with higher climate change awareness and environmental risk perception, and the interaction between education and political affiliation has been demonstrated to predict belief in climate change.¹⁸ In the United States, however, higher educational attainment is associated with higher climate change risk perception for politically liberal individuals, whereas higher educational attainment is associated to lower climate change risk perception for politically conservative individuals.¹⁹ This is believed to occur since individuals with higher educational attainment are able to craft strong arguments to defend their ideological beliefs.²⁰ Further, at the national level, a majority of Americans believe in climate change and are concerned about its effects; the United States has been shown to have a diverse range of groups from alarmists, who have the highest climate change risk perception, to naysayers, who have the lowest climate change risk perception.²¹ In a meta-analysis on factors that influence climate change belief, ideologies, values, and political affiliation have been shown to influence climate change belief more significantly than other demographic factors.²²

Two social theses try to explain differences in climate change belief by attention to certain sociodemographic characteristics. The vulnerability thesis considers that non-white individuals may be more vulnerable to the impacts of climate change as a result of living in environmentally susceptible communities, and because of this, they are more inclined to believe in the existence of climate change and its associated risks.²³ Black and Latino individuals have a higher likelihood of living in areas where climate change impacts occur due to discrimination and segregation, which results in increased climate change belief and concern.²⁴ This thesis is supported by a U.S. National Risk Survey that demonstrated that non-white individuals had a greater perception of social vulnerability and environmental injustice, which was independent of education, income, and political affiliation.²⁵ Similarly, the environmental deprivation thesis asserts that individuals who are more exposed to environmental threats, regardless of race, are more likely to be concerned by environmental issues and support action.²⁶ These theories provide critical explanations as to how certain social determinants may be associated with climate change belief and decision making.

Climate change belief research is a relatively new field. Although specific experiential and sociodemographic factors have been found to be associated with climate change belief, further research is needed to replicate findings and to consider interactions among the factors that have been identified to date. Arising from such research climate change education strategies may be crafted and climate change messages may be correctly framed, which may facilitate the implementation of policies and strategies to protect specific populations from climate impacts.²⁷

One research pathway that can provide insight in this field includes assessing a range of factors that could be associated with climate change belief in a population that experienced a highly destructive and disruptive weather event, Hurricane Katrina. Climate change belief within this population has not been previously studied. Further, Hurricane Katrina was the costliest hurricane to make landfall in the United States, and the consequences of this hurricane were devastating, causing major population disruption such as displacement, destruction, economic decline, and loss of life. The cohort assessed in this study was more directly impacted than most individuals who experienced Hurricane Katrina as well, as they were either displaced or lived in severely damaged households due to Hurricane Katrina. Many of these individuals experienced recent natural disasters since Hurricane Katrina. Thus, provided the extent of the effects of Hurricane Katrina on this population, this study sought to answer which experiential, spatial, and demographic factors were most associated with climate change belief in this cohort. It was hypothesized that experiential and spatial factors, particularly the degree of disaster experience, would be most associated with climate change belief than the self-reported reasons that individuals stated had influenced their climate change belief. The vulnerability and environmental deprivation theses were additionally assessed in the context of this study, since Hurricane Katrina disproportionately impacted racial and ethnic minorities.²⁸ By exploring the association between these factors and climate change belief within this population, improved understanding of climate change belief in populations who experienced natural disasters and the proposal of tailored climate awareness and education campaigns could be possible.

METHODS

Data source and measures

The study was approved by the New York University Institutional Review Board. The data source for this study was the fifth wave of data collection from the Gulf Coast Child and Family Health (G-CAFH) Study, a longitudinal observational cohort study of 1079 randomly

¹⁸Ibid.

¹⁹Lee *et al.* (2015). Op. cit.

²⁰Lee *et al.* (2015). Op. cit.; Pearson *et al.* (2017). Op. cit.

²¹Anthony A. Leiserowitz. "American Risk Perceptions: Is Climate Change Dangerous?" *Risk Analysis* 25 (2005): 1423–1442.

²²Matthew J. Hornsey, Emily A. Harris, Paul G. Bain, and Kelly S. Fielding. "Meta-Analyses of the Determinants and Outcomes of Belief in Climate Change." *Nature Climate Change* 6 (2016): 622–626.

²³McCright and Dunlap (2011). Op. cit.; Slovic (1999). Op. cit.; Palmer (2003). Op. cit.; Kahan *et al.* (2007). Op. cit.; Pearson *et al.* (2017). Op. cit.

²⁴Milfont *et al.* (2014). Op. cit.

²⁵Pearson *et al.* (2017). Op. cit.; Terre A. Satterfield, C. K. Mertz, and Paul Slovic. "Discrimination, Vulnerability, and Justice in the Face of Risk." *Risk Analysis* 24 (2004): 115–129.

²⁶Pearson *et al.* (2017). Op. cit.

²⁷Teresa A. Myers, Matthew C. Nisbet, Edward W. Maibach, and Anthony A. Leiserowitz. "A Public Health Frame Arouses Hopeful Emotions about Climate Change: A Letter." *Climatic Change* 113 (2012): 1105–1112; Myers *et al.* (2013). Op. cit.

²⁸Richard M. Zoraster. "Vulnerable Populations: Hurricane Katrina as a Case Study." *Prehospital and Disaster Medicine* 25 (2010): 74–78.

selected households who experienced Hurricane Katrina.²⁹ A two-stage cluster sampling method was utilized to enroll participants from Louisiana and Mississippi in 2006, and five total waves of in-person data collection were conducted over a 13-year period. In 2017 and 2018, 647 individuals were interviewed in the fifth wave, representing a retention rate of 79% of all living, eligible respondents.

A convenience sample of approximately one-quarter of the G-CAFH cohort ($n = 169$) was surveyed about their climate change beliefs during the fifth wave of interviewing; a climate change module, comprising two climate change belief-related questions, was included in the survey after the fifth wave of data collection had begun. Participants were asked whether or not they were convinced that climate change is happening, and the sources of their beliefs, including Hurricane Katrina, other flooding events that happened before Katrina, recent flooding events and hurricanes since Katrina, news and science reports, friends and family, or other reasons. Individuals who responded that they were not convinced of climate change at all were not asked this climate change belief influences question. As a result, these individuals were recoded into the “No” or “No Climate Belief” category, given that these influences would not have convinced them that climate change is happening.

Additional variables were analyzed based on the climate change belief literature, including income, age, education, gender, race, risk perception regarding household flooding risk, exposure to a natural disaster other than Hurricane Katrina, and whether a household resided in an area prone to coastal flooding from sea-level rise. In addition, coastal flood data were retrieved from the National Oceanic and Atmospheric Administration Office for Coastal Management, which provides the boundaries for areas that are at risk of frequent coastal flooding from sea-level rise, and these data were analyzed by using ArcMap.³⁰ These variables were compared with the exposures of interest to investigate which factors most impacted climate change belief. Further information regarding these variables, the coding of the variables, and climate change-related survey questions can be found in the Appendix A1.

Statistical analyses

The set of statistical analyses was conducted by using Stata 15.1 for the individuals who responded to the

question about participants' climate change beliefs ($n = 169$). Univariable and bivariable analyses were conducted, and Pearson's Chi-squared tests were used ($p < 0.05$). In the case of small cell values, a Fisher's exact test was used ($p < 0.05$). A bias analysis was conducted comparing the characteristics of respondents who were presented with the climate change module versus those who were not. A multivariable logistic regression was then performed to assess the association between the potential influential factors and climate change belief, allowing for the most significant predictors of belief to be identified. Crude, unadjusted odds ratios (ORs) were calculated. A full model included all predictors, and a parsimonious model was then assembled by using a stepwise regression, theories, and significant findings within the full model. The Akaike information criterion (AIC), the Bayesian information criterion (BIC), and the goodness-of-fit (GOF) test were calculated for these models.

RESULTS

Table 1 provides the univariable analysis, which includes climate change belief, self-reported influences of climate change, spatial and experiential factors, and sociodemographic characteristics. More than two-thirds of the overall sample believed in climate change (69.8%), and more than half of the sample experienced a natural disaster other than Hurricane Katrina (50.3%). The following determinants of climate beliefs were reported, from the most cited to the least: news and science reports (39.0%), recent flooding events and hurricanes (35.5%), Hurricane Katrina (33.1%), other flooding events that happened before Katrina (17.2%), other reasons not specified (13.0%), and friends and family (12.4%). Table 2 provides the bivariable analysis, which compares the independent variables with the dependent variable of climate change belief, where race, exposure to Hurricane Katrina, recent flooding events and hurricanes, news and science reports, and the influence of friends and family were all statistically significant factors associated with climate change beliefs.

Table 3 provides the multivariable analyses. The crude ORs highlighted that Hurricane Katrina (OR: 7.0; confidence interval [CI]: 2.6–18.9), recent flooding events and hurricanes (OR: 8.0; CI: 3.0–21.6), news and science reports (OR: 5.2; CI: 2.3–12.0), and friends and family (OR: 4.7; CI: 1.1–21.0) persisted as climate change belief influences had positive associations with climate change belief, meaning that these groups were more likely to believe in climate change than their respective reference groups. Further, white individuals (OR: 0.2; CI: 0.1–0.4) and interaction categories, including white individuals with less than or equal to a high school education (OR: 0.2; CI: 0.1–0.58) and white individuals with more than a high school education (OR: 0.2; CI: 0.1–0.7), had significant negative associations with climate change belief, meaning that these groups were less likely to believe in climate change than their respective reference groups. In the full model, which includes and adjusts for all independent variables, and the stepwise regression, race was

²⁹David M. Abramson, Yoon Soo Park, Tasha Stehling-Ariza, and Irwin Redlener. “Children as Bellwethers of Recovery: Dysfunctional Systems and the Effects of Parents, Households, and Neighborhoods on Serious Emotional Disturbance in Children after Hurricane Katrina.” *Disaster Medicine and Public Health Preparedness* 4 (2010): S17–S27; “The Gulf Coast Child and Family Health Study.” n.d. <<https://www.nyu-pir2.org/g-cafh>> (Last accessed on November 4, 2020).

³⁰“Flood Frequency.” The National Oceanic and Atmospheric Administration Office for Coastal Management, 2020. <<https://coast.noaa.gov/arcgis/rest/services>> (Last accessed on November 4, 2020).

TABLE 1. UNIVARIABLE ANALYSIS FOR THE GULF COAST CHILD AND FAMILY HEALTH STUDY SUBSET, WHICH INCLUDES PARTICIPANTS WHO ANSWERED THE CLIMATE CHANGE BELIEF QUESTION ($N=169$), UNITED STATES, 2017–2018

	% (n)
Total	169
How convinced the individual is that climate change is happening	
Convinced	69.8 (118)
Not convinced	30.2 (51)
Exposure to natural disasters other than Katrina	
No	50.3 (85)
Yes	49.7 (84)
Climate change belief influence: Hurricane Katrina	
“No” or “no climate belief”	66.9 (113)
Yes	33.1 (56)
Climate change belief influence: other flooding events that happened before Katrina	
“No” or “no climate belief”	82.8 (140)
Yes	17.2 (29)
Climate change belief influence: recent flooding events and hurricanes	
“No” or “no climate belief”	64.5 (109)
Yes	35.5 (60)
Climate change belief influence: news and science reports	
“No” or “no climate belief”	61.0 (103)
Yes	39.0 (66)
Climate change belief influence: friends and family	
“No” or “no climate belief”	87.6 (148)
Yes	12.4 (21)
Climate change belief influence: other	
“No” or “no climate belief”	87.0 (147)
Yes	13.0 (22)
Income	
<\$20,000	40.2 (68)
\$20,000–\$49,999	22.5 (38)
\$50,000+	17.8 (30)
Refuse	19.5 (33)
Age	
29–59 years old	64.5 (109)
60+ years old	35.5 (60)
Education	
Less than or equal to high school/GED	56.9 (95)
More than high school/GED	43.1 (72)
Gender	
Male	36.1 (61)
Female	63.9 (108)
Race/ethnicity	
Black	46.7 (79)
White	44.4 (75)
Other/refuse	8.9 (15)
Residence in flood-prone coastal area	
No	89.9 (152)
Yes	10.1 (17)
Risk perception: is home at risk of flooding	
No	33.7 (57)
Yes	56.2 (95)
Maybe	10.1 (17)

GED, General Education Development.

found to be the only significant variable (AIC: 200.38; BIC: 247.15; GOF: 170.96; $p < 0.005$). As a result, race was the only variable included in the final, parsimonious model. Race (OR: 0.2; CI: 0.1–0.4) had a significant negative association with climate change belief (AIC: 192.17; BIC: 201.56).

DISCUSSION

Main findings

This study aimed at assessing the factors that influence climate change belief. Almost 70% of this sample believes in climate change. According to the 2019 Yale Climate Opinion Maps, ~67% of Americans believed in climate change, whereas 62% and 61% of individuals from Louisiana and Mississippi believed in climate change, respectively, which is where a majority of this sample reside.³¹ The G-CAFH sample resembles the U.S.-wide trend more so than the state trends. It is possible that certain characteristics differentiate this sample and their beliefs compared with the rest of the population in Louisiana and Mississippi, which could include the collective experience of Hurricane Katrina and having resided in the hardest hit regions by this disaster.

Interestingly, most potential influences that were found to be significant in the literature were not found to be significant in this sample, including age, gender, income, and education. Of the assessed experiential, spatial, and sociodemographic factors, race was found to be the most significant variable across the various models, where white individuals were substantially less likely than Black individuals to believe in climate change.

Socioeconomic status was investigated to observe whether or not it was a potential underlying reason as to why this difference in belief by race was identified. Thus, an interaction term between race and education was assessed. Although this interaction term was significant as crude odds ratios, this significance dissipated once other variables were included in the models. This suggests that socioeconomic factors do not explain the differences by race.

Two reasons were identified as to why climate change belief differences by race were observed, which were related to social inequity, environmental exposure, and ideology. As highlighted by the vulnerability and the environmental deprivation theses, Black individuals may be more exposed to climate change effects due to social inequities, causing them to be more vulnerable.³² As a result, these individuals may be more likely to believe in climate change, to be concerned by these environmental issues, and to support climate action.³³ White individuals may experience climate change impacts less than

³¹Peter D. Howe, Matto Mildenerger, Jennifer R. Marlon, and Anthony Leiserowitz. “Geographic Variation in Opinions on Climate Change at State and Local Scales in the USA.” *Nature Climate Change* 5 (2015): 596–603.

³²McCright and Dunlap (2011). Op. cit.; Pearson *et al.* (2017). Op. cit.

³³Pearson *et al.* (2017). Op. cit.

TABLE 2. BIVARIABLE ANALYSIS OF THE PARTICIPANTS WHO RESPONDED TO THE CLIMATE CHANGE BELIEF QUESTION (N=169), GULF COAST CHILD AND FAMILY HEALTH STUDY, UNITED STATES, 2017–2018

	<i>G-CAFH subset (n=169)</i>			p*
	<i>Total, N (%)</i>	<i>Outcome: belief in climate change</i>		
		<i>No, n (%)</i>	<i>Yes, n (%)</i>	
Exposure to natural disasters other than Katrina				0.058
No	85 (50.3)	20 (39.2)	65 (55.1)	
Yes	84 (49.7)	31 (60.8)	53 (44.9)	
Influence of Hurricane Katrina on CCB				0.000 ^{†,‡}
“ <i>No</i> ” or “ <i>no climate belief</i> ”	113 (66.9)	46 (90.2)	67 (56.8)	
Yes	56 (33.1)	5 (9.8)	51 (43.2)	
Influence of other flooding events that happened before Katrina on CCB				0.121 [‡]
“ <i>No</i> ” or “ <i>no climate belief</i> ”	140 (82.8)	46 (90.2)	94 (79.7)	
Yes	29 (17.2)	5 (9.8)	24 (20.3)	
Influence of recent flooding events and hurricanes on CCB				0.000 ^{†,‡}
“ <i>No</i> ” or “ <i>no climate belief</i> ”	109 (64.5)	46 (90.2)	63 (53.4)	
Yes	60 (35.5)	5 (9.8)	55 (46.6)	
Influence of news and science reports on CCB				0.000 ^{†,‡}
“ <i>No</i> ” or “ <i>no climate belief</i> ”	103 (61.0)	43 (84.3)	60 (50.9)	
Yes	66 (39.0)	8 (15.7)	58 (49.1)	
Influence of friends and family on CCB				0.039 ^{†,‡}
“ <i>No</i> ” or “ <i>no climate belief</i> ”	148 (87.6)	49 (96.1)	99 (83.9)	
Yes	21 (12.4)	2 (3.9)	19 (16.1)	
Other influences on CCB				0.468 [‡]
“ <i>No</i> ” or “ <i>no climate belief</i> ”	147 (87.0)	46 (90.2)	101 (85.6)	
Yes	22 (13.0)	5 (9.8)	17 (14.4)	
Income				0.079 [‡]
<\$20,000	68 (40.2)	23 (45.1)	45 (38.1)	
\$20,000–\$49,999	38 (22.5)	10 (19.6)	28 (23.7)	
\$50,000+	30 (17.8)	13 (25.5)	17 (14.4)	
Refuse	33 (19.5)	5 (9.8)	28 (23.7)	
Age, years				0.173
29–59	109 (64.5)	29 (56.9)	80 (67.8)	
60+	60 (35.5)	22 (43.1)	38 (32.2)	
Education				0.311
≤HS/GED	95 (56.9)	32 (62.8)	63 (54.3)	
>HS/GED	72 (43.1)	19 (37.2)	53 (45.7)	
Gender				0.109
Male	61 (36.1)	23 (45.1)	38 (32.2)	
Female	108 (63.9)	28 (54.9)	80 (67.8)	
Race				0.000 ^{†,‡}
Black	79 (46.7)	12 (23.5)	67 (56.8)	
White	75 (44.4)	36 (70.6)	39 (33.0)	
Other/refuse	15 (8.9)	3 (5.9)	12 (10.2)	
Residence in flood-prone coastal area				0.628
No	152 (89.9)	45 (88.2)	107 (90.7)	
Yes	17 (10.1)	6 (11.8)	11 (9.3)	
Risk perception: is home at risk of flooding				0.855 [‡]
No	57 (33.7)	17 (33.3)	40 (33.9)	
Yes	95 (56.2)	30 (58.8)	65 (55.1)	
Maybe	17 (10.1)	4 (7.8)	13 (11.0)	

Variables were in bold if their bivariable associations had a *p*-value below 0.05.

*Pearson’s χ^2 test used unless otherwise indicated.

[†]Indicates significance (*p* < 0.05).

[‡]Fisher’s exact test used.

CCB, climate change belief; G-CAFH, Gulf Coast Child and Family Health; HS, high school.

TABLE 3. MULTIVARIABLE LOGISTIC REGRESSION MODELS, WHERE THE CRUDE ODDS RATIOS, FULL MODEL, AND PARSIMONIOUS MODEL WERE ASSESSED FOR PARTICIPANTS WHO RESPONDED TO THE CLIMATE CHANGE BELIEF QUESTION (N= 169), GULF COAST CHILD AND FAMILY HEALTH STUDY, UNITED STATES, 2017–2018

	<i>G-CAFH subset (n= 169)</i>		
	<i>Crude OR (95% CI)</i>	<i>Full model adjusted OR (95% CI)</i>	<i>Parsimonious model adjusted OR (95% CI)</i>
Exposure to natural disasters other than Katrina			
No	1.0	1.0	
Yes	0.5 (0.3–1.0)	0.6 (0.3–1.3)	
Influence of Hurricane Katrina on CCB			
“ <i>No</i> ” or “ <i>no climate belief</i> ”	1.0		1.0
Yes	7.0 (2.6–18.9)		9.4 (2.6–33.5)
Influence of other flooding events that happened before Katrina on CCB			
“ <i>No</i> ” or “ <i>no climate belief</i> ”	1.0		
Yes	2.3 (0.84–6.6)		
Influence of recent flooding events and hurricanes on CCB			1.0
“ <i>No</i> ” or “ <i>no climate belief</i> ”	1.0		12.6 (3.6–44.7)
Yes	8.0 (3.0–21.6)		
Influence of news and science reports on CCB			
“ <i>No</i> ” or “ <i>no climate belief</i> ”	1.0		1.0
Yes	5.2 (2.3–12.0)		15.6 (4.8–50.5)
Influence of friends and family on CCB			
“ <i>No</i> ” or “ <i>no climate belief</i> ”	1.0		
Yes	4.7 (1.1–21.0)		
Other influences on CCB			
“ <i>No</i> ” or “ <i>no climate belief</i> ”	1.0		1.0
Yes	1.5 (0.5–4.5)		13.0 (3.1–53.8)
Income			
<\$20,000	1.0	1.0	
\$20,000–\$49,999	1.4 (0.6–3.4)	1.8 (0.7–4.9)	
\$50,000+	0.7 (0.3–1.6)	0.8 (0.3–2.3)	
Refuse	2.9 (1.0–8.4)	2.3 (0.7–7.5)	
Age, years			
29–59	1.0	1.0	
60+	0.6 (0.3–1.2)	0.6 (0.3–1.3)	
Education			
≤HS/GED	1.0	1.0	
>HS/GED	1.4 (0.7–2.8)	1.6 (0.4–6.2)	
Gender			
Male	1.0	1.0	
Female	1.7 (0.9–3.4)	2.1 (0.9–4.8)	
Race			
Black	1.0	1.0	1.0
White	0.2 (0.1–0.4)	0.2 (0.1–0.6)	0.2 (0.1–0.4)
Other/refuse	0.7 (0.2–2.9)	0.5 (0.1–3.7)	0.7 (0.2–2.9)
Race × education			
Black × ≤HS	1.0	1.0	
Black × >HS	1.3 (0.4–4.6)	1.0	
White × ≤HS	0.2 (0.1–0.6)	1.0	
White × >HS	0.2 (0.1–0.7)	0.9 (0.2–4.7)	
Other/Ref × ≤HS	0.5 (0.1–3.2)	1.0	
Other/Ref × >HS	1.4 (0.2–13.6)	2.2 (0.1–48.4)	
Residence in flood-prone coastal area			
No	1.0	1.0	
Yes	0.77 (0.27–2.21)	1.4 (0.4–5.2)	
Risk perception: is home at risk of flooding			
No	1.0	1.0	
Yes	0.9 (0.5–1.9)	0.5 (0.2–1.2)	
Maybe	1.4 (0.39–4.9)	0.5 (0.1–2.3)	

Bolded values depict that the confidence interval does not cross 1.0, and *p*-value is <0.05.

Full-sample GOF:

Full-model AIC: 200.38, BIC: 247.15, GOF: 170.96, (*p* < 0.005).

Parsimonious model AIC: 192.17, BIC: 201.56.

AIC, Akaike information criterion; BIC, Bayesian information criterion; CI, confidence interval; GOF, goodness-of-fit; OR, odds ratio.

non-white individuals, resulting in a lower risk perception of climate change effects.³⁴ Further, it is also possible that Black and white individuals differ in their climate change beliefs due to political affiliation. In both Louisiana and Mississippi, more than 85% of Democrats and <50% of Republicans believe that climate change is happening.³⁵ In both states, a 2014 study showed that Black individuals were far more likely to be Democrats, whereas white individuals were more likely to be Republicans.³⁶ The topic of climate change has become increasingly ideologically and politically polarized over time, where liberals are more likely to believe in climate change than conservatives.³⁷ Thus, the reason as to why there was a discrepancy between these racial groups in this sample should be further investigated.

Certain biases and methodological limitations may exist in this study. Only a subsample of the G-CAFH study's fifth wave sample was asked about climate change belief; however, it is important to note that based on univariable and Chi-Squared bias analyses, this subsample is similar to the whole sample with the exception that the subsample had a higher frequency of low-income participants than the whole sample. Moreover, temporality could also not be assessed, since individuals were only asked about their climate change belief after the experiences occurred. Questions about political affiliation were not asked, and individuals who did not believe in climate change at all were not asked why they have this belief. Overall, despite these limitations, climate change belief in this sample merits being studied.

The field of climate change belief is developing, making it important to analyze climate change influences in various regions and within different populations. Further understanding of climate change belief is needed, especially since climate change belief has been previously shown to be associated with climate action. By improving knowledge on how belief is formed and, specifically, why certain racial groups are more inclined to believe in climate change, tailored strategies regarding communication, preparedness, adaptation, and mitigation may be implemented.

AUTHOR DISCLOSURE STATEMENT

The authors have no conflicts of interest or financial ties to disclose.

FUNDING INFORMATION

Funding was received from the National Institutes of Health (grant number: P01HD082032).

Address correspondence to:
Anais Teyton
Department of Epidemiology
School of Global Public Health
New York University
715 Broadway
New York, NY 10003
USA

E-mail: at4109@nyu.edu

Appendix A1

APPENDIX A1. VARIABLES AND CODING

DEPENDENT VARIABLE

- Climate change belief (Original categories): Not convinced at all; Not very convinced; Mostly convinced; Completely convinced

³⁴McCright and Dunlap (2011). Op. cit.; Slovic (1999). Op. cit.; Palmer (2003). Op. cit.; Pearson *et al.* (2017). Op. cit.

³⁵Matto Mildenberger, Jennifer R. Marlon, Peter D. Howe, and Anthony Leiserowitz. "The Spatial Distribution of Republican and Democratic Climate Opinions at State and Local Scales." *Climatic Change* 145 (2017): 539–548.

³⁶"Party Affiliation among Adults in Louisiana by Race/Ethnicity." *Pew Research Center*, 2014. <<https://www.pewforum.org/religious-landscape-study/compare/party-affiliation/by/racial-and-ethnic-composition/among/state/louisiana>>; "Party Affiliation among Adults in Mississippi by Race/Ethnicity." *Pew Research Center*, 2014. <<https://www.pewforum.org/religious-landscape-study/compare/party-affiliation/by/racial-and-ethnic-composition/among/state/mississippi>>.

³⁷Aaron M. McCright and Riley E. Dunlap. "The Politicization of Climate Change and Polarization in the American Public's Views of Global Warming, 2001–2010." *Sociological Quarterly* 52 (2011): 155–194.

- Climate change belief (Recoded for the purposes of this study): Not convinced (ref.); Convinced

INDEPENDENT VARIABLES

- Income: <\$20,000 (ref.); \$20,000–\$49,999; \$50,000 or more
- Age: 29–59 years (ref.); 60 years or older
- Education: Less than or equal to a high school degree/General Education Development (ref.); Associate degree/Technical certificate; 4-year college
- Gender: Male (ref.); Female
- Race: Black (ref.); White; Other/Refuse
- Risk perception regarding if the participant's home is at risk of flooding: No (ref.); Yes; Maybe
- Exposure to a natural disaster other than Hurricane Katrina: No (ref.); Yes
- If a household resided in an area that is prone to flooding from sea-level rise: No (ref.); Yes

DESCRIPTIVE VARIABLES

- Influences for climate change belief (select all that apply): Hurricane Katrina; other flooding events that happened before Katrina; recent flooding events and

hurricanes since Katrina; news and science reports; friends and family; other reason

- “No” or “No Climate Belief” (ref.); Yes
- Note: Individuals who responded that they are not convinced of climate change at all were not asked this climate change belief influences question; these individuals have been recoded into the “No/No Climate Belief” category, given that these influences would not have convinced them that climate change is happening.

CLIMATE CHANGE-RELATED SURVEY QUESTIONS

How convinced are you that climate change is happening?

- Completely convinced
- Mostly convinced
- Not very convinced
- Not convinced at all?

Which of the following helped convince you that climate change is happening? Please tell us all that may apply.

- Hurricane Katrina
- Other flooding events that happened before Katrina
- Recent flooding events and hurricanes
- News and science reports
- Friends and family
- Other?