

# **Evaluating the Relationship Between Mental Health and Outdoor Exposure During the COVID-19 Pandemic Lockdowns Across Urban and Rural Communities**

By

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## **ABSTRACT**

The Coronavirus (COVID-19) lockdowns began in March 2020 and brought on a slew of physical and mental health issues. Before the pandemic began, studies were associating outdoor/natural exposure with an improvement in mental health. A survey was deployed that asked participants how their mental health, coping mechanisms, and outdoor exposure habits changed once the pandemic began, with a focus on if nature's presumed beneficial influence was different between urban and rural communities. The findings show that depression and anxiety, as well as the emotions associated with those psychosocial disorders, did worsen once the lockdowns began with higher averages coming from participants in urban areas. It is also concluded that urban residents reported their outdoor exposure was more beneficial to their mental health than rural residents. Ultimately, this research could be used as a guideline for government officials, therapists, architects, and many more, to think about when planning ways to improve mental health.

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## **I. INTRODUCTION**

When the pandemic first began in March of 2020, the physical health of people was the top priority of scientists and healthcare professionals. This left mental health to be overshadowed by rapidly increasing hospitalization rates and death tolls (Center for Disease Control and Prevention, 2020). The lockdowns, due to the rapid spread of the novel Coronavirus (COVID-19), not only affected people's bodies but it also affected their mental state. There has been evidence that global health events, such as pandemics, cause an increase in mental health disorders (Esterwood & Saeed, 2020). As the COVID-19 pandemic progressed individuals reported experiencing higher levels of stress, anxiety, and depression (Javed et al., 2020). The situation presented by the pandemic limited regular coping mechanisms for people, creating or intensifying feelings of depression and anxiety more so than before.

During the 2020 lockdowns, primary coping methods to help with increasing negative emotions were making a schedule/routine, maintaining virtual social contact, avoiding too much media exposure, meditation, taking up new hobbies such as cooking or knitting, and walking outside (Raj & Bajaj, 2021). Even the Center for Disease Control and Prevention (CDC), which at the beginning of the strict lockdowns was encouraging people to stay indoors, recommended going for an outdoor walk as a coping mechanism to improve both physical and mental states (2020). Along these lines, before the pandemic began more research was being published about the benefits of outdoor exposure on mental health (Bratman et al., 2019). In many cases, connections between increased experiences with nature and its mental health benefits were discovered a few years before COVID-19 hit, but there was no clear consensus if this relationship was more beneficial in urban or rural areas (Cox et al., 2017).

I wanted to see if the positive correlation between mental health and outdoor exposure was still relevant during the pandemic lockdowns with an emphasis on how this varies across urban and rural communities. I conducted a survey during the summer of 2021 that asked participants about their relationship with nature and how it affected their mental health before the pandemic began and then asked similar questions, but this time focused on the period during the pandemic lockdowns. I wanted to determine if those who took advantage of the outdoors during lockdown periods had more positive mental health outcomes than those who didn't, and if this differed in urban versus rural settings.

## **II. BACKGROUND**

In March of 2020, the novel Coronavirus sent the U.S. into a nationwide lockdown. People suddenly found themselves in unfamiliar and upsetting territory, making it difficult to adjust and led to an increase in negative emotions. The loss of jobs and its related effects (i.e., the inability to pay rent), school closures, social isolation, and the death of loved ones, among other things, contributed to a higher risk for psychiatric illnesses associated with COVID-19 (Pfefferbaum et al., 2020). People experienced varying levels of loneliness, irritability, boredom, fear, sadness, anxiety, and fatigue (Raj & Bajaj, 2021). When viral outbreaks of life-threatening diseases occur, people are often left with Post Traumatic Stress Disorder (PTSD) (Esterwood & Saeed, 2020). This can manifest in many different forms of challenging mental health issues, but some of the most common ones are depression and anxiety disorders (Pfefferbaum et al., 2020). As more research is being done into psychosocial disorders, it's no surprise that diagnoses of depression and anxiety were rising even before the pandemic began. Some causes of depression and anxiety are experiencing trauma, a stressful event, abuse, financial problems, major life changes, and/or other medical issues (CDC, 2022). These are common problems people have,

about 16 million people in America suffer from depression and anxiety because of the issues listed, and the pandemic exacerbated many of these problems worldwide (Pfefferbaum et al., 2022).

The CDC recommended that when these difficulties arise, individuals should closely monitor psychosocial needs, keep to a routine, and seek assistance when needed (CDC, 2020). The CDC released guidelines while under lockdown; notably, exercise was recommended but going into enclosed areas such as gyms was not (CDC, 2020). Guidelines for visiting parks and outdoor spaces had less stringent rules, as the CDC suggested that “in many areas, people can visit parks, trails, and open spaces as a way to relieve stress, get some fresh air, and stay active” (2020). During that time, the CDC also proposed that individuals only leave their homes to buy essentials like groceries and go for a daily walk to get individual exercise or exercise a pet. Unfortunately for residents living in certain metropolitan areas such as New Jersey, the government decided to close their public parks (Volence et al., 2021). This was controversial for residents living in these densely packed urban areas, as their options for coping with the pandemic lockdowns became even more limited than those who lived in areas with more easily available natural environments.

Prior to the pandemic, research into the way green/blue, outdoor spaces are beneficial to mental health showed that people who got outside frequently had less intense feelings of depression and anxiety (Pearson et al., 2014). In one study, participants were placed in a stressed/mentally fatigued state to induce sleepiness, boredom, and anxiety (Pearson et al., 2014). Participants were then shown images of the natural environment, and some were given an immersive outdoor experience in which natural smells were released and sounds of nature were played. Overall, accessibility to green space led to a decrease in fatigue and boredom (Pearson et



al., 2014). They found that “immersion” was an important component for the psychological restoration process as the results showed that the participants that got the immersive experience had faster rates of stress reduction than those who were just shown images of nature (Pearson et al., 2014). There was a meta-analysis done of 21 studies that explored the dynamic between nature-connectedness and mental health. In these studies, counselors who used nature-based guided meditations were brought in, and therapists that encouraged clients to spend time in natural places were also utilized. It was concluded that individuals who were more connected to nature tended to experience positive effects such as vitality and life satisfaction when compared to those who were less connected with nature (Capaldi et al., 2014).

Another aspect to look at when investigating mental health differences is location. There was a study done on the challenges of the pandemic specifically within the city. While cities typically have parks and implement other green areas, this is not sufficient access to nature to provide benefits such as fresh air, space for outdoor activities, and reduction of stress levels (Bil et al., 2021). The Stress Reduction Theory states that people frequently exposed to natural environments recovered from stress more quickly than those in urban environments (Bratman et al., 2019). While this theory first came to light in 1981 by Stephen Ulrich, it was recently tested in places that are notorious for being stressful, such as hospitals and universities (Bratman et al., 2019). Due to these findings, I thought it would be interesting to see how mental health differed between people who lived in an urban environment compared to those in rural environments during the strict COVID-19 pandemic lockdowns.

#### A. RESEARCH QUESTIONS

A survey was conducted with these three specific research questions in mind:

1. How anxious or depressed (clinically diagnosed and non-clinically diagnosed) were people before the pandemic, what coping mechanisms did they use, and how did these vary across locations?
2. How did levels of anxiety or depression change (clinically diagnosed and non-clinically diagnosed) during the pandemic, how did coping mechanisms change in lockdown, and did these vary across locations?
3. How did mental health coping mechanisms change due to lockdown restrictions, what was the role of the outdoors in providing comfort, and how did these vary across locations?

## **B. SIGNIFICANCE**

I compared the coping mechanisms, the role/importance of the outdoors, and the use of the outdoors as coping mechanisms for depression and anxiety in both pre-pandemic and during-pandemic years. This was also compared with newfound coping mechanisms during the pandemic such as online happy hours with friends, online virtual entertainment nights, personal hobbies, and others to see how the outdoors was utilized. I then compared the impacts that spending time outdoors had on mental health to determine if increased outdoor activity became more important as the availability of other pre-pandemic coping mechanisms changed.

The outcomes of this study aid current and future research in linking improved mental health with an outdoor relationship. These results provide people that experience depression and anxiety, especially those living in urban areas that lack sufficient available green space, with a clear-cut coping mechanism. Whether this means a trip to a greenhouse, park, or simply adding more plants into a person's living space, increasing natural greenery into everyday life is relatively simple and cost-effective. This research is applicable to many different areas, such as

mental health professionals suggesting ways to treat psychosocial disorders, notoriously nerve-racking places like the doctor's office that want to create a more relaxing and friendly environment, or even policymakers looking to increase overall happiness in their constituents. The results from this study benefit not only professional institutions, but individuals looking to reduce their daily negative emotions and anxiousness as well.

### **III. METHODS**

Over the summer of 2021, I conducted a survey using the program Qualtrics, aimed at answering the research questions. The population of interest was citizens in the United States that were eighteen years or older. The main purpose of the survey was to first understand how people's coping mechanisms changed during the pandemic compared to pre-lockdown years with an emphasis on the way the outdoors was utilized in both periods. The second was to see if there was a correlation between a change in mental health and the participant's exposure to the outdoors.

There were three main sections of the survey. The first section asked about demographics, including gender, ethnicity, income, marital status, and location. The next section asked participants about their mental health a year prior to the pandemic lockdowns which began in March 2020. It asked questions to determine how many people experienced feelings of depression and/or anxiety and how often people experienced emotions commonly associated with psychosocial disorders such as boredom, fear, restlessness, irritability, lethargy, stress, anger, and difficulty sleeping. These were selected after reviewing numerous articles on depression and anxiety, and these eight were frequently mentioned under the context of the pandemic (Pfefferbaum et al., 2020). Subsequently, the survey also asked what coping mechanisms were used to remedy those emotions, if the outdoors was an important coping

mechanism, if the participant saw a licensed mental health professional and if that mental health professional recommended going outside as a coping mechanism.

The final section asked participants about their mental health during their primary pandemic lockdowns, specifying the dates being between March 2020 and March 2021. These specific dates were chosen because The World Health Organization (WHO) officially declared the Coronavirus a global pandemic on March 11<sup>th</sup>, 2020, United States President at the time Donald Trump declared a nationwide emergency on March 13<sup>th</sup> of the same year and shortly following that many states began shutting down schools, offices, restaurants, gyms, and other public places to stop the spread of COVID-19 (CDC, 2022). The survey asked if there were changes in the feelings of depression/anxiety, the associated emotions, and coping mechanisms. The last section, still focusing on the period during lockdowns, had participants evaluate their relationship with the outdoors to see if going outside became more important as previous non-pandemic coping mechanisms were less accessible. All three sections of the survey were aimed at answering the research questions, which sought to find how participants' mental health changed with their relationship to the outdoors, if it varied in different locations, and how the pandemic affected all those aspects. The hypothesis of this thesis was that there is a positive correlation between mental health and outdoor exposure. It was likely that during the pandemic, when people had limited coping mechanisms, those who frequently went outside experienced less intense depressive and anxious episodes.

#### **IV. FUNDING & INSTITUTIONAL REVIEW BOARD**

Funding was provided by the Undergraduate Research Opportunity Program (UROP) which was used to print paper copies of the survey, as gas money to travel to different research

sites, and to compensate participants for taking the survey (10 participants won a \$20 Visa gift card that was sent out in August when the survey officially closed).

The survey required human participants which meant it needed to be submitted to the Institutional Review Board (IRB) before recruiting participants. The IRB approval number is 21-0290. Participants were required to provide informed consent before beginning the survey and if they submitted their email for the gift card drawing, they were redirected to a separate survey to ensure all responses were anonymous.

To recruit participants, I posted flyers with a QR code linked to the survey on public bulletin boards and poles around the CU Boulder campus, Chautauqua hiking area, and local parks in Denver, Boulder, Julesburg, Sterling, and Limon Colorado. These locations were chosen mainly due to population size and places that were deemed Metropolitan or non-Metropolitan areas based on various maps and definitions provided by the U.S. Department of Agriculture (USDA) Economic Research Service (ERS) (2000). In these same places I also approached people in person with a paper version of the survey and offered to read it to them or have them take it on their own if they agreed to participate. All COVID-19 safety precautions at the time were taken, such as wearing masks, staying six feet apart, and cleaning frequently touched items.

Links to the survey were sent out in both the Undergraduate newsletters for the Environmental Studies and English departments at CU Boulder. The survey was also posted to numerous social media platforms including Facebook, Twitter, Instagram, and Reddit (in the subreddit r/samplesize) from my personal accounts which was shared by friends and family. The in-person survey locations were also chosen due to UROP restrictions, which stipulated that recipients of the grant wouldn't be allowed to travel out of state for their research endeavors due

to COVID-19 concerns at the time. This restricted all in-person responses to be Colorado-based, so all out-of-state answers likely came from social media.

## **V. DATA ANALYSIS**

Prior to beginning the analysis, some demographic categories were condensed to streamline the statistical analysis process. I personally went through the data using the search and replace function to find the responses in which participants had selected more than one answer. In the ethnicity demographic category “multi-racial”, was created as an answer to incorporate participants who selected more than one. Similarly, the gender demographic sorted results of participants who selected all their applicable identities were condensed into “man”, “woman”, and “non-binary/third gender”. Lastly, the location demographic was originally broken into four specific types of urban/rural settings but was changed to simply “urban” or “rural” environments. Some responses were deleted completely as they looked to be insincere and had the potential to confound the data. See Appendix A for the full-length survey.

The data analysis was done in Microsoft Excel and R. Pivot tables were made for each survey question in Excel which made data summarization simple. It was then easy to see what questions needed visual representation through graphs or further analytical comparisons to answer the research questions. The main statistical tests were done in R which were the Shapiro-Wilk to test if the data was normally distributed and the Kruskal-Wallis to compare how the data varied across demographics, and because I was under the assumption that the data was non-normal. Tests to compare means were also used to see differences among demographics. These tests also returned a p-value which helped determine if the data was normally distributed or not.

## VI. RESULTS & DISCUSSION

### A. DEMOGRAPHICS

We received a total of 891 responses, but these were condensed down to a total of 776, well above our original goal of 200. When comparing the results from our survey to the literature surrounding mental health and outdoor spaces both before and during the pandemic lockdowns, much of the findings reflected what was previously published in the field.

First, to briefly break down the demographics, the majority of participants were Caucasian, earning middle incomes, and there was about an even ratio of people who identified as men and women. Most people also were employed during the deployment of the survey and found it from a social media site or a link. It would have been ideal to receive an even number of urban and rural participants but 88% of the total participants were from the urban area, which likely skews many of the results that statistically compare how certain survey questions differ between the two locations. Full breakdown of demographics results is outlined below in Table 1.

*Table 1 Demographics*

Demographic	Categories	Percentages
Ethnicity	Caucasian	44%
	Hispanic or Latino/a	20%
	Black/African American	12%
	Asian or Asian American	9%
	Multi-racial	9%
	Native American	6%
Income	\$1 - \$9,999	5%
	\$10,000 - \$24,999	13%
	\$25,000 - \$49,999	31%
	\$50,000 - \$74,999	31%
	\$75,000 - \$99,999	19%
	\$100,000 or more	1%

Location	Urban Rural	88% 12%
Gender	Man Woman Non-binary/third gender	49% 40% 11%
Marital status	Single Married/domestic partnership Divorced Other	50% 40% 8% 2%
Employment status	Employed Not employed	93% 7%
Survey taking method	Social media post Flyer publicly posted In-person Campus newsletter	55% 25% 14% 6%

**B. MENTAL HEALTH PRE-PANDEMIC**

The section of questions that asked about mental health and outdoor exposure before the pandemic lockdowns began established a baseline to evaluate the general frequency of depression and anxiety outside of the emotionally strenuous environment. As depicted in Figure 1, overall, about 56% of participants agreed they experienced depressive and anxious feelings before the lockdowns began. This result becomes important when looking at Table 2 which covers the way mental health professionals addressed pre-pandemic coping mechanisms (50.57% of the total participants said they saw a mental health professional before the pandemic began). Within this population that saw a mental health professional, 88.05% of participants said the professional recommended going outside and 87.6% said that going outside helped them. This parallels other studies I found that link outdoor exposure to improved mental state without the stressors of a global pandemic (Bratman et al., 2019; Capaldi et al., 2014).



Figure 1 Responses asking participants about depression and anxiety before the pandemic began

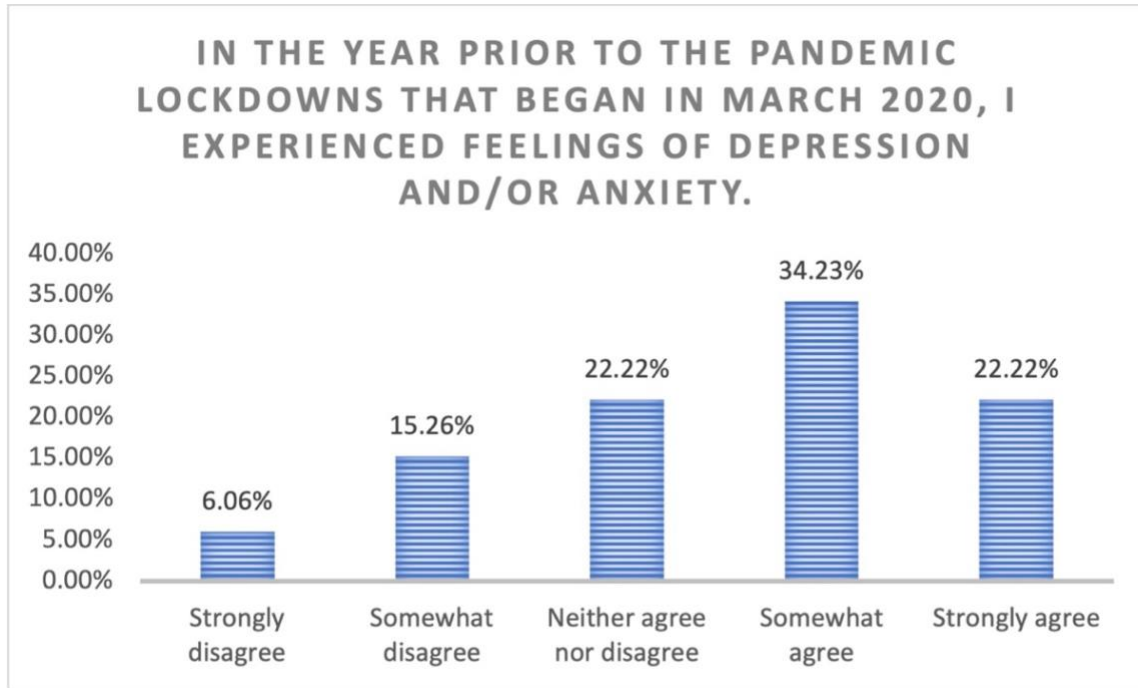


Table 2 Responses from people who saw a mental health professional before the pandemic began

Survey Question	Yes	No	Not sure
Did they recommend going outside?	88.05%	9.07%	2.88%
Did going outside help?	87.58%	9.09%	3.33%

### C. MENTAL HEALTH DURING PANDEMIC

When comparing Figure 1 with Figure 2, it shows that the pandemic had a negative impact on mental health as a little more than 75% of participants agreed their feelings of depression and anxiety got worse during the lockdowns. This is further confirmed by Figure 3 which depicts changes in the frequency of emotions associated with depression and anxiety. The results show that overall, at least 40% of participants experienced increases of boredom, fear, restlessness, irritability, lethargy, stress, anger, and difficulty sleeping during the pandemic lockdowns when compared to participants' baseline levels from before COVID-19 restrictions

began. Figure 3 also shows that the most common change in emotions was an increase, further confirming that these results are consistent with other studies that discuss the worsening change in psychosocial disorders such as stress, anxiety, and depression associated with the pandemic lockdowns (Javed et al., 2020).

Figure 2 Results from asking participants if depression and anxiety worsened during the pandemic

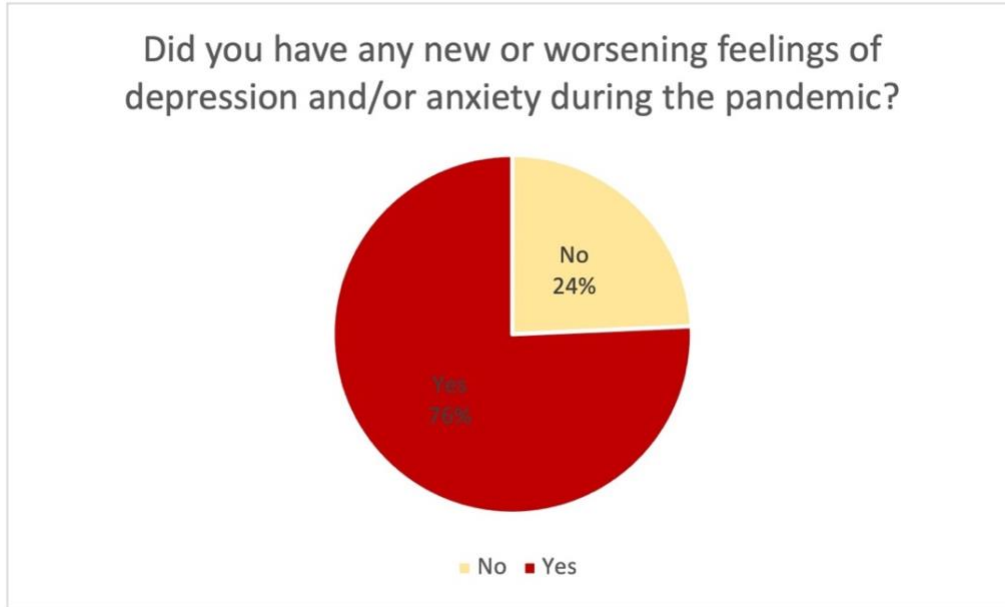


Figure 3 Change in emotions associated with depression and anxiety during the pandemic lockdowns

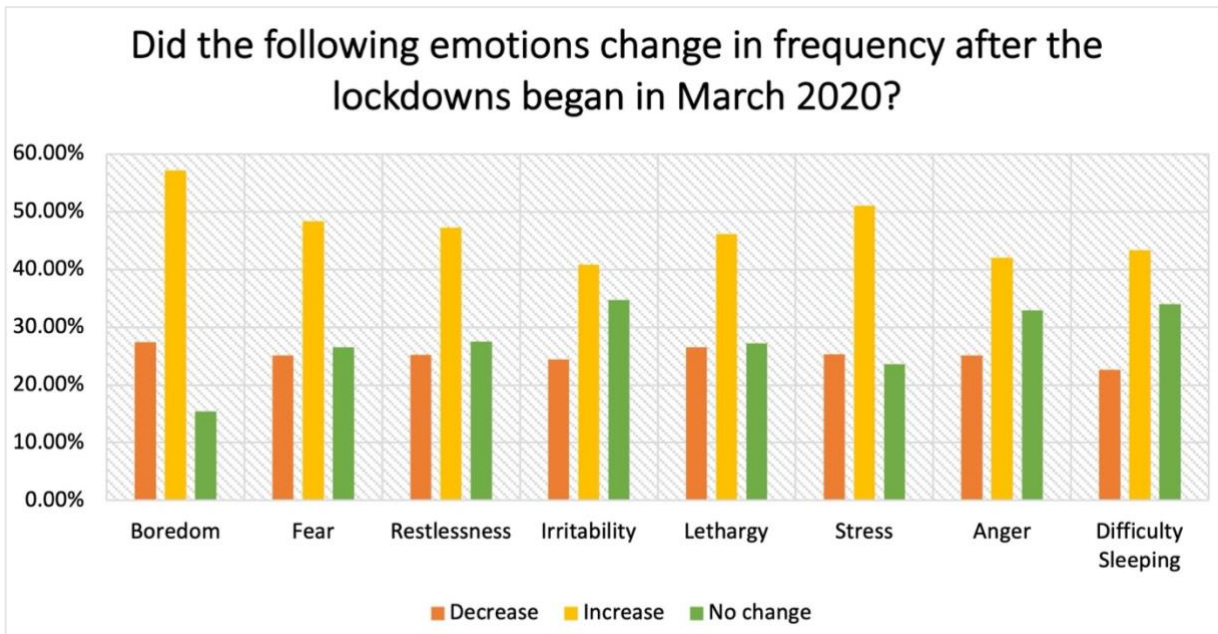


Table 3 shows the main coping mechanisms used to treat depression and anxiety that were mentioned in the existing literature parallel our participants' answers. New hobbies, online connections, and going outside were highly recommended (Javed et al., 2020; Raj & Bajaj 2021). About 36% of participants from our survey said they picked up a new hobby while taking a daily outdoor walk ranked second highest at about 24%. What makes this result more compelling is that people went outside less during the pandemic compared to before as seen in Figures 4 and 5. Our results indicate that before the pandemic began, almost 40% of people went outside for more than ten minutes a day, but once the lockdowns began that number decreased by about 15%. This might be due to the government closures of indoor recreation places. The assumption is that more people turned towards walks in parks, or nature trails for recreational purposes (Reid et al., 2021) however most metropolitan areas lack an abundance of those places (Chen et al., 2020). Since most of the participants from the survey are from urban areas, their decrease in outdoor activity due to an overall lack of green spaces in their area makes sense

*Table 3 Responses asking participants what new coping mechanisms they picked up during the pandemic to supplement the loss of others*

New type of coping mechanism	Percentage
Picked up a new hobby	35.60%
A daily outdoor walk	23.67%
Virtual exercise classes	18.54%
Zoom / online get togethers	17.32%
No change / no added coping mechanisms	4.30%
Other	0.58%

As mentioned, there was a general decline in the total time spent outdoors (Reid et al., 2021; Heo et al., 2021) once the pandemic began as seen in figures 4 and 5. This is interesting when paired with Table 4 which depicts how people felt about the outdoors when the pandemic started. Table 4 shows that the majority of people (76% of the total) did agree that the outdoors became more important to them as a supplement for the other coping mechanisms they lost during lockdowns. The table also shows that 73% of participants agreed that going outside during lockdowns improved their mood. Because of the decrease in time spent outside (figures 4 and 5), it is important to recognize how beneficial the outdoors really was to participants because even though their frequency of going outside decreased, they still found going outdoors to be very important as it helped to improve their moods.

Figure 4 Frequency of participant's time spent outside for more than 10 minutes before and during the pandemic

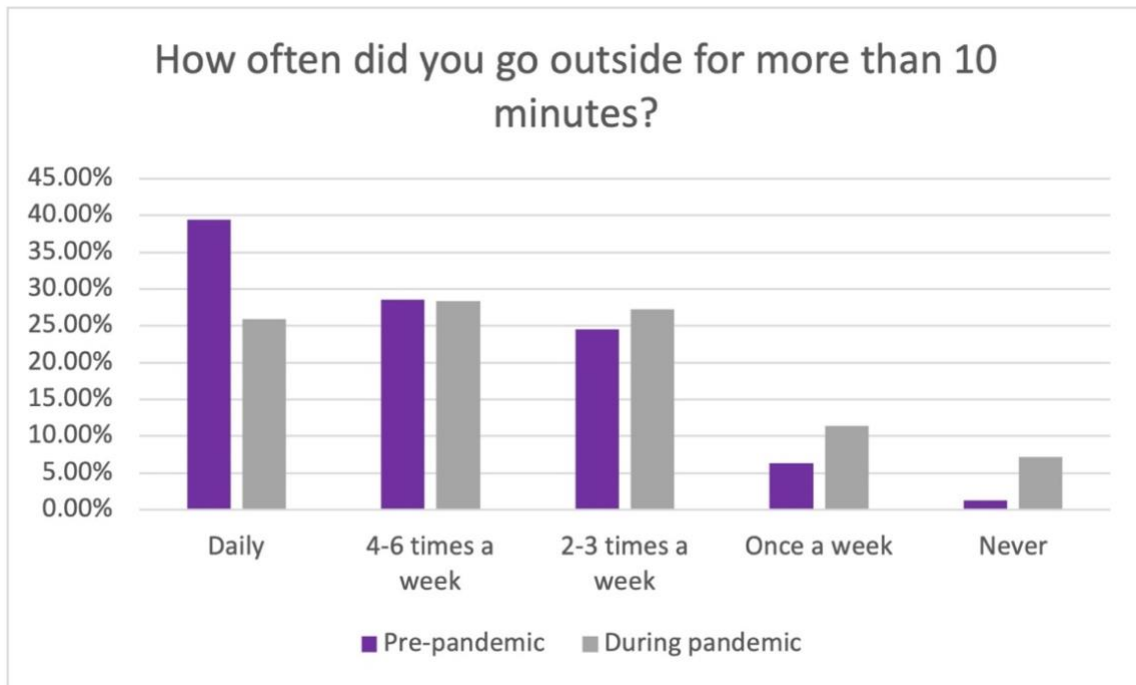


Figure 5 Frequency of participant's time spent outside for more than 10 minutes before and during the pandemic

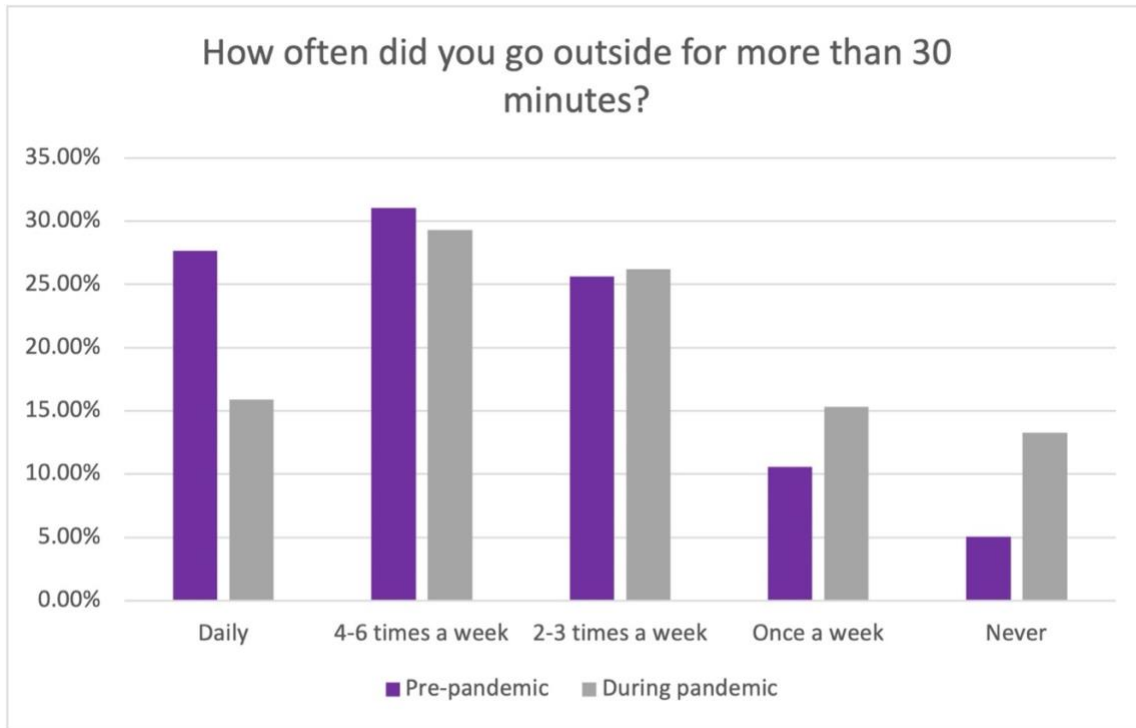


Table 4 Answers to questions asking about participants' relationship with the outdoors as a coping mechanism during the pandemic

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
The permissible outdoor walk/time outside became more important to me as other coping mechanisms were restricted.	31.56%	44.27%	19.64%	4.31%	0.23%
Going on a walk, exercising, or getting outside generally helped to improve my overall mood during the lockdowns.	34.77%	38.05%	20.95%	6.00%	0.23%

**D. THE PANDEMIC'S EFFECT ON MENTAL HEALTH ACROSS URBAN AND RURAL COMMUNITIES**

The final area of interest for this thesis was how these connections between mental health and outdoor exposure varied between urban and rural settings. Generally, there is consensus that residents of urban areas, mainly cities, benefit less from the positive influence greenery has on mental health simply because there is a lack of it in urban locations (Bil et al., 2021). This survey returned similar results, as seen in Figures 6 and 7. Figure 6 shows that on average, 65% of participants who lived in urban settings did experience worsening feelings of depression and anxiety, compared to only 27% of those who lived in rural settings during the lockdown period. Figure 7 shows how the outdoors affected participants; looking at the column on the left, on average 32% of people living in urban areas strongly agreed that the outdoor walk became more important as other coping mechanisms were less available. In this same figure, the column on the right confirms that 35% of urban residents strongly agreed their mood improved from getting outdoors when compared with the smaller 1% of rural residents that also strongly agreed.

Figure 6 Proportions of people who said "Yes" to the question: Did you have any new or worsening feelings of depression and/or anxiety during the pandemic? in both urban and rural environments. Accompanying p-value is 0.02.

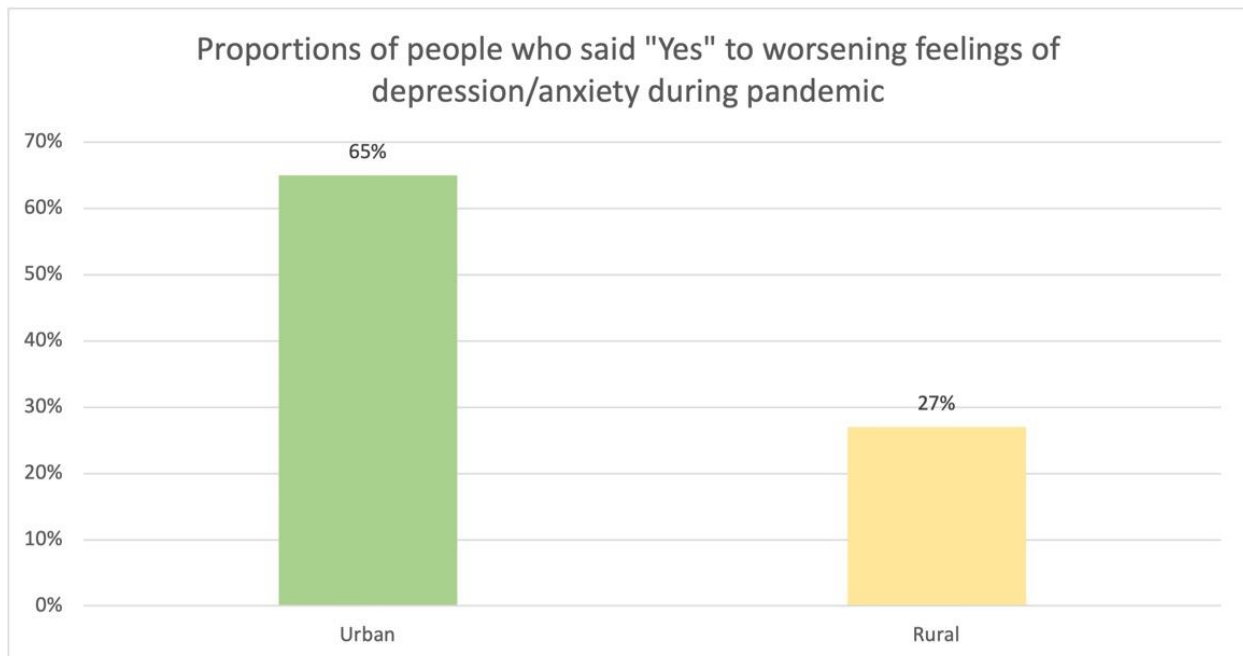
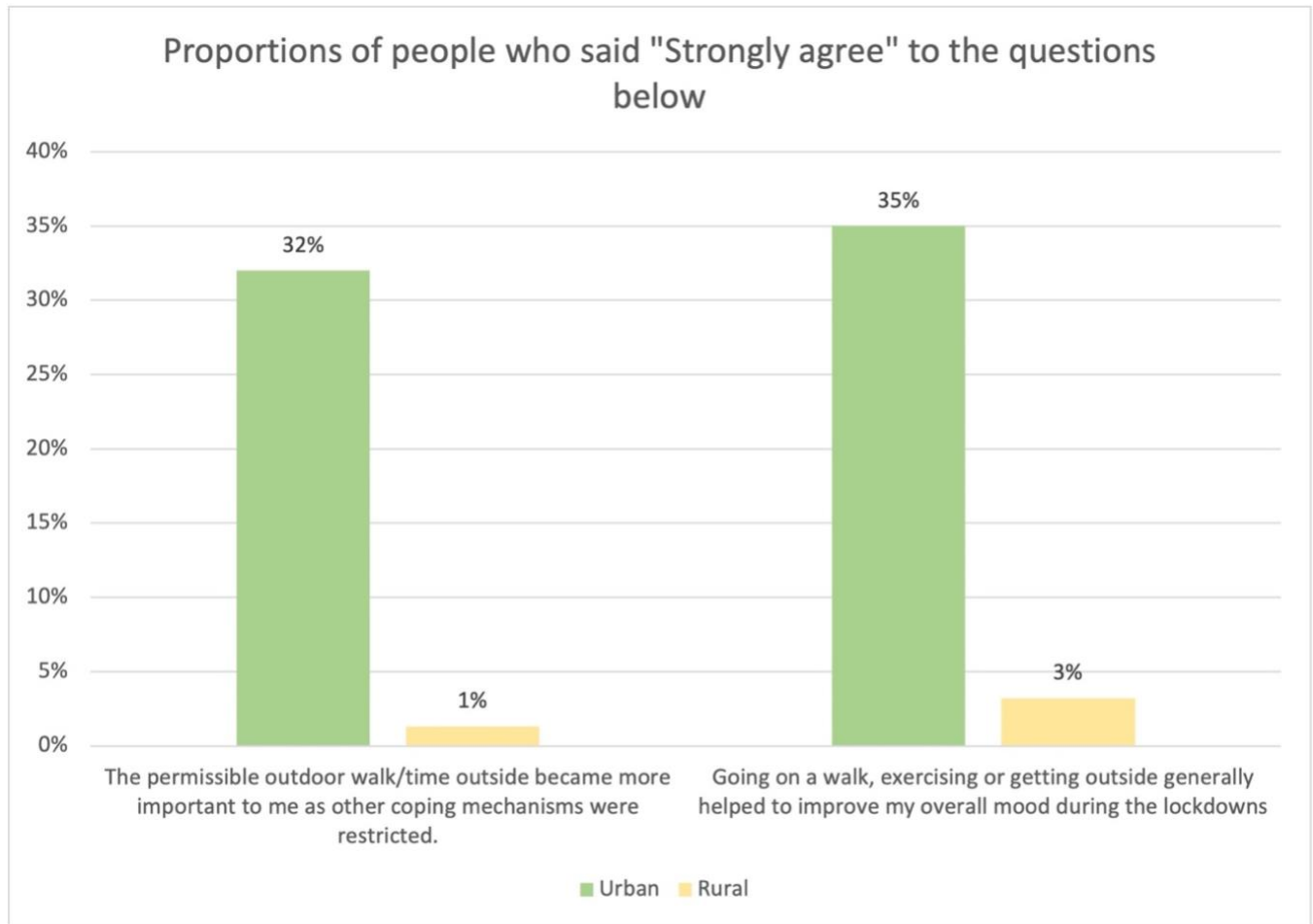


Figure 7 Proportions of people across urban and rural communities that said they "strongly agree" with the two statements below. Accompanying p-values are 0.001 (left section of columns) and 0.02 (right section of columns).



## VII. RESEARCH LIMITATIONS

While these findings reflect what’s in the current literature, there were a few limitations in this study. Firstly, the research questions could have been answered better if the survey questions asking about mental health and the relationship with the outdoors both before and during the pandemic were more consistent. For example, in the first section of the survey, focusing on a year before the lockdowns began, participants were asked if they saw a mental health professional and if that mental health professional recommended going outside as a coping mechanism. It would have been interesting to see how mental health professionals were

utilized during the pandemic (i.e., if there was an increase in patients due to worsening mental health or a decrease because people could no longer afford to go to them), and if their recommendations to go outside as a coping mechanism changed while under lockdown. Similarly, the question asking if going for a walk improved overall mood was only asked within the context of the pandemic lockdowns, but it would have been ideal to ask the same question in the pre-pandemic context as well.

The percentage of people living in urban versus rural locations also provided a limitation. Because the data was so unevenly distributed, with 88% of participants being from an urban area, this skewed the results for further data analysis, especially for the comparisons of certain survey questions across the location demographic. Ideally, there would be about 50-50 split between the two locations for more concise data analysis.

Another notable limitation is the role social media played in getting survey answers. The majority of survey responses came from social media or a link, which presents a few issues. The participants who took the survey via links I sent out from my personal social media accounts likely were biased because the majority of my friends and family that interact with my profiles have similar views on the issues brought up in the survey that I do.

A problem that came from posting it to the large social media platform Reddit made it hard to monitor the sincerity of people online, meaning many of them could have lied about their age and country in order to take the survey. Along those lines, this made it easy for people to answer any of the questions dishonestly which would further skew the sincere responses. Since the survey was posted to r/samplesize on Reddit, this doesn't make the survey population truly random as the main reason why people join that subreddit is because they are interested in taking surveys and collecting rewards. Bots are also an issue to be aware of when posting anything to a



large social media platform; they can easily bypass survey inclusion barriers, such as questions requiring certain ages and countries of origin to take them and then submit random computer-generated responses acting as a human.

The time the survey was deployed also posed some limitations. It was sent out in late June 2021. This was a full year after the pandemic lockdowns first began in March 2020 by the survey's definition. Due to the long period of time between when lockdowns were enforced and when people took the survey, it's probable that participants didn't have the most accurate recollection of what was going on during that time. This includes things like their mental state, changes in hobbies, and time spent outdoors.

Despite these limitations, this research still demonstrates how the pandemic negatively affected participants' mental health, how their coping mechanisms changed during the lockdowns, and how getting outdoors become more important and helped improve mental health in different locations.

## **VIII. RECOMMENDATIONS**

After looking at the existing literature surrounding mental health during the pandemic, and mental health changes with outdoor exposure, I recommend integrating more natural scenery and environments in densely packed cities. The results from the survey indicate that participants living in urban areas experienced higher levels of depression and anxiety. It's also important to recognize the trend that urban residents reported feeling their outdoor time became more important to them as a coping mechanism when the lockdowns restricted others. Urban residents said their outdoor time was more helpful to their mental health when compared to the rural residents.

My hope is that these conclusions can help politicians, architects, landscape design planners, or other influential decision-makers in creating a less stress-inducing environment. This idea of implementing more natural aspects into everyday life to improve mental health can also apply to any place looking to reduce their stressful environment such as job interview waiting rooms, doctors' offices, or even just around the household. It would be great if more professional institutions and individuals understand how beneficial it is for people to have consistent exposure to nature and that integrating more of this will improve the overall mental health of people, especially those living in urban areas.

## **IX. CONCLUSION**

When the novel coronavirus first caused stringent nationwide lockdowns in March of 2020, there was a decline in people's mental health. This study found that before the lockdowns began participants generally used and enjoyed the outdoors as a coping mechanism for depression and anxiety. Once the pandemic began, people were going outside less, but still found activities such as going on an outdoor walk to be beneficial to their health. When comparing the effect of the pandemic lockdowns with location, more people living in urban areas reported worsening feelings of depression and anxiety than those living in rural areas. This thesis was conducted with the intent of understanding if exposure to natural environments improves the mental state of people with depression and/or anxiety, especially within the context of the pandemic lockdowns. Our results confirm that going outside is a beneficial coping mechanism for psychosocial disorders that worsened due to the lockdowns, especially in urban areas where participants had less access to natural environments.

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## **XII. APPENDIX**

### **A. QUALTRICS SURVEY**

#### **Block One: Consent form**

##### **INFORMED CONSENT**

###### **Purpose of the Study:**

The purpose of the study is to investigate how the relationship between outdoor recreation and green scenery influences mental health. This study is going to look at the effect and importance the natural world has before and during the pandemic. It will also examine how people typically coped with depression and anxiety prior to the Covid-19 lockdowns, under the restrictions in March 2020 to a year later in March of 2021. Our primary objective is to understand how the methods of coping changed before and during the pandemic, and if there's been a change in the importance of the outdoors and its influence on the aspects of mental health.

###### **Background research:**

This past year, there has been research on how the pandemic can affect mental health. Such psychosocial concerns come in the form of depression, anxiety, insomnia, and increased substance use among others. Pre-pandemic research confirms that in general, more access to open spaces and even just seeing greenery was proven to increase people's self-perceived status of mental health.

We expect that you will be in this research study for about 5- 10 minutes.

We expect about 150 people will be in this research study.

###### **Explanation of Procedures:**

The research procedure will occur as a survey, taken only once with no follow-ups. The survey should take between five to ten minutes and will ask questions about general demographics (age, gender, race, etc.), any mental health issues before and during the lockdowns, and the coping mechanism used to remedy those issues, with a few specific questions relating to the relationship outdoors. The research will take place during the months of June, July, and August. The survey should take about five to ten minutes to complete. You may interact with an enumerator if the survey is being administered in person. The survey can also be accessed through a URL or QR code the enumerator will provide. All data will be collected from the completed surveys.

###### **Voluntary Participation and Withdrawal:**

Whether or not you take part in this research is your choice. You can leave the research at any time and it will not be held against you. If you are a CU Boulder student or employee, taking part in this research is not part of your classwork or duties. You can refuse to enroll, or withdraw



after enrolling at any time, with no effect on your class standing, grades, or job at CU Boulder. You will not be offered or receive any special consideration if you take part in this research.

Confidentiality:

Information obtained about you for this study will be kept confidential to the extent allowed by law. Research information that identifies you may be shared with the University of Colorado Boulder Institutional Review Board (IRB) and others who are responsible for ensuring compliance with laws and regulations related to research, including people on behalf of the Office for Human Research Protections. The information from this research may be published for scientific purposes; however, your identity will not be given out. If you decide to give us your name and email, there is a possibility that the information may be released if the data is accessed by someone unauthorized or stolen.

Payment for Participation:

If you agree to take part in this research study and provide your name and email, you will be entered into a drawing for a \$20 Visa gift card. The drawing will take place at the start of August and if you choose to enter your email information, I will reach out to you if you are a winner.

Questions:

If you have questions, concerns, or complaints, or think the research has hurt you, talk to the research team at limi6880@colorado.edu and Karen.Bailey@Colorado.EDU This research has been reviewed and approved by an IRB. You may talk to them at (303) 735-3702 or irbadmin@colorado.edu if:

- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.
- You have questions about your rights as a research subject.
- You want to get information or provide input about this research.

By clicking the "yes" option below, I agree that I have read the above description and want to participate in the research survey.

- Yes
- No

**Block Two: Demographics**

Are you 18 years old or older?

- Yes
- No

Are you currently living in the United States?

- Yes
- No

What is your ethnicity?

- Hispanic or Latino/a
- Caucasian
- Black/African American
- Asian or Asian American / Pacific Islander
- Native American / American Indian
- Prefer not to say
- Other (write below)

What gender do you identify as? (select all that apply)

- Man
- Woman
- Non-binary / third gender
- Transgender
- Cisgender
- Prefer not to say
- Other (write below)

Are you currently classified as a "dependent"? (do your parents claim you on their tax returns)

- Yes
- No
- Not sure

What is your marital status?

- Single
- Married / domestic partnership
- Divorced
- Widowed
- Other

Are you currently employed?

- Yes
- No

What is your combined household annual income? (If you're a dependent add your parents income / if you're married include your partners income)

- \$1 - \$9,999
- \$10,000 - \$24,999

- \$25,000 - \$49,999
- \$50,000 - \$74,999
- \$75,000 - \$99,999
- \$100,000 or more

Where do you currently live?

- City / Metro area (Urban)
- Suburban / City adjacent (Urban)
- Farmland with more than 5 acres of green space owned (Rural)
- Small town with a population between 2,500 - 9,999 people (Rural)

How did you come to take this survey?

- Was approached in person
- Flyer posted on bulletin board, light post / telephone pole, or local advertising area
- Social media post
- Campus newsletter email

### **Block Three: Mental health a year before the pandemic began in March 2020**

This section focuses on your **mental health a year prior to the pandemic lockdowns** that began in March 2020

To what extent do you agree with the following statement?: In the year prior to the pandemic lockdowns that began in March 2020, I experienced feelings of depression and/or anxiety.

- Strongly agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Strongly disagree

A year prior to the pandemic lockdowns, about how often did you experience the following emotions?

- Boredom
- Fear
- Lethargy (lacking energy and enthusiasm)
- Restlessness
- Stress
- Anger
- Irritability
- Difficulty sleeping

What coping mechanism did you use to remedy the previous emotions? (select all that apply)

- Engaging in hobby (arts and crafts, gaming, reading, etc.)
- Self-care (shopping, a relaxing bath, spa day, etc.)
- Exercise
- Drinking and/or smoking nicotine products
- Recreational drugs
- Going outdoors (hiking, biking, walking, picnic, park, etc.)
- Spending time with friends and family
- Other (write below)

A year prior to the pandemic lockdowns, did you talk to a mental health professional about any of the previously mentioned emotions?

- Yes
- No

How often did you see the mental health professional?

- Once a week or more
- Every other week
- Once a month
- Less than once a year
- A few times a year

Did they recommend going outside as a coping mechanism?

- Yes
- No
- Not sure

Did you feel as though going outside helped you?

- Yes
- No
- Not sure

What were some of their most helpful recommended coping mechanisms?

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This section of questions focuses on your relationship with the **outdoors** a year prior to the **pandemic** lockdowns in March of 2020.

To what extent do you agree with the following statement?: Spending time outdoors is something I enjoy.

- Strongly agree
- Somewhat agree

- Neither agree nor disagree
- Somewhat disagree
- Strongly disagree

To what extent do you agree with the following statement?: Going outside is one of my preferred coping mechanisms for depression and/or anxiety.

- Strongly agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Strongly disagree

How often did you go outside for more than 10 minutes?

- Daily
- 4-6 times a week
- 2-3 times a week
- Once a week
- Never

How often did you go outside for more than 30 minutes?

- Daily
- 4-6 times a week
- 2-3 times a week
- Once a week
- Never

#### **Block Four: Mental Health During the Pandemic**

This section focuses on your mental health during the pandemic lockdowns (between March 2020 and March 2021 or whenever your state ended restrictions).

Did you have any new or worsening feelings of depression and/or anxiety during the pandemic?

- Yes
- No

Did the following emotions change in frequency after the lockdowns began in March 2020?

- Boredom
- Fear
- Lethargy (lacking energy and enthusiasm)
- Stress
- Restlessness
- Anger

- Irritability
- Difficulty sleeping

To what extent do you agree with the following statement?:

The coping mechanisms previously relied on before the pandemic became more restricted or less accessible during lockdowns.

- Strongly agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Strongly disagree

To what extent do you agree with the following statement?: Going on a walk, exercising or getting outside generally helped to improve my overall mood during the lockdowns.

- Strongly agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Strongly disagree

What new coping mechanisms, if any, did you pick up to supplement the loss of others?

- Zoom / online get togethers
- Picked up a new hobby (puzzles, home improvement, crafts, etc.)
- A daily outdoor walk
- Virtual exercise classes
- No change / no added coping mechanisms
- Other (write below)

This section focuses on your relationship with the **outdoors during the pandemic lockdowns** (between March 2020 and March 2021 or whenever your state ended restrictions).

If state regulations allowed it, was it recommended by your local government or other authorities that you spend some time outside to exercise yourself, pets, or to get a change of scenery?

- Yes
- No
- Not sure

The permissible outdoor walk/time outside became more important to me as other coping mechanisms were restricted.

- Strongly agree
- Somewhat agree
- Neither agree nor disagree

- Somewhat disagree
- Strongly disagree

How often did you go outside for more than 10 minutes?

- Daily
- 4-6 times a week
- 2-3 times a week
- Once a week
- Never

How often did you go outside for more than 30 minutes?

- Daily
- 4-6 times a week
- 2-3 times a week
- Once a week
- Never

**Block Five: End**

The purpose of this survey is to determine if you experienced any changes in mental health associated with spending time outdoors during the pandemic lockdowns.

Do you have anything you'd like to add that wasn't brought up in the survey?

- Yes (write below)
- No

Would you like to be entered into the drawing for a \$20 Visa gift card?

- Yes
- No

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