

An Exploration of the Relationship Between Online Interest and Outdoor Related Injuries

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March 18, 2025

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Introduction

Google has become an integral part of human interaction and day to day life. The impact is more than we ever could have thought, with significant effects on all of society, from our personal lives to business (Gastaldi 2014). We use it for anything and everything, from work to communication to leisure. However, with the benefits it provides also comes a set of difficulties that we have not yet fully explored. Specifically, one area that we identified as concerning is the complicated relationship between online interest and physical injuries in the outdoors. As individuals are further immersed into the internet, we pose the question, is there a connection between the rise in online interest and the frequency of outdoor related injuries? We wanted to explore the relationship between these variables to understand if the interactions we have online are affecting our safety as well.

Literature Review

Our paper seeks to fill the gap between the knowledge areas of injuries, the outdoors, and online interest. Historically, Google Trends has been used to perform research on a variety of “variables in a wide range of areas, including IT, communications, medicine, health, business and economics,” (Jun et al. 2018). The use of Google Trends in research papers has also been increasing. Over time it has shifted more towards using it to forecast changes within these research papers, (Jun et al. 2018). Google Trends has also been used to forecast the present, similarly to how we used it, although in different fields (Choi et al. 2012).

Nuti et al. (2014) discusses the use of Google Trends within the view of health care research. Nuti highlights the free and interactive nature of the program that allows researchers to obtain interesting and insightful data about the general population. The paper performed a

systematic review of research papers that used Google Trends in their research methodology, discovering the distributions of topic domains.

Yet another example of Google Trends being an integral part of a research paper was when Gholamzadeh et al. (2025) used it to discover the relationship between public interest in online searches with asthma information. This paper used Google Trends within each specific patient in order to explore and better understand their needs on asthma.

While we sought to explore the relationship between online interest and outdoor related injuries, little research has been performed on the topic. This led us to use a subset of online research: social media. We explored the published materials on social media usage and outdoor injuries to provide a comprehensive review of the subject area given the present information.

Social media has been making outdoor recreation and activities more popular (Rödl et al. 2024). Since people's lives have become more interconnected and dependent on technology and phones, the opportunity was created for the internet to influence their lives. The shift to more people spending time outdoors has changed due to people sharing locations, pictures, and information. In addition, Covid-era restrictions may have played a role in social media usage increasing (Parlak Sert et al. 2023). Rödl et al. (2024) identifies that the relationship between society and nature has shifted with digital content and the idea of nature often relating to how much interaction or support a given post may receive. The paper focuses on #friluftsliv ("open-air living"). By examining this hashtag and others, the researchers explored the interaction between personal photography and social media.

Another aspect of this phenomenon is the performative nature of social media (Arts et al. 2021). People create posts based on what they think other people want to see, formed by their interactions with other people. Pictures are not just simply posted, they are also posed and edited to be more aesthetic. Within Instagram specifically, the study found that Instagram was

considered by users to be a place where inspiration was supposed to be. Because of this, users may believe that posts need to be visually pleasing, positive, and portray them in an extremely specific manner. Due to this elevated level of use and content that focuses on the outdoor experience, Arts et al. (2021) discovered users focus on how applicable it is to Instagram's platform. In addition to discovering this effect, they discovered that people are self-aware that they may search for places that are considered photogenic or fitting to Instagram, perhaps more than for inner pleasure.

In addition, social media's cyclical relationship between the platform and the users has also possibly led to an increase in visitation to public land as discussed by Mackenzie et al. (2023). While the interaction between cumulative Instagram engagement amounts and numbers of visits to parks was not correlated, they concluded that Instagram could be affecting a small number of specific locations. This was done through tracking park-specific content and engagement within the Instagram app. For example, there are lines just to see and photograph popular destinations like Delicate Arch at sunrise. They found that the only places that saw this correlated increase were places with more aesthetic landscapes that make "better" pictures. This quantification is important for demonstrating the relationship between online users and the outdoors.

In addition, there is much literature about accidents and injuries outdoors. Ranging from less extreme outdoor activities such as hiking at national parks to far more extreme activities such as rock climbing, the types and rates of accidents that have occurred are well documented ("Sports" 2023). Some of this literature focuses on improving safety measures to reduce accidents. For example when looking at drowning risks within Yellowstone National Park, researchers found that people were far more likely to put themselves in dangerous situations. An

example of this was being close to a river during summer months and when air temperatures were higher (Girasek 2016).

Moreover, the literature also delves into more extreme outdoor sports. One article found that while most climbing injuries are minimal, when a multisystem accident occurs it can be much more significant (Raunch 2020). They found that training and preparation were both key to being safe when climbing, which agrees with our proposition that having training matters to the safety of individuals when doing outdoor activities, not just climbing.

Apparently, the effect of training and preparation affecting safety crosses cultural boundaries. Roman et al. (2022) found that about a quarter of Poles' got their information about adventure and extreme tourism from the internet. This also supports the possibility of a relationship between how much an outdoor activity appears on the internet and how much that activity is then practiced. While the sector of research on accidents related to outdoor activities is extensive, it does not cover the relationship between these injuries and internet searches that our research question covers.

No research exists on how people's internet interest in outdoor activities affects their chances of getting injured in outdoor activities. Harris (2020) explores how smartphone technology and social media influence risk perception in outdoor recreation. She argues that social media has made hiking and outdoor adventures more popular, but it has also contributed to an over-reliance on technology for navigation and safety. She found that hikers assume that smartphones will always provide guidance and emergency assistance, leading to increased risk-taking behavior. The phenomenon of "Instagram hiking" contributes to unrealistic expectations, where people underestimate the difficulty of hikes based on curated social media images, often showing up for hikes with insufficient gear and clothing. This has resulted in a rise in Search and Rescue incidents, as many individuals venture into challenging outdoor environments without

the necessary preparation or skills (Harris 2020). Harris highlights that while technology provides valuable tools, its presence may create a false sense of security that leads people to take risks they otherwise would not.

Weiler et al. (2020) in “Selfies to Die For: A Review of Research on Self-Photography Associated with Injury/Death in Tourism and Recreation,” provide a comprehensive review of selfie-related deaths and injuries. Their research identifies over 250 reported fatalities in the past decade, many occurring in natural settings such as cliffs, bodies of water, and wildlife areas. The authors highlight how social media and the pursuit of the “perfect shot” encourage risky behaviors, often causing individuals to prioritize their online presence over personal safety. Young males are identified as the most at-risk demographic, as social media platforms amplify the appeal of extreme and visually compelling content. The study underscores how social media not only drives individuals to take risks but also normalizes these behaviors through widespread visibility. To mitigate these dangers, the authors recommend strategies such as persuasive communication, increased visitor education, and targeted social media campaigns to discourage reckless actions. They also emphasize the need for further research into how digital content influences risk perception and decision-making in outdoor settings.

An extensive review found little on internet interest and outdoor injuries, aside from a couple of undergraduate senior theses focused on the social media element of internet interest. Tess Stopczynski, an undergraduate student from the University of Vermont, studied the influence of social media and injury occurrence within University of Vermont undergraduates. Through surveys and statistical tests the results of her survey were not conclusive. However, she did notice trends that students followed accounts or individuals who participated in extreme activities (Stopczynski 2020). Another discussed the public opinion of social media and public land usage, along with the rhetoric attached to those discussions (Doyon 2020).

Theoretical Design and Hypothesis Development

Our study examines the relationship between online interest in extreme outdoor activities and the incidents of related injuries through the lenses of confirmation bias and the uses and gratifications theory. Confirmation bias refers to the tendency to favor information that confirms one's pre-existing beliefs while disregarding contradictory evidence (Nickerson, 1998). In the context of extreme sports, individuals may selectively consume online content that portrays these activities positively, thereby reinforcing their existing perceptions and underestimating potential risks. Concurrently, the uses and gratifications theory poses that individuals actively seek media content to satisfy specific needs, such as entertainment, information, or social interaction (Salubi & Muchaonyerwa, 2018). This intentional selection of media content can lead to an overrepresentation of favorable depictions of extreme sports, further skewing risk perception. The interplay of these cognitive and behavioral factors may contribute to increased participation in high-risk activities without adequate consideration of potential dangers.

The Dunning-Kruger effect is seen when people are significantly below their perceived skill or knowledge level, unable to calibrate perceptions with reality (Dunning, pg. 260, 2011). Dunning asserts that people tend to be much more ignorant than they think they are, and that ignorance is an inevitable fact. People are not regularly forced to confront the areas they are ignorant in, as they have little daily interactions with them, and thus continue to be unaware of their ignorance (Dunning, pg. 249, 2011). This effect has been used as a framework for numerous other academic works spanning across many different genres including medical (Rahmani 2020), statistics (Gignac et al. 2020), sports (Sullivan et al. 2019), and language (Saito et al. 2020).

Our hypothesis is informed by the theories of confirmation bias, uses and gratifications and the Dunning-Kruger effect. The integration of confirmation bias and the uses and

gratifications theory offers a nuanced understanding of how online behavior influences risk perception in extreme outdoor activities. Individuals exhibiting confirmation bias may gravitate toward online communities and content that validate their adventurous pursuits, reinforcing a skewed perception of safety (Modgil et al., 2021). Simultaneously, from a uses and gratifications perspective, the pursuit of content that fulfills desires for thrill and community belonging can result in selective exposure to media that downplays risks (Vinney, 2021). This selective exposure not only reinforces existing beliefs but also shapes future media consumption patterns, creating a feedback loop that perpetuates the underestimation of risks associated with outdoor activities. Understanding this dynamic is crucial for developing interventions aimed at promoting balanced risk assessments among enthusiasts. We hypothesize that to interact with the outdoors people more frequently get into situations they are unprepared for. This then relates to the Dunning-Kruger effect. Outdoor activity novices will participate in activities above their knowledge level. They are overconfident in their abilities just like the Dunning-Kruger effect would suggest, which could lead to accidents. We believe that with the increased level of online interest a higher percentage of people become injured while doing outdoor activities first seen online because they are unprepared.

Given this we propose the following hypothesis:

Alternative Hypothesis: Search terms on Google are correlated with the number of outdoor related injuries

Null Hypothesis: Search terms on Google are not correlated with the number of outdoor related injuries

Research Design and Methodology

We used Google Trends data to reflect the popularity of a subject over time. This is relevant because it is a platform that people use to explore topics via technology instead of getting expert advice or learning from people who already have the skill.

Google Trends measure search terms in terms of "Search interest relative to the highest point for the given region and time. A value of 100 is the peak popularity for the term. A value of 50 means the term is half as popular. A score of 0 means there was not enough data for this term" ("Google"). The given location and time period we used matched our injury data: the United States from 2013-2023. Because Google Trends gave the data monthly and our injury data was yearly, we aggregated it by summing the popularity scores for a year and then dividing by 12 to get an average score for a given year.

Our injury data is government statistics on injuries and accidents, obtained from the National Electronic Injury Surveillance System which is run by the Consumer Product Safety Commission. This database pulls from ERs across the nation. This means that if someone gets injured doing an outdoor activity, but the injury is not significant enough for them to go to the ER, we will not end up including that injury in our analysis. This was acceptable to us as we are more interested in serious injuries. This data is counts of ER visits over the years 2013-2023 based on the different consumer products that the injuries are related to. We went through this data and chose injuries that would be related to outdoor activities, for example, horseback riding related injuries. This gave us data on outdoor activities to compare with data on Google Trends over the years.

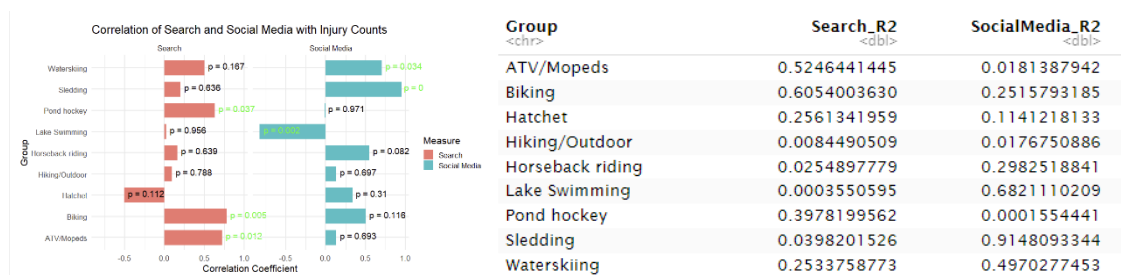
To ensure accuracy in addition and cater to our skill set, we performed the analysis in a couple of different ways. We used the coding language R to perform the correlation analysis. To prepare the data for this we began by loading the necessary R libraries (e.g., `readxl`, `dplyr`, `ggplot2`) to read two sheets from an Excel file—one containing search popularity data, the other containing injury data. Both datasets were cleaned by removing unnecessary rows and pivoting from wide to long format, so that each row corresponded to a single year and either a subject (search data) or injury category (injury data). We then used `case_when()` to group related items (e.g., “Bicycle,” “Biking,” “Mountain bikes” all into one “Biking” category) in both datasets, ensuring category names matched. Finally, we joined the two datasets on year and group, giving us one dataset with both popularity and injury count for each activity in each year.

The second method we used to explore was a cross-correlation function along with performing linear regressions on each of the variables using Python in Jupyter Labs. To prepare the data for this we used linear interpolation for any null values, which gave us estimates for those values. We then combined all search terms to match the search term columns for the injuries. For example, for the injury column the title is “Beach, Picnic, Camping Equipment” but for our search terms there were separate terms with the column titles, “Beach,” “Picnic,” and “Camping.” We then created a new column with the mean of each of those different but related search terms and the same title as the one injury column. The overall purpose of this was so that we could directly compare that to the matching injury column. These preprocessing steps helped us set the data up correctly for our analysis later.

Correlation was useful for testing our hypothesis as it calculates the association between variables. This is shown as a value between zero and one. The significance of the correlation is

the P-Value (Udovičić et al. 2019). We used this to determine the positive or negative relationship between Google Trends and injuries related to the outdoors and recreation.

Results and Discussion



Our results within R through a group correlation analysis revealed that Biking showed a strong positive correlation ≈ 0.78 ($p \approx 0.0048$) between search popularity and injury counts, while ATV/Mopeds also had a substantial correlation ≈ 0.72 ($p \approx 0.0117$). Other activities like Hatchet or Hiking/Outdoor showed weaker or non-significant correlations. For social media popularity specifically, several groups exhibited moderate correlations, though only a few were statistically significant. Notably, Sledding had a high positive correlation of ≈ 0.96 , ($p \approx 0.0002$), whereas Lake Swimming was strongly negative at ≈ -0.83 ($p \approx 0.0017$).

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overall Search and Injury Correlation:

Pearson's product-moment correlation

data: merged_data$Popularity and merged_data$Injury_Count
t = 2.7562, df = 92, p-value = 0.007051
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.07792266 0.45342322
sample estimates:
cor
0.2761792

overall Social Media and Injury Correlation:

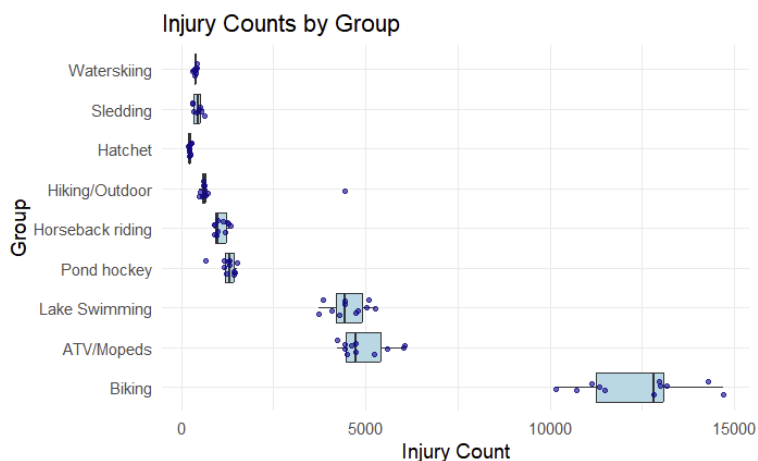
Pearson's product-moment correlation

data: social_media_injury$SocialMedia and social_media_injury$Total_Injury
t = 1.4404, df = 9, p-value = 0.1836
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
-0.2256170 0.8198426
sample estimates:
cor
0.4328394

overall R-squared for Search and Injury: 0.07627494
overall R-squared for Social Media and Injury: 0.1873499

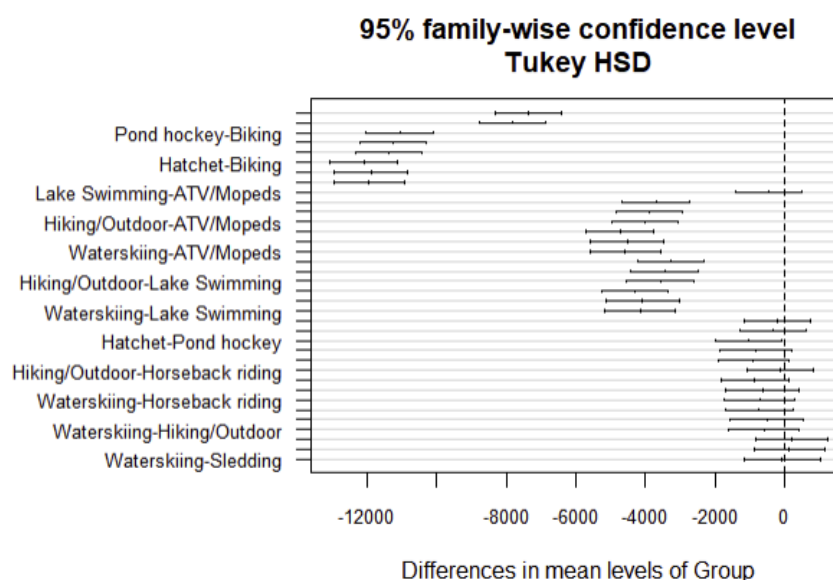
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Overall, the correlation between combined search popularity and injury counts was ≈ 0.28 ($p \approx 0.007$), suggesting a modest but real connection. The overall correlation for social media was ≈ 0.43 ($p \approx 0.18$), which was not statistically significant.



We also conducted a one-way ANOVA (an Analysis of Variance test) to examine whether average injury counts differed across all groups. This test yielded a high F value (≈ 333.8) and a

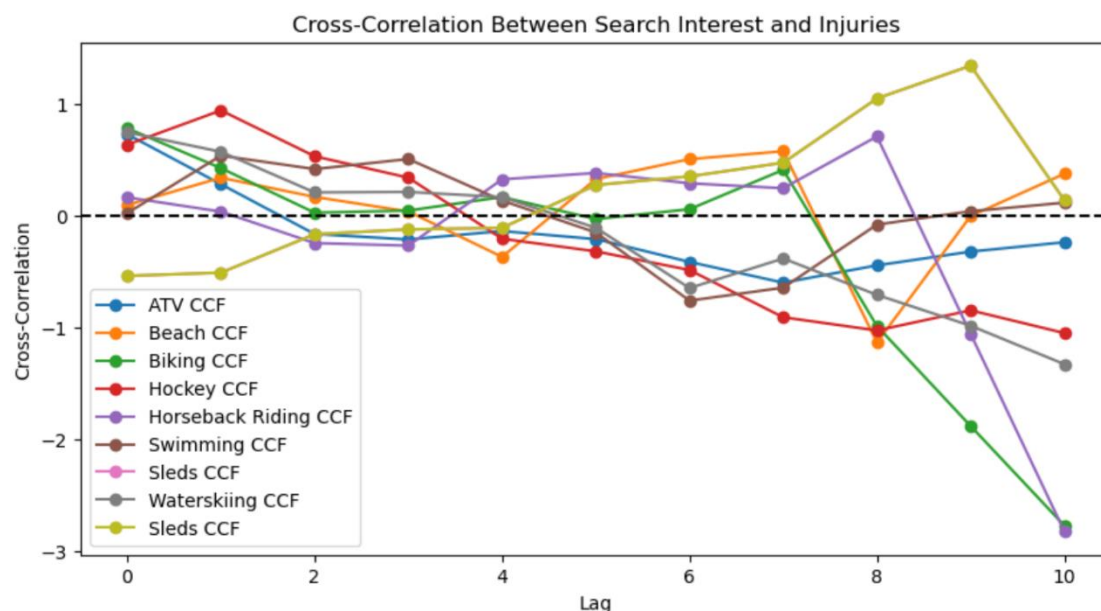
low p -value of $< 2e-16$, indicating that at least one group's mean injury count was significantly different from the others.



The Tukey HSD post hoc test pinpointed which specific groups (e.g., Biking, ATV/Mopeds) differ most from lower-injury activities such as Waterskiing and Hatchet. The ANOVA result matters because it confirms that not all activities have the same injury risk: some clearly stand out with higher mean ER visits. The strong correlations for Biking and ATV/Mopeds suggest that as online interest in these activities grows, so may injury rates, underscoring a real-world impact of digital trends. On the other hand, the non-significant overall social media correlation implies that broader social media popularity may not always translate into more injuries, though individual categories like Sledding and Lake Swimming show contrasting outcomes. Ultimately, these findings highlight the potential value of monitoring search and social media trends to anticipate and address public safety concerns, particularly for high-risk activities.

Based on analysis using Statsmodel's CCF tool we developed the following graph to represent cross-correlation. As can be seen for most of the variables the strongest correlation

between injuries and searches occurs with either a small lag or no lag. This means there is no delay in the highest correlation of search interest to injuries. In addition, the peak correlation for all variables is positive meaning that as search interest goes up injuries also go up.



Based on our simple linear regressions of each category, we found the following variables to be significant based on a p-value of 0.05. The ATV/Moped/Minibike category had a p-value of .012. This p-value indicates that the results are significant. The graph demonstrated the expected relationship is positive, which means that as the search interest goes up so does the number of injuries related to ATVs, mopeds, and minibikes. The Bicycles category also showed a significant p-value at .005. Similarly to the ATV category, there is an expected positive relationship, which indicates that as bicycle search interest grows so does the number of injuries related to bicycles. Hockey also demonstrates a significant relationship with a p-value of .037 while also following a positive relationship trend. The water skiing/tubing/surfing category had a p-value of .009 indicating a significant relationship that was also positive.

Based on our results and p-values, with a significance level of 0.05 we can conclude there is a relationship between some of the categories search interest and those categories corresponding injuries. Among all our categories that showed a significant relationship within the specified significance threshold, they all had positive relationships. From this, we concluded that as search interest in a category rises, so does the number of injuries in that category for some of our categories. Overall, based on our findings we were able to reject the null hypothesis which is, there is no correlation between Google Trends and injury rates over time.

Limitations and Future Research

Due to the nature of the circumstances in which our research occurred there are several limitations that could have overall implications on our final interpretations of our data. Our access to third party proprietary data was limited, which led to changes in our research design and outcome. In addition, we had null values within our dataset which impacted the overall quality of the data. These problems with our data pose significant challenges when we were drawing definitive conclusions about each of the variables.

We only explored a small subset of this research, however there are several different opportunities for further investigation. With an expanded timeline there could be opportunities to allow a more thorough examination of the topic, and the ability to address other findings that may come up in the process. Having an increased sample size with higher quality data collection could address many of our data quality concerns and reduce any limitations we found. If the process is set up so data is collected across different social media platforms with a wider scope, there could be a broader range of variable selection which would be useful in seeing other

relationships. Pairing historical data with tracking in the future could allow for the effects to be studied in terms of long-term impact as well.

Overall, this paper is an example of how this thought process could be used to address the problem but would benefit from a different dataset. For future endeavors, we suggest finding a dataset that gives numerical data on mentions relating to outdoor activities. Having historical data over the past 10 years or longer on hashtags such as “#outdoors” and how many times that hashtag was mentioned in posts could be compared with ER visit rates for a given activity.

In conclusion this research area is an untapped subject that seems to have significance based on our preliminary findings. Future research in the subject could be extremely valuable and this information could be informative on the relationship that humans have with the internet and their own health and safety. More research and approaches should be done in the area to help find more concrete findings.

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