Climatic Change (2020) 159:61–74
https://doi.org/10.1007/s10584-019-02635-y

Physical activity and climate change attitudes

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Received: 27 February 2019 / Accepted: 17 December 2019 / Published online: 3 January 2020

Abstract
Climate change has impacted people, communities, and industries around the world, including sport and physical activity. Drawing from Stern's (J Soc Issues 56(3):407–424, 2000) value-belief-norm theory, which focuses on identifying predictors of environmentally significant behavior, the purpose of this study was to explore the degree to which physical activity participation is associated with pro-environmental attitudes. The authors collected data at the county level in the USA ($N = 3136$), accessing publicly available data from a variety of sources. They also controlled for potential alternative explanations, including percent of the county population living in a rural setting, age 65 or older, that is female, that is non-Hispanic White, that has a college degree or greater, and that voted Democrat in the 2016 Presidential election. Results indicate that physical activity participation was positively associated with people's belief that climate change personally affects them. These beliefs were, in turn, positively associated with the belief new policies are needed to address climate change. The authors discuss contributions to theory and practice.

Keywords Sport · Physical activity · Self-interest · Climate attitudes

1 Introduction

Climate change has impacted people, communities, and industries around the world, including sport and physical activity (McCullough and Kellison 2017). Recognizing the significant mix of sport and the environment, scholars have increasingly investigated the issue. One strand of research focuses on organizational decision-making and the desire to engage in environmentally friendly behaviors (Inoue and Kent 2012; Kellison and Hong 2015; Sartore-Baldwin and McCullough 2018; Trendafilova et al. 2013). Embedded in this scholarly stream are studies focusing on engaging sport fans to engage in more responsible behaviors (Casper et al. 2014;

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Du Preez and Heath 2016). A second stream of scholarship focuses on how consumers and sport participants impact the sport environment (Collins et al. 2007; Triantafyllidis et al. 2018; Wicker 2018). For instance, Wicker (2019) estimated the carbon footprint of active sport participants in Germany, illustrating differences across sport types and based on participant characteristics. A third stream of scholarship has also emerged, as environmental scientists have investigated the association between climate change and activities in which people engage, including working outside or participating in sport (Evans 2019; Obradovich and Fowler 2017; Kjellstrom et al. 2016). Obradovich and Fowler (2017) showed how climate change might negatively affect physical activity participation during summer months but could spur increased activity during what will be warmer winter months. Kjellstrom et al. (2016) noted the negative impact of climate change on human performance, particularly when in hot areas. Collectively, this research demonstrates the many ways in which sport, fans, participants, and the environment are related to and potentially impact one another.

There also remains a fourth strand of scholarship—the manner in which outdoor physical activity is associated with attitudes toward nature and the environment—though researchers have comparatively devoted less attention to it. Beery (2013), for instance, observed that friluftsliv, or nature-based activity and recreation outdoors, is positively associated with connectedness to nature and the environment. Brymer et al. (2009) conducted a hermeneutic phenomenological study of extreme sport participants. They reported feeling connected to nature via their sport participation. This association, the authors argued, "leads to a desire to care for the natural world" (p. 193). These studies do much to support Lumber et al.'s (2017) observation that "there is a growing realization that a positive, connected relationship with nature leads to pro-environmental attitudes and wellbeing benefits" (p. 1).

In this study, we seek to expand on this scholarship by exploring the degree to which physical activity participation is associated with pro-environmental attitudes. We draw from value-belief-norm theory (Stern 2000) to hypothesize that being physically active is positively associated with the belief that climate change can result in personal harm, as well as the desire for climate regulations. We draw from several public datasets to examine these associations at the county level in the USA. In doing so, we contribute to the small but growing literature examining the association between sport and climate-change attitudes. As we highlight in the discussion, our findings also have implications for climate change advocates and sport managers, alike.

2 Theoretical framework

2.1 Value-belief-norm theory

We principally draw from Stern's (2000) value-belief-norm theory to guide our research. As we outline in the following space, Stern focused on pro-environmental behaviors, not attitudes, the latter of which is the focus of our analysis. We recognize the two are not the same, as a number of scholars have highlighted the value-action gap (Dietz et al. 2009; Gifford et al. 2011). That noted, the underlying principles in Stern's theory—that values are ultimately associated with environmentally focused beliefs and behaviors—have relevance to our study of the association between physical activity and climate change attitudes.

Stern (2000) focused on identifying predictors of environmentally significant behavior, such as activism, non-activist behaviors in the public or private spheres, and other behaviors. He suggested that one's values serve as a foundation. These could take the form of biospheric

values, altruistic values, or egoistic values. As an example, one might approach environmentally significant behavior from an altruistic standpoint, with the belief that pro-environmental behavior is good for all people. The values should give rise to beliefs, including a person's ecological worldview, the perspective that there could be negative consequences for objects or activities one values, and the position that the individual has the ability to reduce that threat. The beliefs then give rise to personal norms or the sense that one has an obligation to engage in pro-environmental actions. The norms then give rise to the aforementioned environmentally significant behaviors.

Stern (2000) theorized the variables representing a chain, whereby values give rise to beliefs and so on. Thus, personal norms to engage in environmentally friendly activities manifest from beliefs about the environment and, specifically, the belief that current conditions threaten an activity or object one's values. Those concerns turn to action when actors believe their actions can create change. The threat to something about which people care, therefore, is key in adopting pro-environment attitudes and behaviors. Or, as Stern (2000) wrote, "The consequences that matter in activating personal norms are adverse consequences to whatever the individual values" (p. 413).

A number of researchers have offered support for value-belief-norm theory. For example, Lind et al. (2015) examined the mode of transportation among people living in urban areas. They found that values and beliefs helped to predict personal norms, and further analyses showed the model helped to differentiate among people who drove their cars, used public transportation, or bicycled or walked. As another example, Landon et al. (2018) drew from the value-belief-norm theory to reliably predict pro-environmental behaviors among tourists, including engaging in behaviors to reduce environmental impacts, consuming local goods and services, and spending time and money in order to find sustainable options. Other scholars have used the model to explain household energy efficiency (Fornara et al. 2016), participation in smart energy systems (van der Werff and Steg 2016), and environmentally conscious consumer behavior (Hartmann et al. 2018), among others.

2.2 Outdoor physical activity, the environment, and adverse consequences

As previously noted, value-belief-norm theory holds that people develop a sense of obligation to support environmental initiatives when something they value becomes threatened due to environmental changes (Stern 2000). Drawing from this theory, we argue that physical activity participation is one such valued activity. Brymer et al.'s (2009) work partially illustrates this connection. They found that outdoor sport participation was associated with greater connection to nature. And, when this connection occurred, people developed a sense obligation to care for and protect the environment—the very space in which they participate in sport. This association suggests that sport participation can enhance (a) one's connection with the environment and (b) the sense of potential sense of loss (i.e., lack of sport participation) if the environment is threatened. As further evidence of the connection, across three experimental studies, Mayer et al. (2009) found that walking in natural settings increased their connectedness to nature and positive affect. In their earlier work, members of the research team found that as that connection to nature increased, so too did the likelihood of people engaging in eco-friendly actions (Mayer and Frantz 2004).

Researchers in related fields have offered evidence to support this rationale. Paudyal et al. (2015), for example, surveyed trout anglers in Georgia (USA). They found that the outdoorspeople expressed concern with climate change because of the impact on their ability

to pursue their recreational activity. De Urioste-Stone et al. (2015) examined the climate change perceptions of people who visited Acadia National Park (USA). They found that most people who voiced concern about climate change did so because of the belief that it would negatively affect the park and their experiences. Participants pointed to rising sea levels, harm to natural resources, and not being able to access recreational areas due to flooding and coastal erosion. Groshong et al. (2018) observed similar patterns among engaged users of state parks. These studies illustrate that people's climate change attitudes are associated with, at least in part, the degree to which they anticipate climate change will impinge upon their ability to pursue their physical and recreational activities.

Another interpretation of these data—and one that we argue is consistent with value-belief-norm theory—is that people develop climate attitudes that align with their self-interests. This connection can be in opposition to or support of environment-related actions. Moser (2010) illustrated the former, as she noted that people who favor the status quo have an interest in creating uncertainty about climate change's impact or people's ability to change it. She wrote:

> The self-interest ranges from the unintentional, unconscious intent of the vast majority of people in western and westernized societies to defend the comforts of their modern lifestyles, or … to avoid confrontation with their own mortality to the understandable, if misguided, and sometimes deliberately misleading efforts of special interests to secure their financial fortunes. (p. 36)

However, people can also engage in environmentally conscious behaviors when they believe their own interests or those of society are at stake (Evans et al. 2013). For example, Nunn et al. (2016) collected data from college students in the Pacific Islands. Most (90%) felt a strong connection to nature, a relationship with Pacific Island cultural roots. The participants were also likely to consider climate change as a "huge" problem and noted that climate change would affect their future, thereby demonstrating that "climate change is not perceived as an abstract threat in the Pacific" (p. 485).

This scholarship suggests that place attachment may be a driver of self-interest and climate change attitudes (Curnock et al. 2019; Scannell and Gifford 2013), and researchers focusing on snow sports offer additional support for these linkages and the role of place attachment. Scott et al. (2008) investigated climate change vulnerability of recreational areas in the Northwest US. They found that by 2070, most of the snowmobile and ski areas are likely to be negatively impacted by climate change, as the areas are unlikely to have the needed snow to stay open. Dawson and Scott (2013) arrived at similar conclusions and also highlighted the impact on consumers and the economy. From 2049 to 2060, many ski areas will likely have to remain closed due to a lack of snow, resulting in a potential negative economic of over $300 million (Dawson and Scott 2013). Further, consumers will have to drive further to reach reliable ski area; for example, the 8-plus million citizens of New York, NY, will have to 3 h further than they do today to reach such a desired destination (Dawson and Scott 2013). The impact of climate change is not lost on recreational enthusiasts. In a study set in Australia, Pickering et al. (2010) found that most skiers (87%) believed climate change would negatively affect the ski industry. The consumers in their study were also less likely to ski, accordingly, even when resorts made their own snow.

In addition to self-interests related to place attachment, people might also develop pro-environmental attitudes because of the negative health effects of exercising in polluted environments. As previously noted, Mayer et al. (2009) demonstrated the linkage between being in nature and psychological health. However, pollutants might interrupt this relationship.

For instance, Welsch (2006) utilized panel data from happiness surveys in 10 European countries. He found that air pollution was significantly associated with decreased subjective well-being. Zhang et al. (2017), in a study set in China, examined the influence of air pollution on subjective well-being over time. They found that as pollutants increase, people's happiness decreases and their depressive symptoms increase. This scholarship suggests that there are times when being outdoors might actually be harmful, especially when pollutants are high. This scenario might encourage people who engage in outdoor physical activity to adopt pro-environmental attitudes, as doing so would be in their own healthy self-interest.

2.3 Current study

Drawing from Stern's (2000) value-belief-norm theory and the related scholarship, we argue that people who participate in physical activity are (a) likely to develop a connection with the environment and nature, (b) recognize that climate change might serve to threaten their ability to be active (i.e., what Stern 2000, refers to as the belief in adverse consequences for valued objects), and (c) because of this threat, take actions to protect the environment. And, while we recognize that not all physical activity takes place outdoors, a sizeable portion—more than half—does (2018 Participation Report 2018).

We tested these ideas at the county level in the USA, assessing the association between physical activity participation and beliefs that climate change personally affects the individual. We then examined the influence of such attitudes on the belief that climate change policies are needed. Based on our review and the theoretical framework, we hypothesized:

Hypothesis 1: Participation in physical activity will be positively associated with people's belief that climate change personally affects them.

Hypothesis 2: People's belief that climate change personally affects them will be positively associated with the belief new policies are needed to address climate change.

3 Method

3.1 Data collection, measures, and variables

As outlined in greater detail in the following space, we collected data at the county level in the USA ($N = 3136$), accessing publicly available data from a variety of sources. We gathered data from each source separately and then merged the data into a single file. An overview of the data is provided in Table 1.

3.2 Physical activity

We gathered physical activity levels, *PhysAct*, from the County Health Rankings and Roadmaps (2017), a project supported through a collaboration between the Robert Wood Johnson Foundation and the University of Wisconsin Population Health Institute. The initiative provides data about a number of community health characteristics, including physical activity. We used the 2017 data in this analysis. The County Health Rankings and Roadmaps database reports the percent of people who are sedentary, so we subtracted this value from 100 to compute the *PhysAct* measure.

Table 1 Overview of variables and descriptive statistics

Variable	Description	Mean	SD	Min	Max
Controls					
Access	Percent of population who have access to places for physical activity	59.30	24.32	0.00	100.00
Rural	Percent of population living in a rural community	58.59	31.48	0.00	100.00
Age 65	Percent of population age 65 or older	17.99	4.52	4.29	54.80
Female	Percent of population who are female	49.91	2.29	28.48	56.74
White	Percent of population who are non-Hispanic Whites	76.83	19.90	3.22	98.36
Education	Percent of population who have a bachelor's degree or higher	20.80	9.14	2.99	80.21
VoteDem	Percent of population who voted Democrat in the 2016 Presidential election	0.33	0.16	0.03	0.96
Physical activity measures					
PhysAct	Percent of population who are physically active	74.04	5.20	58.60	91.90
Climate change attitudes					
PersonalHarm	Percent of population who think global warming will harm them personally a moderate amount or a great deal	38.17	4.06	29.10	51.46
ClimatePolicy	Percent of population who think new policies are needed to curb the effects of climate change	72.33	2.84	64.75	80.28

3.3 Climate attitudes

We gathered climate change attitudes from the 2018 Yale Climate Change Study, which represents attitudes for that year. Howe et al. (2015) outlined how these data are collected and estimated at the population level each year. Briefly, the researchers draw from various data sources and then use multilevel regression and poststratification to develop population estimates about climate change attitudes. They explained:

> The first stage of MRP (multilevel regression) models individual outcome variables (for example, beliefs, attitudes, policy support, and so on) as a function of demographics, state- or region-specific geographic effects, and temporal effects to account for changes in public opinion over time. In the second stage (poststratification), modeled coefficients for each demographic–geographic respondent type are weighted by the proportion of each type within each geographic area. Unlike disaggregation, MRP methods can reliably project opinion in areas with sparse data coverage by partially pooling information from survey responses outside of that local geographic unit. (p. 597)

In presenting the data, the research team offers estimates for the percent of people within a specific setting (e.g., state, county) who express various beliefs and attitudes.

Though this dataset focuses on global warming, the measures do provide population estimates of people's attitudes toward the climate (Howe et al. 2015). The first outcome, *PersonalHarm*, reflects the percent of the population who think "global warming will harm them personally a moderate amount/a great deal." The second outcome, *ClimatePolicy*, represents the county population who think new policies are needed to curb the effects of climate change. Some researchers have examined climate policy options separately, with single items measuring each possible action (e.g., Nilsson et al. 2004). The Yale study offered a similar list. In our study, we were interested in whether the participants believed climate change policies needed to be enacted, in general, and, thus, considered *ClimatePolicy* as a single dimension. The high correlations among the items (*r*s from .44 to .95) are supportive of this approach. As such, we computed an overall measure by taking the mean score of six items

of people who somewhat or strongly support: "funding research into renewable energy sources," "regulating CO_2 as a pollutant," "setting strict limits on existing coal-fire power plants," "requiring fossil fuel companies to pay a carbon tax and use the money to reduce other taxes (such as income tax) by an equal amount," "requiring utilities to produce 20% electricity from renewable sources," and "providing tax rebates for people who purchase energy-efficient vehicles or solar panels." The reliability coefficient for the six items was high ($\alpha = .93$).

3.4 Controls

We also included a number of control variables to account for alternative explanations. People who have access to places to recreate and be physically active are more likely to be active themselves and lead healthy lives (Mason et al. 2018). Thus, drawing from data available from the County Health Rankings and Roadmaps database, we included *Access* or the percent of people who have access to places for physical activity. Researchers have shown potential differences in climate attitudes between those living in rural and urban settings (Lee et al. 2015). Thus, we drew from the County Health Rankings and Roadmaps database to include *Rural* or the percent of the population living in a rural community. Other researchers have shown that gender (McCright 2010), age (Reinhart 2018), and race (McCright and Dunlap 2011) can influence beliefs about climate change. Thus, drawing from the County Health Rankings and Roadmaps database, we controlled for percent of the population that was age 65 or older (*Age65*), female (*Female*), and non-Hispanic Whites (*White*). The designation of non-Hispanic White is consistent with how the US Census Bureau conceptualizes race, where such questions "generally reflect a social definition of race recognized in this country and not an attempt to define race biologically, anthropologically, or genetically" (Race 2018; see also Cunningham 2019). In addition, Lee et al. (2015) found that, worldwide, educational attainment was the strongest predictor of climate change attitudes; as such, drawing from the United States Department of Agriculture (n.d.), we included *Education* as the percent of people in the county who earned at least a bachelor's degree. Finally, political orientation might also influence climate change attitudes (McCright et al. 2016). As such, we controlled for the percentage of the population who voted Democrat in the 2016 US Presidential election (*VoteDem*) by accessing the voting records made available from the Guardian and available on GitHub (US County Election Results n.d.).

3.5 Analytical strategy

We first computed bivariate correlations among all variables (see Table 2). We expected that physical activity would be positively associated with people's belief that climate change personally affects them and that, in turn, such beliefs would hold a positive association with the belief new policies are needed to address climate change. These relationships suggest a mediated model, whereby mediation occurs when "the causal effect of an independent variable (X) on a dependent variable (Y) is transmitted by a mediator (M)" (Preacher et al. 2007, p. 186). In the case of the current study, the relationship between *PhysAct* (X) and *ClimatePolicy* (Y) would be mediated by *PersonalHarm*. Given this possibility, we examined the hypotheses via regression analyses using Hayes' (2018) PROCESS model. Though other analytical techniques, such as structural equation modeling, are available, Hayes has demonstrated that the PROCESS model offers the same results with a greater number of resources available to the user (Hayes and Rockwood in press; Hayes et al. 2017).

Table 2 Correlations among controls, physical activity measures, and climate change attitudes

Variable	1	2	3	4	5	6	7	8	9	10
1. Access	–									
2. Rural	−.649**	–								
3. Age 65	−.206**	.481**	–							
4. Female	.210**	−.184**	.093**	–						
5. White	.122**	−.278**	−.230**	−.146**	–					
6. Education	.543**	−.495**	−.213**	.176**	.001	–				
7. VoteDem	.322**	−.407**	−.249**	.155**	.164**	.404**	–			
8. PhysAct	.449**	−.363**	−.127**	−.078**	.245**	.642**	.328**	–		
9. PersonalHarm	.258**	−.275**	−.070**	.006	.410**	.155**	.354**	.310**	–	
10. ClimatePolicy	.315**	−.239**	.014	.027	.116**	.283**	.409**	.457**	.790**	–

Notes. *$p < .05$. **$p < .01$. ***$p < .001$

By way of preliminary analyses (see Table 2), *PersonalHarm* held a statistically significant association with almost all of the variables, *Female* being the exception. The highest association was with *ClimatePolicy* ($r = .79$), which, while high, did not reach the threshold for concern of multicollinearity (Hair et al. 2010). A similar pattern emerged for *ClimatePolicy*. Thus, from a bivariate perspective, the following characteristics are associated with the belief that climate change is going to personally affect the individual and their support for climate policies: more urban residents, fewer people age 65 or older, more racial minorities, more college educated residents, and more people who voted Democrat in the 2016 President election. Finally, the variance inflation factors were all less than 2.6, well below the cutoff values (10) signaling multicollinearity (Hair et al. 2010).

4 Results

4.1 Descriptive statistics

As seen in Table 1, an average of 74.04% of the people in each county was physically active in some way. These data do not necessarily indicate that they met recommended guidelines for physical activity (US Department of Health and Human Services 2018); rather, they simply indicate the percent of residents in the county who were not sedentary. Only 59.30% of the county residents had access to places for physical activity. The disconnect between the two values illustrates that people are regularly physically active in spaces outside fitness facilities or even designated parks and recreational facilities. In terms of climate change attitudes, an average of 38.17% of residents in each county believed that climate change did or was going to personally affect them. On the other hand, a little over 72% supported policies aimed at curbing the effects of climate change ($M = 72.33$, $SD = 2.84$).

4.2 Hypothesis testing

Results of the regression analysis using PROCESS (Hayes 2018) are available in Table 3. We predicted that participation in physical activity (Hypothesis 1) will be positively associated with people's belief that climate change personally affects them. The model accounted for 34% ($R^2 = .34$, $p < .001$) of the variance in *PersonalHarm*. Consistent with our expectations, both

Table 3 Results of regression analysis

Consequent						
	PersonalHarm			ClimatePolicy		
Antecedent	Coefficient	SE	*p*	Coefficient	SE	*p*
Access	.030	.004	< .001	−.001	.002	.346
Rural	−.006	.003	.052	.001	.001	.259
Age65	.181	.016	< .001	−.007	.007	.313
Female	−.019	.029	.515	−.006	.012	.612
White	−.095	.004	< .001	.054	.002	< .001
Education	−.058	.010	< .001	−.015	.004	< .001
VoteDem	1.479	.499	.003	4.954	.208	< .001
PhysAct	.229	.016	< .001	.084	.007	< .001
PersonalHarm	–	–	–	.582	.008	< .001
Constant	25.49	2.00	< .001	38.824	.853	< .001
	$R^2 = .340$			$R^2 = .771$		
	F (8, 3053) = 196.710, $p < .001$			F (9, 3052) = 1143.902, $p < .001$		

Notes. Indirect effects of *PhysAct* through *PersonalHarm*: Effect = .134, *SE* = .009 (95% CI: .116, .153)

physical activity measures were positively and significantly associated with the belief that climate change personally affects them.

We then predicted a positive association between people's belief that climate change personally affects them and the belief new policies are needed to address climate change (Hypothesis 2). This hypothesis was also supported, as the relationship between *PersonalHarm* and *ClimatePolicy* was positive and significant ($B = .582$, $SE = .008$, $p < .001$). The overall model explained 77.1% of the variance of the dependent variable ($R^2 = .771$, $p < .001$).

Finally, though not explicitly hypothesized, we tested whether *PersonalHarm* mediated the relationships between *PhysAct* and *Access* and *ClimatePolicy*. This was indeed the case: indirect effects of *PhysAct* through *PersonalHarm*: effect = .134, *SE* = .009 (95% CI: .116, .153). Put another way, physical activity is associated with the belief that new policies are needed to curb climate change effects via the belief that climate change causes personal harm.

5 Discussion

Climate change has the potential to impact people in a variety of ways, including their sport and physical activity involvement (McCullough and Kellison 2017). Recognizing this relationship, researchers have examined organizational efforts to engage in environmentally friendly activities, the manner in which sport consumers impact the environment through their fan behaviors or physical activity, and the impact of climate change on physical activity and human performance (Evans 2019; Obradovich and Fowler 2017; Kjellstrom et al. 2016). In this study, we extended this scholarship by examining the manner in which physical activity was associated with climate change beliefs. Specifically, we found that as physical activity rates and access to physical activity increased, so too did people's beliefs that climate change impacted them personally. Such beliefs were important, as they mediated the relationship between physical activity and the belief that policies were needed to curb climate change's effects. In the following space, we outline the contributions of the study, implications, limitations, and future directions.

5.1 Overview of findings

Our study makes several contributions to the extant literature. First, Stern (2000) suggested that the decision to take climate change-related action is largely driven "by beliefs that environmental conditions threaten things that the individual values" (p. 413). Previous researchers focusing on recreational and physical activity participants have suggested that attitudes toward climate change are shaped, at least partially, by the degree to which the change would impact their ability to continue in these activities (Groshong et al. 2018; Pickering et al. 2010; De Urioste-Stone et al. 2015). Our dataset allowed us to explicitly test and offer empirical support for these relationships. Results suggest that personal impact mediated the relationship between the physical activity measures and beliefs about climate policy. Importantly, we demonstrated as much by employing a national dataset, thereby offering a more robust examination of the relationships than previous authors have presented.

We were also able to rule out other potential explanations. Previous researchers have shown that a variety of factors can shape climate change attitudes, including the type of community in which one lives, race, gender, education, age, and political persuasion (Lee et al. 2015; McCright 2010; McCright and Dunlap 2011; McCright et al. 2016; Reinhart 2018). In our multivariate analysis, the percent of county residents age 65 or older, the percent of racial minorities in the county, and the percent of the county to vote Democrat were all related to people's beliefs that climate change personally harms them. Interestingly, the percent of people in the county with a bachelor's degree or greater was negatively related to personal harm beliefs, thereby running counter to Lee et al.'s multinational study. Thus, the effects of education on climate change beliefs might be different in the USA than it is in other countries. Importantly, even after accounting for these effects, physical activity measure still had positive, statistically significant effects on people's beliefs that climate change personally harms them.

5.2 Implications

Our findings have a number of implications for climate change policy and for those involved with the delivery of sport and physical activity. Moser (2010) previously suggested that lack of immediacy represented one of the major obstacles in trying to convey the importance of climate change. She wrote:

> The general insulation of most modern, urbanized individuals from climate and the physical environment—living, working, learning, and playing most hours of the day in climate controlled buildings, moving in protective vehicles through vastly human-altered landscapes, and spending relatively little time in attentive, observing, or interactive modes in nature makes it difficult to notice subtle, incremental environmental changes. (p. 34)

Our study suggests that promoting greater physical activity—most of which is performed outdoors—is one way to overcome this immediacy effect. Indeed, related scholarship suggests that being physically active in outdoor settings can result in a connectedness to nature and the environment (Beery 2013; Brymer et al. 2009; but see also Lumber et al. 2017, who suggested people need to be intentional in their outdoor activity in order to realize the benefits). This connection, in turn, has the potential to generate environmental-related attitudes (Pickering et al. 2010).

Thus, activists, scientists, and policy-makers looking to shape public opinion around climate change should consider the sport and physical activity domain. They might, for instance, target communications to people who regularly engage in outdoor recreation, physical activity, and sport. They can note that the activities might not be available unless climate change actions occur. Sport-focused environmental activist groups like Surfrider Foundation, Protect Our Winters, and 11th Hour Racing (sailing) have formed to promote environmental policy and protections. These groups advocate addressing climate vulnerability to preserve the future of their respective sports. Their concern extends to outdoor recreationists who have been forced to adapt their own behaviors as a result of climate change and its impact on recreational activities (Cocolas et al. 2016; Steiger et al. 2017). Specifically, Protect Our Winters changed its nonprofit classification to engage in political discourse surrounding environmental policy. The organization's advocacy is clearly shown on its website with pages outlining ways to become a climate activist (Protect Our Winters n.d.).

The responsibility does not end with climate change advocates, as sport participants and sport managers can also play a role. Sartore-Baldwin et al. (2017) argue that the concept of shared responsibility extends to all individuals within a system (e.g., sport sector) because of their interconnected relationships that produce unjust systems and their resulting adverse outcomes. To engage the array of stakeholders within the sport sector, the United Nations (2018) introduced the Sports for Climate Action Framework during the Meeting of the Parties 24 (COP24). This framework seeks to leverage the social platform and reach of sport to promote more sustainable behaviors among sport organizations and to use the sector's social platform to promote sustainable behaviors among sport participants and spectators. For example, the National Hockey League (NHL) advocates for climate action in the league-wide sustainability report—a first among North America sport leagues. The NHL takes the position that increasing winter temperatures threaten the future of the sport (National Hockey League 2018) because increasing global temperatures result in fewer areas with frozen ponds, rivers, and lakes. These frozen bodies of water are a common place for the sport to be taught and the love of ice hockey to be reinforced. Climate change thereby threatens the grassroots aspects of the sport and the enjoyment of outdoor physical activity.

5.3 Limitations and future directions

Though our study makes several contributions to theory, research, and practice, we also recognize potential limitations. First, we assessed associations among variables—not causality. Of course, theory offers stronger support for physical activity giving rise to climate concerns than the other direction (people's climate concerns spurring their physical activity). Previous research in outdoor recreation (Brymer et al. 2009; Mayer et al. 2009) and tourism (Groshong et al. 2018; De Urioste-Stone et al. 2015) points to the patterns we have hypothesized. Nevertheless, readers should consider the directionality of the relationships with caution. Second, we gathered the data and conducted analyses at the county level, not that of the individual. A more direct test of the hypotheses would be possible with individual level data. Third, because of the nature of the available data, we assessed physical activity, in general, and not the amount of activity or where it took place. These are all factors that could potentially add greater understanding to the patterns we observed in our study, and future researchers might consider these possibilities. Fourth, we examined people's beliefs about personal impact and the need for policies to help curb the impact of climate change. We did not have data, though, related to the final element of Stern's (2000) model: behaviors. Thus, we do not know

the degree to which policy-related beliefs translate into activism, public- and private-sphere non-activist behaviors, or people's behaviors in their organizations. Finally, some researchers have found that the framing of questions ("global warming" versus "climate change") can alter the responses study participants provide, particularly along political divides (Schuldt et al. 2015). We acknowledge that the use of "global warming" in some of the items from the Yale study could have been answered differently if "climate change" or similar alternatives were used.

Finally, we see various avenues for future research. First, in drawing from previous research (Beery 2013; Brymer et al. 2009; Lumber et al. 2017), we suspected that physical activity and access to it would be associated with a closer connection to nature and the environment. However, future researchers would profit from exploring these relationships in greater depth. Second, what happens when climate change does impact people's ability to be active? How do they respond, in terms of their activities of choice or their climate-related behaviors? Future research devoted to better understand the dynamic interplay between climate change and physical activity will help researchers, sport managers, and policy-makers, alike.

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