ON THE ROAD AGAIN: EXPLORING SUSTAINABILITY IN MOTION THROUGH THE THEORY OF PLANNED BEHAVIOUR AND CLIMATE WORRY IN SPORTS TOURISM

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Abstract

Purpose – The purpose of this study was to explore the psychological and demographic factors that influence people's intentions to reduce their carbon footprint when traveling to sporting events. As environmental concerns grow, understanding how climate change impacts sport tourism behavior is critical to promoting sustainable practices in this space.
Methodology/Design/Approach – A cross-sectional correlational design was used, drawing on survey data from 309 participants. PLS-SEM was used to examine the predictors of sustainable travel intentions.
Findings – The model explained 44% of the variance in intention (R^2 = .44) to reduce carbon emissions while traveling to sporting events. Climate change worry significantly predicted behavioral intention (β = .21, p < .001), while climate engagement showed no direct effect (β = .09, p = .203) but had a significant indirect effect through the TPB variables (β = .22, p < .001). Travel-related barriers also emerged as significant predictors. Gen Z, males, and frequent attendees showed lower intentions to reduce their travel-related carbon footprint compared to Millennials, females, and infrequent attendees.
Originality of the research – This research contributes to the field of sustainable sport tourism by highlighting psychological and demographic predictors that will help sport events to carry out targeted interventions for the adoption of low-carbon practices from travelers.
Keywords Sports events, Travel, Climate change worry, Climate change engagement, TPB, PLS-SEM

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INTRODUCTION

Climate change affects nearly every aspect of daily life, including the decisions that people make about when and how to travel, especially important considerations for those attending sporting events. Goldblatt (2020) noted that climate change would impact sport in the coming years, creating challenges for athletes, organizers, and fans. While major sporting events often have a large economic impact and are sometimes seen as tools for growth (Russo & Scarnato, 2018), there is a growing concern about their environmental costs. The UN Climate Change report (UNFCCC, 2021) highlighted that the Sports for Climate Action initiative was helping the global sports industry cut greenhouse gas emissions in half by 2030 and reach net-zero by 2040. This initiative encourages organizations to adopt transparent climate action plans aligned with global climate goals. However, not all sporting events have adopted these practices consistently or effectively, especially when it comes to travel.

Despite these efforts, there is a lack of knowledge about the role of the spectator's own concerns about the environment that affect travel choice. This is especially important, since attending events is one of the biggest causes of event-related emissions. An important question is whether environmental concerns are connected to decisions about traveling and attending sporting events. If this link is clear, it could encourage more attention to sustainability in sports and travel decisions. Sporting events may have the power to both support environmentally aware individuals and raise awareness among those who are not yet engaged. The researchers explored how psychological factors such as climate worry and environmental engagement influence individuals' intentions to reduce their carbon footprints when traveling and attending sporting events. Furthermore, we investigated whether demographic variables such as age, gender, or how often someone attends sporting events affect their willingness to make environmentally conscious travel decisions.

1. LITERATURE REVIEW

1.1 Climate Psychology and Environmental Impacts on Tourism

Studies on overtourism clearly illustrate the challenges to the environment and society that mega events may cause, often resulting in significant ecological strain and social disruption (Koens et al., 2018; Utama et al., 2024). Koens et al. (2018), in particular, drew attention to the contribution of massive events to the existing pressure on local capacity, thus generating problems such as littering and destroying natural habitats. According to Falk (2014), warmer climate zones tend to attract a greater number of people than cold areas (e.g., winter Canada, Alaska), but once temperatures become exceptionally high in these warmer places, as is predicted to happen, this positive factor (i.e., the perceived comfort of warmer conditions) will negatively affect tourism activities. Although these findings provide significant knowledge, they pay little attention to the fact that people's concerns for the environment can lead to a lack of participation or even a choice for remote participation, especially after the COVID-19 pandemic. These works mainly describe common situations connected with tourism, without delving into the specifics of tourism that take place due to massive events such as World Cups and Olympic Games for different countries, where tourists, athletes, and spectators must necessarily travel. Recent research shows that the 2026 FIFA Men's World Cup, spread over all of North America, is expected to be the most polluting tournament in history, with more than nine million tonnes of CO_2 emissions and increasing heat risks that pose serious threats to players and fans (Scientists for Global Responsibility, 2025).

When it comes to low-carbon travel choices, it has been found that individual characteristics, demographics, and information availability play a role. Hall (2005) noticed that there is a difference in mobility among societies from different areas, especially those who live in industrialized and non-industrialized societies (Gössling & Nilsson, 2010), while Higham et al. (2016) examined the concept of *flight shame* or *flight dilemma*, triggered by environmental awareness. While influential, environmental awareness was not enough to discourage flying completely. Similarly, Becken (2019) investigated the use of carbon labeling and other informational tools for low-carbon travel behavior change, focusing on the potential role of such measures in eliminating the need for unnecessary travel. Regarding demographics, in the Swedish context, Elert and Lundin (2022) observed that women care about climate change and act on it more than men. In addition, it has been identified that youth are more informed about climate change than older people, and that this age group prefers environmental travel alternatives and takes their carbon footprint into account (Skeirytė et al., 2022). In the context of sport, these demographic differences are noteworthy as young women fans present a growing market for professional sport teams and events (Nielsen, 2023). Based on tourism studies, sport events are an especially relevant setting for climate-related tourist behavior analysis because they are dependent on sport-related travel that is a significant source of greenhouse gas emissions.

1.2 The Reciprocal Relationship Between Climate Change and Sport Events

Sport has a bi-directional relationship with the natural environment (McCullough et al., 2020). Extreme weather (e.g., heatwaves, floods) and changing weather patterns affect sport events' availability and safety (Dingle & Stewart, 2018). For example, urban areas, where many sport events are held, are especially vulnerable to the heat island effect. In urban heat islands, temperatures rise much higher compared to the surrounding rural areas (Yadav & Singh, 2024), exacerbating climate change's increasingly hot temperatures (Intergovernmental Panel on Climate Change [IPCC], 2022) and threatening athletes', spectators', and officials' safety. Hosting a sporting event also leaves a considerable carbon footprint via waste generation, travel emissions, and material use. Depending on the type and length of sport event, carbon emissions vary from 63 kg of carbon dioxide equivalent emissions (CO_2e) per person for an university sport event in Italy (Piccerillo et al., 2023), 311 kg CO_2e for an average German Bundesliga fan (Loewen & Wicker, 2021), and just under 500 kg CO_2e per capita for the 2019 Men's March Madness Tournament in the US (Cooper & McCullough, 2021).

The majority of sport events' carbon footprints can be attributed to travel. Across studies in North America and Europe, fan and participant travel to sport events creates 70 to 80% of a total sport event's carbon footprint (Cooper, 2020; Cooper & McCullough, 2021; Dolf, 2012). Moreover, a small portion of spectators from faraway places (e.g., those travelling by plane) are responsible for the majority of travel-related emissions. For example, during a carbon assessment of the University of British Columbia's varsity sport events, Dolf and Teehan (2015) found that 4% of the spectators who travelled by plane constituted 52% of total travel-related carbon emissions. Similar findings have been reported by others (Loewen & Wicker, 2021; Piccerillo et al., 2023; Triantafyllidis et al., 2018; Wicker, 2018), emphasizing the importance of travel choice and mode of travel for sporting events carbon emissions. While it is hard to imagine sport events without spectators, reducing travel-related emissions presents a major pathway to reduce sport's environmental impact. Thus, this study focused on psychological and behavioral factors that influence sport event spectators' intentions to lessen their carbon footprints related to their travels.

1.3. Theory of Planned Behavior in Tourism and Sport

The Theory of Planned Behavior (TPB; Ajzen, 1991) is one of the most popular theories for predicting and explaining human behavior. The TPB extends the former Theory of Reasoned Action by Ajzen and Fishbein (1975), which assumed that favorable attitudes led to corresponding behaviors. According to the TPB, behavior is motivated by behavioral intentions, driven by three antecedents: attitude, subjective norms, and perceived behavioral control. The TPB has been used to investigate both general and more specific pro-environmental behaviors. For instance, the TPB has been applied in predicting such behaviors as energy conservation (Clement et al., 2014), eco-friendly purchasing (Maichum et al., 2016), and turning off lights (Levine & Strube, 2012). In tourism, Wang et al. (2018) extended the TPB, including perceived consumer effectiveness and environmental concern, to analyze consumers' intention to visit green hotels in China. The authors found a positive relationship between perceived effectiveness and environmental concern on attitude and behavioral intention. In the context of bicycle touring, Han et al. (2017) found that the addition of personal norms, past behavior, and attractiveness of unsustainable transportation alternatives improved the prediction of sustainable tourism intentions. Although widely applied elsewhere, the TPB was only recently adopted in sport-based environmental research. Early studies examined recycling behavior at sporting events, finding that attitudes, subjective norms, and perceived behavioral control predicted intentions among college sports fans (McCullough, 2013), whereas in a youth baseball context only subjective norms and prior behavior were significant, likely due to limited recycling infrastructure (McCullough & Cunningham, 2011). Previous research showed that the predictive power of the TPB increases when it is combined with other psychological concepts and frameworks (e.g., Casper et al., 2014; Trail & McCullough, 2021). Specifically, the TPB's antecedents are influenced by external factors such as an individual's demographic variables, attitudes towards a target, personality traits, and other individual difference factors (Ajzen, 1991; Wang et al., 2018). With growing concern about climate change and environmental sustainability engagement in sport (Amann & Doidge, 2023; Hwang et al., 2024), our study used climate change worry and climate change engagement as antecedents to the TPB. Although it is a robust framework for explaining intentions related to travel, the inclusion of climate-related psychological factors, such as climate worry and climate engagement, could potentially provide better explanations for sustainable decision-making linked to sport travel.

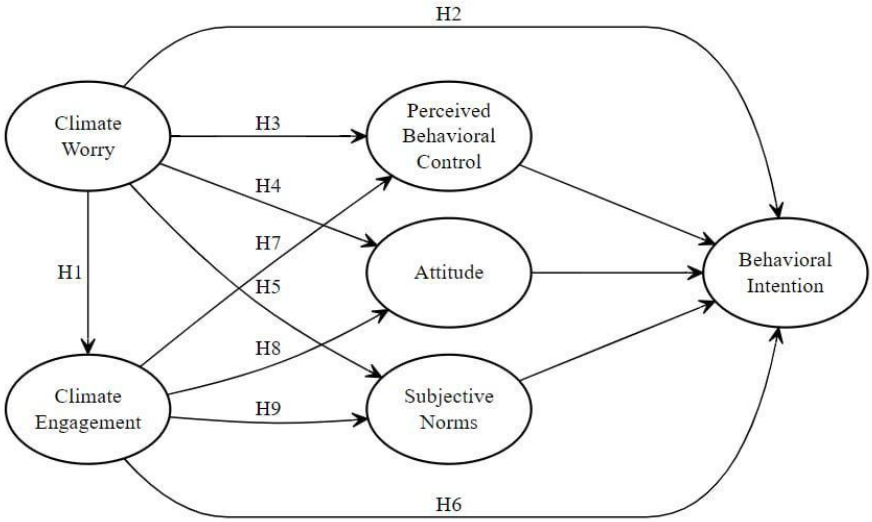
1.4 Climate Change Worry and Climate Change Engagement

Climate change worry (or short: climate worry) has emerged as a key effective response to the ongoing climate crisis, representing a significant factor of public engagement and behavioral adaptation. It is conceptualized on the basis of environmental psychology and affective science to mirror the emotional distress experienced by the individuals as a consequence of reflecting upon the risks that have arisen from anthropogenic climate change (Stewart, 2021; Wullenkord & Ojala, 2023). Climate worry is predominantly characterized as an emotional experience, a negative affect state (specifically worry, unease, or concern) about the possible and current impacts of climate change on the natural environment, communities, and future generations (Ojala, 2012; Pihkala, 2022; Wullenkord & Ojala, 2023). We distinguish it from cognitive concern in terms of its affective nature and its potential to motivate adaptive action (Jylhä et al., 2023). Climate worry has also been found to reliably predict pro-environmental intentions and climate engagement in diverse population samples. Empirical evidence suggests that individuals who self-report experiencing moderate levels of climate worry are more likely to adopt sustainable practices, engage in activism, and support climate policies (Du et al., 2023; Jylhä et al., 2023).

Climate change engagement (or short: climate engagement) refers to individuals' psychological and behavioral involvement with climate change as a socio-environmental issue, encompassing concern, discourse, activism, and behavioral responses (Clayton & Karazsia, 2020; Wullenkord & Ojala, 2023). It is a complex phenomenon that encompasses emotional, cognitive, and behavioral processes, for example, climate-related thoughts, communication about climate issues, climate activism, and climate protection policies (Ojala, 2015). In tourism and hospitality scholarship, climate worry has emerged as a mental factor that can shape pro-sustainable tourism behavior. Climate-conscious tourists tend to demonstrate a strong desire to cut back air travel, practice eco-tourism, and prefer climate-friendly destinations (Gössling & Higham, 2021; Hares et al., 2010). Climate concern, separately, has been found to be related to a strong sense of personal responsibility and a greater perceived risk of high-carbon travel, especially for destinations that experience vulnerable climate zones, such as coastlines or the poles, that can be damaged by climate change-related activities (McKercher et al., 2010). Although climate conscious travel behavior has gained traction in the tourism field, the effects of climate worry and climate engagement in relation to sport-related travel and consumption have not been explored. Sport-related travel and consumption vary from regular tourist behavior because their underlying motivations differ regarding psychological, socio-cultural, and self-concept motives (Smith & Stewart, 2007). In particular, identification, when team belonging comprises a large part of a fan's self-identity (Wann & Branscombe, 1993), presents a uniqueness of sport, where excessive fan attachment can lead to negative behavior and misplaced priorities (Davis & McGinnis, 2016).

Following a TPB-based framework, it is hypothesized that attitude, subjective norms, and perceived behavior control would positively contribute to behavioral intention, while climate worry and climate engagement would influence these elements by adding to the emotional concerns and active engagement with climate concerns. As a result, we developed the following model and hypotheses (Figure 1):

Figure 1: **Proposed Structural Model**



Given its extensive testing and validation in previous research, this study did not focus on investigating the basic assumptions proposed by the TPB. Instead, the focus was on exploring how additional factors, specifically climate change worry and climate engagement, relate to the TPB components within the context of sporting events and environmentally conscious travel decisions. With that we created nine hypotheses:

Climate worry was hypothesized to positively influence climate engagement, sustainable travel intentions, perceived behavioral control, attitudes, and subjective norms (H1–H5). Climate engagement was expected to have similar positive effects on sustainable travel intentions, perceived behavioral control, attitudes, and subjective norms (H6–H9). A direct influence on behavioral intention was predicted with climate engagement, given that people who engage with climate actions are more likely to be environmentally responsible and make a positive shift from concerns to climate change-directed behaviors, especially in areas such as travel that require personal effort.

Based on these hypotheses, three key research questions were built to guide the investigation into climate-related concerns and behavioral factors that influence sustainability travel intentions:

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1. Research Question 1 (RQ1): To what extent do climate worry and climate engagement predict the components of the TPB in explaining individuals' intentions to reduce their carbon footprints when traveling to sporting events?
2. Research Question 2 (RQ2): How do environmental concerns (climate change worry, climate engagement, attendance reasons, attendance barriers) predict the behavioral intention to reduce carbon footprints while traveling to sporting events?
3. Research Question 3 (RQ3): Are there any statistically significant differences in intention to reduce carbon footprints while traveling/attending sporting events across age groups, gender, and spectating frequency?

2. METHODS

This study used a quantitative cross-sectional correlational design to investigate the relationships among key psychological and behavioral factors related to sports events and climate change concerns. In order to contact respondents who were more likely to attend sporting events, recruitment of the respondents for this study was done through the utilization of a non-probability sampling approach that involved spreading the invitations through emails, social platforms, and public poster announcements. The sampling approach included announcements within higher learning institutions across the United States. This emphasis on US-based participants was intentional to ensure consistency in transport systems, sport event contexts, as well as cultural factors that shape travel behavior. Therefore, this study used a non-probability sampling method and the findings cannot be fully generalized to include all sport event attendees. This sampling methodology could potentially expose the study to issues of selection or sampling bias, and specific generations of the population could potentially be over-represented in the study. The criteria for this research required that all respondents be above the age of 18 years. The research included a total of 309 respondents who participated willingly by submitting anonymous questionnaires that had been prepared through Google Forms after being approved by the IRB. It is worth noting that because Google Forms was used, the total number of respondents who participated is unknown because Google Forms only saves finished questionnaires. The objectives of this study entailed establishing the association that exists between increasing concerns about the environment, especially climate-related issues, and their effect on attending and traveling to sport events.

2.1 Instruments

In this study, we used a 40-item questionnaire divided into three sections. The first section collected demographic information, including gender (female and male), generational cohort (1946–1980, 1981–1996, and 1997–2007), frequency of attending sporting events (0, 1–5, 6–10, 11–15, 16–20, and 21+), and levels of interest (Not at all, Slightly, Moderately, Very, and Extremely) in various sports such as football, soccer, baseball, auto racing, basketball, tennis, golf, and combat sports. The second section explored what drives people to attend sports events, what stops them from attending, and what interests them about traveling to particular sports events. The third section was focused on respondents' concerns about climate change. For the final section of the questionnaire, the items were carefully adapted in wording to align with the specific aims of the study and that is to determine the relationships among the key variables. Three scales were used: the Theory of Planned Behavior Scale developed by Ajzen (1991), Climate Change Worry Scale developed by Stewart (2021), and Climate Change Engagement Scale developed by Clayton and Karazisa (2020). All the scales were adapted by rewording items to capture the context of sport-related travel and climate concerns but maintained the structure and intent of the original, validated instruments. To provide an example, TPB items were adapted to cover intentions, attitudes, subjective norms, and perceived control in relation to lowering carbon emissions as part of travel to sporting events (e.g., "I intend to minimize my carbon emissions when I travel to sporting events"). Climate Worry items were modified to measure personal concern for the environmental effects of sport-related travel (e.g., "I am worried about the effects of climate change due to travel to sporting events"). None of the items were deleted, and all original response formats were maintained on a 5-point Likert response format. Prior to data collection, items were reviewed by a small group of students to assess clarity and comprehension, providing support for content validity.

2.2 Data Analysis

First, the descriptive statistics were calculated for each variable and demographic measure, including the sample means, standard deviations, and distribution shapes. Second, correlation tests were run to identify potential relationships between the variables. For the analyses, PLS-SEM was conducted using SmartPLS (version 4.1.1.5) and Jamovi (version 2.6.11.0). We used PLS-SEM because it extends an established theoretical framework through the inclusion of additional constructs, consistent with its use in exploratory research for theory development (Hair et al., 2019). Initially we tested the TPB model, where perceived subjective norms, perceived behavioral control, and attitude served as endogenous variables predicting behavioral intention to reduce carbon footprint. We used two additional constructs, climate worry and climate engagement, as exogenous variables to explain the TPB variables. Mediation analyses within the PLS-SEM were also used to test whether climate worry and climate engagement added direct or indirect explanatory value beyond the core TPB constructs, providing a comprehensive evaluation of the proposed model. Furthermore, the results showed that the assumption of normality was violated. According to Clason and Dormody (1994), data collected using Likert scales often have non-normal distributions. However, parametric tests such as ANOVA and *t*-tests are generally robust to violations of normality (Hoekstra et al., 2012; Stevens, 2013). Additionally, because PLS-SEM is non-parametric it is tolerant of non-normal data, making it an appropriate test for analyzing structural relationships in studies using Likert survey measures. Model quality was evaluated by examining validity and reliability, which is explained in the results section. In order to reduce common method biases, we used procedural methods such as anonymization, the use of validated scales, and format diversification. Furthermore, we also tested multicollinearity through the evaluation of the VIF indices of the PLS-SEM model, where all indices were less than 3.3.

3. RESULTS

Before testing the proposed model's hypotheses, descriptive statistics and correlations among the study variables were examined to ensure that the data met the necessary assumptions for analyses. First, we explored background information of 309 participants that fully completed the questionnaire. Of these, 54.9% identified as female, 45.1% as male, and one participant preferred not to answer this question. Respondents expressed the greatest interest in attending American football, baseball, and basketball events. Additionally, 63.1% of respondents indicated a strong willingness to travel for sports events in the future, with an average of 3.1 (SD = 1.60) games visited per year. The sample consisted of 11.0% Baby Boomers and Gen X (born 1946–1980), 30.1% Millennials (1981–1996), and 58.9% Gen Z (1997–2007). On average, participants attended 3.10 (SD = 1.62) sporting events per year (see Table 1). The Climate Change Worry Scale demonstrated the highest internal consistency reliability (Cronbach's α = .95), while the Perceived Behavioral Control subscale showed the lowest (Cronbach's α = .76).

Table 1: **Demographics of the Participants (n = 309)**

Demographics	Categories	Population	Proportion (%)
Gender	Female	169	54.9%
	Male	139	45.1%
Generations	1946–1980	34	11.0%
	1981–1996	93	30.1%
	1997–2007	182	58.9%
Number of spectating	None	36	11.7%
	1–5 events	116	37.5%
	6–10 events	58	18.8%
	11–15 events	27	8.7%
	16–20 events	25	8.1%
	21+ events	47	15.2%

The Pearson correlation coefficient (*r*) was computed to examine the relationships between the variables. The correlations are presented in Table 2, which shows all positive statistically significant relationships. The strongest positive relationship was between climate engagement and attitudes, $r = .61$, $p < .05$.

Table 2: **Pearson Correlations Among Composite Variables**

		1	2	3	4	5
1.	Behavioral Intention					
2.	Perceived Behavioral Control	.420*				
3.	Attitude	.503*	.420*			
4.	Subjective Norms	.420*	.425*	.374*		
5.	Climate Change Engagement	.421*	.323*	.613*	.285*	
6.	Climate Change Worry	.472*	.296*	.296*	.365*	.472*

Note. * = $p < .05$

RQ1: To what extent do climate change worry and climate engagement predict the components of the TPB in explaining individuals' intentions to reduce their carbon footprints when traveling to sporting events?

The structural model explained a substantial portion of the variance in the intention to reduce carbon footprints when traveling to sports events ($R^2 = .45$, $p < .001$). Climate worry significantly predicted perceived behavioral control (H3; see Table 3 for statistical results for all hypotheses) and subjective norms (H5). Climate worry significantly and directly predicted climate engagement (H1) and behavioral intention (H2). Climate engagement significantly predicted perceived behavioral control (H8) and attitudes (H7). In turn, attitudes (β = .23, $t = 3.84$, $p < .001$), subjective norms (β = .25, $t = 4.86$, $p < .001$), and perceived behavioral control (β = .14, $t = 2.78$, $p = .006$) all positively and significantly predicted behavioral intention. Direct TPB paths were not reported in Table 3 as the model has been extensively tested and validated in previous research, but were included in Figure 2. However, two hypothesized direct effects were not statistically significant: the effect of climate worry on attitude (H4), and the effect of climate engagement on behavioral intention (H6). These non-significant direct effects suggested an exploration of the role of indirect pathways, which suggested that climate worry and climate engagement influence intentions through antecedent TPB constructs.

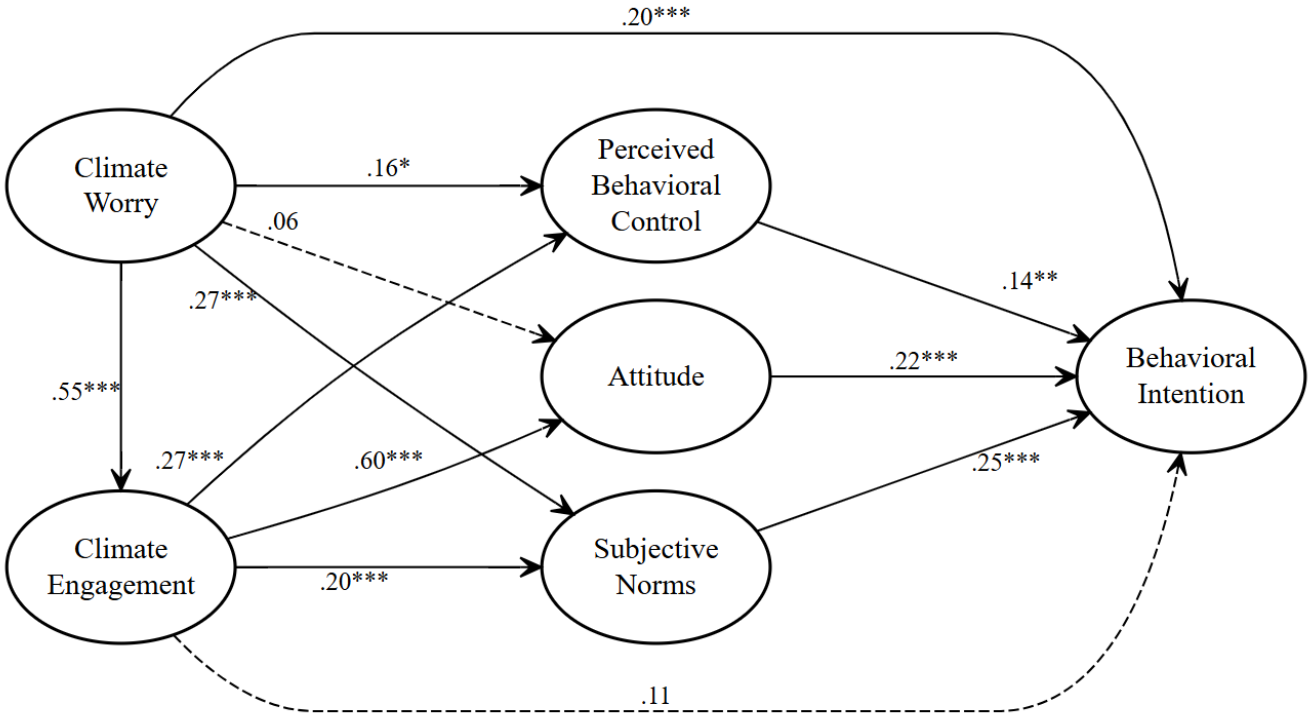
Bootstrapping with 10,000 resamples was used to test the statistical significance of all paths (see Figure 2 and Table 3). All total indirect effects in the final model (e.g., climate worry to behavioral intention) were statistically significant at $p \leq .001$. Notably, even though it did not have a direct effect, climate engagement had a statistically significant indirect effect on behavioral intention through other variables (β = .22, $t = 5.82$, $p < .001$), and climate worry indirectly influenced attitude (β = .33, $t = 4.86$, $p < .001$). The model fit was acceptable with an SRMR of .085.

Table 3: **Standardized Path Coefficients and Significance for Testing Structural Model Hypothesizes**

Hypothesis and Relationship path	**β**	***R*²**	***p***
H1: Climate Change Worry → Climate Engagement	.547	.277	< .001*
H2: Climate Change Worry → Behavioral Intention	.202	.004	.001*
H3: Climate Change Worry → Perceived Behavioral Control	.162	.003	.016*
H4: Climate Change Worry → Attitude	.056	.004	.262
H5: Climate Change Worry → Subjective Norms	.266	.077	< .001*
H6: Climate Change Engagement → Behavioral Intention	.107	.007	.094
H7: Climate Change Engagement → Perceived Behavioral Control	.273	.066	< .001*
H8: Climate Change Engagement → Attitude	.603	.364	< .001*
H9: Climate Change Engagement → Subjective Norms	.195	.031	.001*

Evaluations of validity, reliability, and multicollinearity were performed to confirm the model's quality. First, composite reliability (CR, rho_a) values ranged from .80 to .96, exceeded the often recommended threshold of .70 and indicated strong internal consistency. Specifically, climate worry demonstrated the highest CR (rho_a) at .96, while the remaining constructs ranged from .80 to .88. Second, Average Variance Extracted (AVE) values in the model ranged from .59 to .72, supporting convergent validity. The only construct falling slightly below the recommended .50 threshold was climate engagement (.48). Additionally, discriminant validity was established, as all Heterotrait-Monotrait (HTMT) ratios remained below the conservative 0.85 cutoff. The highest HTMT value observed was 0.76, between climate engagement and attitude, well within acceptable limits. Lastly, all inner VIF values ranged from 1.00 to 2.05, well below the commonly recommended threshold of 5.00 (Hair et al., 2019), indicating no issues of multicollinearity within the structural model.

Figure 2: **Full Statistical Model**



* = $p < .05$; ** $p < .01$; *** = $p < .001$

RQ2: How do environmental concerns (climate worry, climate engagement, attendance reasons, attendance barriers) predict the behavioral intention to reduce carbon footprints while traveling to sporting events?

To investigate how environmental concerns(e.g., climate worry, climate engagement), attendance reasons (e.g., environmentally friendly events), and attendance barriers (e.g., creating carbon footprints) predict the behavioral intention to reduce one's carbon footprint while traveling to sporting events, a multiple linear regression analysis was performed. Assumptions of regression were checked and met prior to analysis. The overall model was statistically significant, $F(4, 304) = 32.349$, $p < .05$, explaining 29.8% (R^2) of the variance in behavioral intention.

Among the predictors, climate worry (β = .269, $p < .05$), climate engagement (β = .243, $p < .05$), and attendance barriers related to carbon footprint concerns (β = .410, $p < .05$) were statistically significant positive predictors of behavioral intention to reduce carbon footprints while traveling and attending sporting events. On the other hand, environmentally friendly events did not significantly predict behavioral intention. The attendance barriers variable was the strongest predictor of intention.

> **RQ3**: Are there any differences in intention to reduce carbon footprints while traveling/attending sporting events across age ranges, gender, and spectating frequency?

To address our third research question, whether there are differences in the intention to reduce carbon footprints while traveling to or attending sporting events based on generation, gender, and spectating frequency, we conducted parametric tests, including ANOVA and independent samples *t*-tests. First, to investigate generational differences between Baby Boomers with Gen X (born 1946–1980), Millennials (1981–1996), and Gen Z (1997–2007), a one-way ANOVA was performed. The results showed a statistically significant difference in behavioral intention to reduce carbon footprints, Welch's $F(2, 98.2) = 4.16$, $p < .05$. A Games-Howell post hoc test indicated that Gen Z ($M = 2.68$, $SD = 0.74$) reported significantly lower intention to reduce carbon footprints while traveling to and attending sporting events than Millennials ($M = 2.93$, $SD = 0.80$). No other pairwise differences were statistically significant in this case.

We examined if there was a gender difference in the intention to reduce carbon footprint when traveling to and participating in sport events. The analysis showed that there was a statistically significant difference, $t(306) = 3.75$, $p < 0.05$. Females ($M = 2.93$, $SD = 0.73$) had a higher intention to lessen their carbon footprints compared to males ($M = 2.61$, $SD = 0.75$). Next, we looked at the relationship between the number of games attended every year and the intention to decrease one's own carbon footprint when one travels to and participates in sport events. A one-way ANOVA test (Welch-test) reported a significant statistical difference between the groups, $F(5, 98.6) = 3.41$, $p < 0.05$. Furthermore, there was a significant statistical difference between participants who attend very few or no games versus participants who attend 21+ games per year. These participants who attend very few or no games have a higher concern for reducing their own carbon footprints ($M = 3.18$, $SD = 0.73$) compared to the individuals who attend sport events the most ($M = 2.60$, $SD = 0.64$).

4. DISCUSSION

The aim of this study was to investigate psychological and demographic factors that affect the intentions of individuals to reduce their carbon footprint in regard to traveling to sports events. Our study was based on the Theory of Planned Behavior and included such components as climate worry, climate engagement, and travel-related incentives and constraints. These served as the basis for formulating our research questions. The areas of our research have remained unexplored within the current body of knowledge, and our findings have the potential to address this, especially since sports tourism is a growing area that continues to have a massive carbon footprint, albeit a relatively unexplored subject.

The first research question explored how concerns about climate change and active involvement in climate-related actions relate to the TPB variables influencing intentions to travel more sustainably to sporting events. The model explained 44% of the variance in intentions. Clayton et al. (2017) also found that emotional concern and direct participation in climate action can be a good motivation for someone to adopt low-carbon behaviors. This aligns with our finding that climate worry significantly predicts behavioral intention, consistent with Wullenkord and Ojala (2023), who emphasized that climate worry is a meaningful emotional driver of pro-environmental engagement. Based on TPB, the antecedents, attitudes, norms, and perceived behavioral control, were all significant predictors of the intention to lower one's carbon footprint while attending sports events. This is consistent with previous TPB research conducted within a sports context, wherein similar predictors were found to influence either pro-environmental behavior and/or recycling behavior among sports audiences (McCullough, 2013; McCullough & Cunningham, 2011). Out of these, the strongest predictors were attitudes and subjective norms, which points to the fact that personal values and friends' expectations are key factors. This is of particular importance in the case of sports fans, for whom a trip to an event is more likely to be a group decision and the experience of the whole event could be a significant factor. Newland and Yoo (2021) found similar results with their model that positive word of mouth and intentions to frequently visit such events could also promote pro-environmental intentions, which could imply a relation between the more sustainable choice and long-term interest in such events. Overall, the findings highlight the need to consider both psychological and social drivers when promoting sustainable travel.

The second research question examined the role of environmental concern, more specifically climate worry, climate engagement, motivations to attend (such as an interest in environmentally friendly events), and barriers to attending (such as concern about carbon footprint), on the prediction of the intention to act to decrease carbon footprint when traveling to sporting events. The overall model was significant and explained 29.8% of the variance in the dependent measure of behavioral intention. Climate worry, climate engagement, and barriers to sporting event attendance associated with concern about carbon footprint were each positively significant predictors of intentions to act to decrease carbon footprint, but the environmental friendliness of events was not. These results indicate a discrepancy between what drives people to act to decrease their carbon footprint associated with sporting event travel and what environmentally sustainable practices are present at sporting events. This reflects broader tourism literature, where climate-related awareness has been shown to influence travel choices (Gössling & Higham,

2021; Hares et al., 2010). Moreover, because travel represents 70–80% of the carbon footprint of many sport events (Cooper, 2020; Dolf & Teehan, 2015), it is not surprising that worry about travel emissions emerged as a stronger predictor than vendors' sustainability practices. Measures like low-carbon transport and carbon offsets could be more effective, as transportation is a key concern for FIFA and U.S. organizers ahead of the 2026 World Cup (Gaudet, 2024).

The third research question looked at how generational differences, gender, and frequency of spectating impact people's intentions to reduce their carbon footprints when attending sporting events. These findings could be important for event planners to better understand what groups are likely to minimize their carbon footprints in sporting events through low-carbon transport options and what group would need support or/and incentives. We found a significant difference in climate change travel intentions among the generations. While Gen Z is often viewed as the most environmentally conscious generation, Millennials were actually more likely to say they truly intend to reduce their carbon footprints when traveling to sporting events, which may reflect due greater autonomy and perceived behavioral control. It is clear that Generation Z is engaged in climate-related conversations, expressing their visible concerns (Swim et al., 2022); however, this does not mean that it automatically translates to their behaviors in sustainable travel. This concern *action* gap among younger groups is consistent with patterns observed in climate engagement research, where emotional worry does not always lead to behavioral follow-through (Ojala & Bengtsson, 2019). Second, gender differences emerged in sustainable intentions. An independent-samples t-test showed that female respondents reported a statistically significantly higher intention to reduce their carbon footprints than male respondents. This aligns with prior work showing that women express higher levels of climate concern and engage more in climate-friendly behaviors compared to men (Elert & Lundin, 2022; Skeirytė et al., 2022). Moreover, we explored whether the frequency of attending sporting events affects people's willingness to reduce their carbon footprints. The results showed that spectators who attend games less frequently were more likely to express intentions to lower their carbon emissions than those who attend games very often. Specifically, individuals who attended few or no games per year expressed significantly stronger intentions to reduce their carbon footprints than those attending 21 or more games per year. People who attend sporting events more often may put their passion for the game and sports team ahead of environmental concerns, while those who go less frequently might think more carefully about the environmental impact of their travel, since it feels more like a choice than a habit.

4.1 Practical and Theoretical Implications

As highlighted in the results, the findings suggest that participants are more concerned about carbon footprints associated with traveling to sporting events than about the environmental practices of the events themselves. In other words, environmentally friendly sport events do not strongly influence people's decisions to attend. For marketing teams, however, genuinely sustainable stadiums or events could offer valuable promotional opportunities if communicated effectively. Furthermore, tourist retention and boosted tourist loyalty are fundamental factors for sports event marketing. Therefore, a sporting event host and associated organizers are encouraged that they take these aspects (i.e., climate change worry and climate engagement) into account while planning sporting events since the transportation process. On the basis of these findings, event organizers, sport marketers, or even host destinations can develop a range of actions that can be taken to promote sustainable travel. These can include the provision of information about the emissions associated with travel, collaboration with public or sustainable transport operators, or offering rewards for making a greater effort to travel sustainably. Instead of having them make a decision, strategically providing them with options to reduce carbon footprints (e.g., partnering with airlines adopting low-carbon practices) would be practical solutions. Furthermore, our results related to generations, Gen Z needs more than just awareness, they need practical, actionable steps to turn sustainable intentions into behavior when it comes to attending sporting events. Technology can be the key enabler in converting good intentions into action, especially in the case of Gen Z, through applications and various other digital platforms. By leveraging the power of technology as a communication platform in transferring the difference between intentions and actions, we may be able to create a paradigm shift in sports tourism.

Theoretically, this study extends the traditional TPB framework by presenting evidence that climate worry and climate engagement predict all four TPB variables. While TPB research has typically focused on cognitive predictors alone, our findings show that climate emotions as well as involvement may trigger environmental intentions, which broadens the application of TPB in sport ecology and sustainability tourism research. Furthermore, the observed generational and gender differences also highlight the value of incorporating demographic characteristics as potential moderators in future behavioral models. Finally, further studies should explore the factors that explain where climate worry and engagement originate, and how they could be impacted or adjusted so that we would know how to feed these two variables even better. Studying these variables as dependent variables would be an interesting perspective to extend the existing model. The model assumes that climate worry and climate engagement influence people's desire to reduce their carbon footprints at sporting events and overall, the model (i.e., the theoretical framework) was largely supported.

4.2 Limitations and Recommendations

Despite the strengths and important findings of this study, there are some limitations that could inform and guide future research. First, one limitation relates to the research design and the second was the survey platform we used (e.g., Google Forms). The cross-sectional design of this study limited our ability to draw causal conclusions about the relationships among the variables. Related to the survey platform issue, we were unable to track how many people initially opened the questionnaire, and we

lacked data on the time each participant took to complete it. Self-reported measures may also cause response bias. Thus, we did not pilot the study, just reviewed content validity with a small group of students. The next limitation came from unequal sample sizes among different generational groups, which may limit the generalizability of the findings to older age groups, and findings to other cultural and geographic settings. After analysis we learned that we missed a few important questions, for example, related to the educational background, income, and a question related to the size of the sporting events that people attend, since smaller scale events and rural events lack more investigation. More studies are needed to investigate why environmentally friendly vendors are not one of the significant reasons that potentially drives people to attend.

Becken (2004) found that willingness to plant a tree was relatively high among tourists (48%), who associated trees with a wide range of benefits beyond their role as carbon sinks. For future research, it would be interesting to investigate feelings of guilt among travelers attending sporting events, and how this might influence their willingness to engage in pro-environmental behaviors. Furthermore, there has been little research carried out to study virtual attendance in providing alternatives for those interested in the environmental cause with newer technologies such as Virtual Reality (VR) and Artificial Intelligence (AI), which may provide immersive alternatives to physical attendance. While there are various opportunities with technological support, there may be carbon footprints in terms of production and use of such technologies, too (Lange et al., 2020).

CONCLUSION

This study focused on what drives people's intentions to reduce their carbon footprints when traveling and attending sporting events. Our findings indicate that emotional concern about climate change (e.g., climate worry) and engagement with environmental issues significantly affect behavioral intention to reduce one's carbon footprint when traveling to enjoy sport events. Social pressures and attitudes play an important role, especially since traveling to enjoy sporting events means that most of these activities result from group participation. While it is becoming more common for event organizers to focus on *greening* the venues, these efforts do not motivate attendees as much as their own concerns about the environmental impact of traveling to the event. This is a sign that event organizers may need to reconsider setting up promotional frameworks to include fewer emissions from traveling to events through greener modes of transport or offering carbon offset programs, much of which is being done by transport companies. Additionally, our findings indicate that demographic characteristics significantly affect the manner by which spectators reduce their carbon footprint. Surprisingly, Millennials had a greater desire to decrease their footprint than Gen Z as spectators. Moreover, women had a greater desire than men, and individuals who frequently go to these events had a lower intention to behave more environmentally sustainably than those who go less frequently. These findings indicate that younger and frequent fans of sports events can be catered to or encouraged to reduce their carbon footprint. It is a fact that, together, as a community, along with governments and event organizers, we must continue to incorporate sustainability into the culture of sports events, not merely for the concerns of fans and the health of the sport itself, but because climate conditions threaten the way we live. Thus, we will likely continue hosting sustainable sporting events, not only because they remain an integral part of our cultural and recreational lives, but also because they showcase the host destinations' capabilities in accommodating large numbers of athletes and spectators.

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