# The role of health and wellbeing in shaping local park experiences during the COVID-19 pandemic

**Abstract**

Parks and protected areas (PPAs) serve a critical role in society as natural reprieves for restoring both mental and physical health. The restorative power of nature was even more evident during the COVID-19 pandemic, when visitation to local PPAs increased dramatically. Resource managers within local PPAs are growing concerned regarding the influence of increasing recreation visitation levels upon health, wellbeing, and overall visitor experience quality. This study examined the influence of social, ecological, and situational factors on visitors' health, wellbeing, and satisfaction in a local PPA setting in New England. On-site intercept surveys were conducted with local PPA visitors from September 2020 to August 2021 (n=539) across both spatial and temporal scales. Structural equation modeling and binary logistic regression analyses suggest that social, situational, and ecological factors were significant predictors of visitor health, wellbeing, and overall satisfaction. Health outcomes (e.g., health improvement) fully mediated the relationship between situational factors (e.g., signage, COVID-19 visitation) and satisfaction and partially mediated the relationship between social factors (e.g., crowding, place attachment) and satisfaction. While ecological factors (e.g., trail and resource degradation) had no direct relationship with health outcomes, they showed a strong negative relationship with visitor satisfaction. Study findings suggest that as local PPA visitation increased during the pandemic, health outcomes also increased significantly, serving to mitigate certain negative impacts, and ultimately enhance overall experience quality. These findings lend themselves to an integration of health and wellbeing, visitor use management, and social-ecological systems conceptual frameworks and provide critical theoretical and managerial insights.

**Management Implications**

This study found that as local park and protected area visitation (PPA) increased during the pandemic, health and wellbeing outcomes also increased significantly, serving to mitigate certain negative impacts, and ultimately enhance overall experience quality. Results indicate additional signage, increasing sense of place, and reducing ecological impacts should be top priorities for resource managers. Finally, study findings validate the critical role that local PPAs and resource managers play in providing opportunities for enhanced health and wellness, particularly during a global pandemic, epitomizing the mantra healthy parks and healthy people.

**Keywords**: Outdoor Recreation; Visitor Use Management; Health Outcomes; Social-Ecological Systems; COVID-19 Pandemic; Parks and Protected Areas

## 1.0 Introduction

A large body of evidence and theories posit a strong connection between nature, human health, and wellbeing (Bratman et al., 2019; Kaplan, 1995; Ulrich, 1991; Wilson, 1984). During the recent COVID-19 pandemic outdoor spaces like parks and protected areas (PPAs) provided countless individuals with a safe place to engage in outdoor recreation activities. Results from a national panel demonstrate that 20% of respondents did not participate in outdoor recreation but began during the pandemic (Taff et al., 2021). In a review on nature engagement during the pandemic (Labib et al., 2022), spending time in the outdoors correlated with decreased mental health symptoms, increased activity, and improved wellbeing (Labib et al., 2022). The authors of the review suggest nature exposure safeguarded against negative mental and physical health outcomes during the pandemic. Numerous studies have also demonstrated a significant growth in visitation to PPAs during the pandemic (Ferguson et al., 2022b; Rice & Pan, 2021). This visitation growth is a possible concern for resource managers that aim to maintain ecological integrity as well as high-quality visitor experiences and physical and mental health outcomes.

Because of the ecosystem services, or benefits, that PPAs provide to human health and wellbeing, PPAs, especially small local PPAs, are considered an essential element of public health (Romagosa, Eagles, & Lemieux, 2015). Thus, it is important to consider the factors which might influence high-quality visitor experiences and health outcomes in small local PPAs. Recently, researchers in the field of outdoor recreation have begun to examine visitor behaviors and experiences through the lens of social-ecological systems (Morse, 2020). This framework considers a more broad and holistic approach to examining outdoor recreation through a multi-system and -scale lens (Ferguson et al., 2022a). These separate yet interconnected and adaptive systems and sub-systems (e.g., social, situational, and/or ecological systems) often span various scales (e.g., spatial, temporal, topical) as well, adding to their applicability in PPA settings (Ferguson et al, 2020).

This study examined the influence of social, ecological, and situational factors on visitors' health, wellbeing, and satisfaction across both spatial and temporal scales. The study context is a local PPA proximate to a major New England university, referred to in this study as College Woods (CW). Resource managers and visitors alike have grown concerned regarding the impacts of various social (e.g., crowding and place attachment), situational (e.g., signage and the COVID-19 pandemic) and ecological (e.g., trail and resource degradation) factors upon visitors' health outcomes and experience quality. While this concept has been suggested in the literature, this is one of the first studies to examine the influence of social, situational, and ecological systems upon health outcomes and experience quality in a local PPA setting in New England. Our study examines these phenomena and expands on the social-ecological systems, outdoor recreation, and public health frameworks and literatures. This study examined the following research questions:

**$R^1$:** To what extent are visitors attaining health outcomes at CW?
**$R^2$:** To what extent are visitors impacted by social, situational, and ecological factors at CW?
**$R^3$:** What is the relationship between social, situational, and ecological factors, health improvement outcomes, and overall satisfaction at CW?
**$R^4$:** What is the influence of social, situational, and ecological factors upon health outcomes at CW?

## 2.0 Literature Review

### *2.1 Health and Nature*

A few theories operationalize the link between nature and positive health outcomes for humans. Biophilia suggests humans have a genetic link to nature and have evolved to have love or affinity for all living things (Wilson, 1984). Stress-restoration theory hypothesizes that viewing or being in natural green spaces can improve attention and cognition and decrease stress (Ulrich et al., 1991). Kaplan's (1995) attention restoration theory posits that nature experiences can aid in recovery from mental fatigue. A growing body of literature has examined these theories or generally tested the idea that nature is positively linked to human health and wellbeing (see reviews: Bratman et al., 2019; Van den Bosh & Sang, 2017). Contact with nature can improve cognition (Abbott et al., 2016), decrease stress (Bratman et al., 2019), and reduce disease and morality (James et al., 2015).

The COVID-19 pandemic was an unprecedented global crisis that had a profound impact on social structures, the economy, health care, and more (Kumar et al., 2021). Research perspectives also pivoted to focus on the impact of the pandemic on various aspects of life. This has been a valuable time to assess the connection between human health and wellbeing. While the virus itself posed obvious threats, lockdowns and behaviors that aimed to reduce virus transmission led to some secondary threats to human health, such as increased depression, loneliness, inactivity, and more (Salari et al., 2020; Violant-Holz et al., 2020). Several studies have identified the positive influence of contact with nature on health during the pandemic, including its effects on stress, anxiety, affect, physical activity, and general wellbeing (Reviewed by Labib et al., 2022). This review (Labib et al., 2022) found a strong and reliable connection between nature and mental health, even suggesting that contact with nature played a significant role in preventing further health problems for many individuals. Because of the important health benefits that PPAs provide, assessing the role of social, situational, and ecological factors in health outcomes is valuable to recreationists, resource managers, policymakers, and the public.

Recreation benefits, including health, have been examined thoroughly in the recreation literature, and these benefits often refer to an improved condition, prevention of a worse condition, or a satisfying psychological experience (Driver, 1998; Driver et al., 1991). Subsequently, perceived health outcomes are derived from the benefits literature as a visitor's health condition may be improved, preventively cared for, and/or psychologically satisfied in a PPA setting (Gomez et al., 2016). Thus, health outcomes refer to changes in health as a result of specific health benefits, investments, and/or interventions. To reliably assess perceived health outcomes in PPA settings, researchers developed the Perceived Health Outcomes of Recreation Scale (PHORS) (Gomez et al., 2016; Hill & Gomez, 2020). Accordingly, PHORS and other various health outcome assessments have demonstrated to be reliable and valid in numerous recreation studies, particularly within the context of overall satisfaction and experience quality. For instance, recent research determined a strong positive relationship between perceived health outcomes and overall satisfaction (Li & Wang, 2012; Serdar, 2021; Wolsko et al., 2019). As such, perceived health outcomes scales serve a critical linkage between the worlds of PPA and health research.

### *2.1 Social-Ecological Systems*

The social-ecological systems (SES) conceptual framework provides an interdisciplinary approach to outdoor recreation research and management, with roots in the environmental sciences (Herrero-Jáuregui et al., 2019; Morse, 2020). SES encompasses the dynamic interplay between social and ecological factors at various levels of interaction within a given system and associated subsystems (Anderies et al., 2004; Morse, 2020; Morse et al., 2013). Historically, outdoor recreation research in PPAs has focused on investigating social factors, often at one point in time , within one singular location. The SES conceptual framework, however, serves to integrate the complex interactions between both social *and* ecological systems, across multiple scales and feedback loops (Anderies, et al., 2004; Ferguson et al., 2022a; 2022b; 2023c; 2023; Herrero-Jáuregui et al., 2019; Morse. 2020; Starbuck, et al., 2006). Moreover, SES serves to expand recreation visitor use management frameworks by integrating multiple levels of interactions (e.g., social, ecological, health) across multiple scales (e.g., spatial, temporal). Thus,

SES offers an ideal conceptual framework for a proactive and systems approach to PPA research and management (Ferguson et al., 2022a; Morse, 2020; Partelow, 2018).

### *2.2 Social Factors*

PPA visitors are often presented with numerous social factors such as crowding, long lines, conflict, and other various human interactions when engaging in outdoor recreation experiences. Collectively, social factors are defined as the interactions a visitor shares with other people, directly or indirectly (Gartner & Lime, 2000; Manning, 2000). These interactions have the potential to influence visitors' perceptions, behaviors, and overall experience quality (Manning, 2011; Miller & McCool, 2003). Crowding is a prevalent social factor within outdoor recreation settings and is defined as the "level of visitor use beyond which the quality of the outdoor recreation experience is diminished to an unacceptable degree" (Manning, 2011, p. 98). Further, research has determined that perceptions of crowding can influence visitor health outcomes and overall satisfaction. For instance, empirical evidence has determined that crowding can pose a significant negative influence upon perceived and actual health outcomes (Evans & Lepore, 1992; Godbey, 2009; Profumo et al., 2021) as well as overall satisfaction (Tseng et al. 2009; Zehrer & Raich, 2016).

### *2.3 Situational Factors*

Outdoor recreation visitor experiences have also been influenced by various situational factors within PPAs. Situational factors refer to contextual elements within a specific setting that can influence visitor perceptions and evaluation of the experience (Gartner & Lime, 2000; Ferguson et al., 2022a; Miller & McCool, 2003). Some of the most common and relevant situational factors include available information and signage as well as the COVID-19 pandemic (Bose et al., 2020; Ferguson et al., 2022b; 2023; Needham & Szuster, 2011; Gramann et al., 1995; Taff et al., 2017). Numerous studies have investigated the influence of signage as well as the pandemic upon both health outcomes and visitor experiences. For instance, research has determined that inadequate signage can negatively influence the visitor experience (Findlay, 2004), while proper signage can have a positive influence upon overall experience quality as well as physical health outcomes (Bose et al., 2020; Taff et al., 2017). More recently, a growing body of research suggests the pandemic may influence various negative and positive health and experience outcomes in PPA settings (Ferguson et al., 2023; Jackson et al., 2021; Rice et al., 2020).

### *2.4 Ecological Factors*

Ecological factors are ever present in outdoor recreation contexts and often serve as the primary draw within many PPA settings. In broad terms, ecological factors refer to elements of the natural environment which visitors may influence and interact with while recreating (Moore & Driver, 2005; Moore, 2012). The most common ecological factors within PPA settings are resource quality, trail quality, and litter. Numerous studies have determined that the quality of the overall natural resource (e.g., flora and fauna) and trails can influence visitor health outcomes and satisfaction (Profumo et al., 2021; Tseng et al., 2021; Zehrer & Raich, 2016). For instance, research suggests resource and trail degradation (e.g., roots, erosion, social trails, mud) may significantly influence perceptions of experience quality (Manning, 2011; Lynn & Brown, 2003) and possibly the attainment of health outcomes (Gomez et al., 2016). Further, a wide array of studies found that the presence of litter in a natural setting may have a disproportionately negative influence upon the visitor experience and/or health outcomes (Gartner & Lime, 2000; Manning, 2011; Miller & McCool, 2003; Moore et al., 2012). For instance, when presented with various forms of environmental degradation, PPA visitors consistently report litter as the most impactful element to their experience quality (Botero et al., 2017; Romo et al., 2019; Moore et al., 2012).

### *2.5 Place Attachment*

For many PPA visitors, outdoor recreation is about more than just the activity but also the place and location itself (Manning, 2011). Humans naturally develop emotional attachments with the people,

places, and things they interact with (Majeed & Ramkissoon, 2020). Place attachment refers to the emotional bond between an individual and a place which encapsulates the emotional and symbolic meaning the individual associates with the setting (Manning, 2011). As a construct, place attachment often broadly represents the sub-constructs of place dependence, place identity, and community and social bonding (Kyle et al., 2004; Manning, 2011). Combined, these concepts have been heavily researched in the PPA literature, particularly within the context of health outcomes and overall satisfaction. For example, numerous studies have determined a strong positive relationship between place attachment and health motivations (Kyle et al., 2004; Manning 2011). Moreover, a meta-analysis of 124 studies determined that visitors' perceived health benefits within a PPA setting often lead to an emotional attachment within that same setting (Majeed & Ramkissoon, 2020). Thus, place attachment carries with it an implied emotional weight that often influences visitor perceptions of both satisfaction and health outcomes.

### *2.6 Satisfaction*

A central goal for resource managers is to provide PPA visitors with high-quality outdoor recreation experiences (Manning, 2011; Miller & McCool, 2003). Within outdoor recreation settings, visitor satisfaction serves as a primary means of assessing experience quality (Bultena & Klessig, 1969; Graefe & Burns, 2013). Satisfaction is frequently defined as the similarity between an individuals' expectations and reality (Bultena & Klessig, 1969; Williams, 1988). For resource managers, accurate assessments of visitor satisfaction and experience quality are essential for informed decision-making and policy design (Graefe & Burns, 2013). Various studies have examined the influence of social factors and health outcomes upon overall satisfaction. For instance, studies have determined an often-positive relationship between health outcomes and satisfaction (Li & Wang, 2012; Serdar, 2021; Wolsko et al., 2019). Accordingly, satisfaction continues to be a critical variable and management criterion when evaluating overall experience quality in PPA settings.

### *2.7 Summary and Research Questions*

Numerous studies have examined the influence of social factors upon health and experience quality (Evans & Lepore, 1992; Godbey, 2009; Manning, 2011; Profumo et al., 2021; Serdar, 2021; Wolsko et al., 2019). Yet relatively few studies have assessed the influence of social, situational, and ecological factors upon perceived health outcomes and overall satisfaction. Our study assessed this gap by examining the influence of social (e.g., crowding and place attachment), situational (e.g., signage and the COVID-19 pandemic) and ecological (e.g., trail and resource degradation) factors upon perceived health outcomes and overall satisfaction, across both spatial (e.g., system-wide) and temporal scales (e.g., across all 4-seasons) at CW, a local PPA in New England. Study findings lend themselves to an integration between SES and visitor use management conceptual frameworks and provide critical theoretical and managerial insights. Rather than hypothesis testing, the goal of our research was to explore the relationships between health, social, situational, and ecological factors. Additionally, we focused on broader questions that were relevant to CW managers. We examined the following research questions (also listed is the research objective associated with each research question):

**$R^1$:** To what extent are visitors attaining health outcomes at CW?

**Objective:** Analyze descriptive statistics of health outcomes measured by the Perceived Health Outcomes of Recreation Scale (PHORS), (Gomez, et al., 2016).

**$R^2$:** To what extent are visitors impacted by social, situational, and ecological factors at CW?

**Objective:** Analyze descriptive statistics of social (place attachment and crowding), situational (COVID-19 and signage), and ecological factors (trail degradation, damage to the resource)

**$R^3$:** What is the relationship between social, situational, and ecological factors, health improvement outcomes, and overall satisfaction at CW?

**Objective:** Employ structural equation modeling to examine the relationships between latent variables (social, situational, and ecological factors, health improvement outcomes) and overall satisfaction.

**$R^4$:** What is the influence of social, situational, and ecological factors upon health outcomes at CW?

**Objective:** Use binary logistic regression to examine how social, situational, and ecological factors contribute to specific health outcomes like health improvement and psychological health outcomes.

## 3.0 Methods

### *3.1 Study Context- College Woods*

College Woods (CW) is an invaluable woodland resource in New England containing more than 230 acres of old-growth forests, streams, and small fields; all of which are owned and managed by a New England University. CW lies on the west edge of campus, which is situated in a rural college town of approximately 15,500 residents and characterized by abundant forests and farmlands (MPSC, 2015). CW is accessible to both the university community as well as the general public for research, teaching, and recreation opportunities (MPSC, 2015). CW offers more than 12 miles of multi-use trails throughout the entirety of its property, but the heaviest visitor use takes place on the CW Loop Trail (CWLT).

The CWLT is a highly developed 2.14-mile trail system. The specific loop trail within CW was designated in 2016, as a part of a university wellness initiative, which was the lead entity to guide the Partnership for a Healthier America's Healthier Campus Initiative. The process included incorporating visitor signage, to improve the ease of access for visitors. These directional signs consist of simple maps and arrows indicating where to travel and distance traveled (in miles). The overall goal of the CWLT was to improve utilization of CW, subsequently improving health outcomes of visitors. The resources that funded this study were made available to the researchers, in part, to provide the partners working on the university wellness initiative information about how the CWLT and CW were being used and the impacts of the PPA on the community.

### *3.2 Data Collection*

On-site face-to-face surveys were used to collect data from CW visitors at four separate entrance and exit locations from September 2020 to September 2021. A trained graduate research assistant approached potential visitors as they concluded their CW experience provided a brief description of the study, informed consent, and requested visitors to participate in the 10–15-minute survey via a tablet computer utilizing Qualtrics data collection software. Most of the time, just one group of visitors would exit CW, so the research assistants approached all potential respondents and asked if they would like to participate in the study. If two or more groups passed the research assistant at the same time, the research assistant would only approach the first group they had encountered. Only consenting adults (18+) were eligible to participate in the study.

As a prerequisite consent question, all visitors were asked, "May I have about 10-15 minutes of your time to complete this survey?" If visitors answered 'yes' to this question, they began the survey. If visitors answered 'no' to this question, they were asked to complete a separate non-respondent socio-demographic survey. Response bias was examined by comparing the socio-demographics related to gender, race, income, and education amongst both respondents and non-respondents. A lack of non-response bias was determined as a series of chi-square analyses found no significant differences between respondents and non-respondent within any study variables. Upon completion of the survey, respondents were thanked for their time. This process generated an 86% response rate, with 629 visitors being approached and 539 visitors completing the survey. This survey method response rate was consistent with similar research methods (Ferguson et al., 2018).

### *3.3 Survey Instrumentation*

The topics within the first portion of the survey included trip visitation, patterns and sociodemographic characteristics. Visitors were prompted to think about their experience "today or within the past few years." Visitors assessed items related to social, situational, and ecological impacts, perceptions of health outcomes, and perceptions of trip satisfaction (Table 2). Most of the items and constructs used in this study were empirically validated. For social factors, visitors assessed items for place attachment (Manfredo et al, 1996; Brownlee et al., 2015). and crowding (Manning, 2011; Dogru-Dastan, 2022). For situational factors, visitors assessed items related to increased or decreased visitation due to COVID-19 and the signage in CW. For ecological factors, victors assessed sub-constructs that included (one item each): 1) trail degradation, 2) damage to the resource, and 3) visible litter, garbage, or vandalism (Shuster et al. 2006; Ferguson et al., 2022a). Next, to measure perceptions of mental and physical health outcomes we used the Perceived Health Outcomes of Recreation Scale (PHORS), which includes three sub-constructs (11 items total): psychological benefits (5 items), improved condition (3 items), prevention of a worse condition (3 items) (Gomez, et al., 2016). Finally, visitors were asked to assess items related to overall satisfaction (Graefe & Burns, 2013).

### *3.4 Data Analyses*

All data were analyzed using Statistical Package for the Social Sciences (SPSS) version 26.0 and Mplus version 7.11. To address research questions one and two, frequencies, percentages, and measure of central tendency were used. To address research question three, structural equation modeling (SEM) was employed (Kline, 2023). To assess SEM fit, a robust selection of fit indices were assessed including RMSEA, CFI, and SRMR (Hooper et al. 2008). Finally, to address research question four, a series of binary logistic regressions were applied, due to the outcome variable being a dichotomous measure (Mertler et al., 2021).

## 4.0 Results

### *4.1 Sample Demographic Information*

A total of 539 visitors completed the survey. Just over half of all visitors were female (54.4%), 43.8% were male, and 1.3% identified as non-binary. The average age of visitors was 30 years with approximately 63% representing the 18-35-year age group. A large majority of the visitors surveyed (94%) reported their race/ethnicity as White. Other ethnicities reported included Spanish/Hispanic/Latino, African American, and Asian. We also asked visitors about how much time they spend in College Woods (CW). On average, visitors noted they spent approximately 6 days per month, 31 days per year, and 7 total years engaged in recreation at CW. Of the entire sample, the four most commonly participated-in activities in CW were hiking/walking (92%), sightseeing or viewing natural features/wildlife (47%), relaxing and hanging out (44%), and trail running (37%). Finally, 44% of the visitors were affiliated with the University and 35% were local residents.

### *4.2 Research Question One*

To assess the extent to which visitors attained mental and physical *health outcomes* in CW, visitors assessed a multi-item empirically validated 7-point Likert scale for Perceived Health Outcomes of Recreation (PHORS) (1 = not like me, 7 = very much like me), which consisted of three sub-constructs (11 items total): 1) psychological benefits (five items), 2) improved condition (three items), and 3) prevention of a worse condition (three items) (Gomez, et al., 2016). Overall, mean scores for health outcomes were high. The mean scores for *psychological benefits* were highest with a construct mean of 5.80 and individual item means ranging from 5.24 to 6.16. The mean scores for *health improvement* were also quite high with a construct mean of 5.71 and individual item means ranging from 5.12 to 6.11. The mean scores related to *prevention of a worse condition* were lower, but still relatively high with a construct mean of 4.47 and individual item means ranging from 4.40 to 4.52.

**Table 1.** CW Visitors' Perceptions of Health Outcomes

| *"I recreate in CW because it…"* | Item M (SD) | Construct M (SD) |
|---|---|---|
| ***Psychological Benefits***[a] *(*α = 0.87) | | |
| Reduces my stress | 6.16 (1.22) | |
| Causes me to appreciate life more | 6.02 (1.27) | |
| Causes me to be more satisfied with my life | 5.82 (1.33) | 5.80 (1.38**)** |
| Is connected to other positive aspects of my life | 5.80 (1.41) | |
| Makes me more aware of who I am | 5.24 (1.71) | |
| ***Health Improvement***[a] *(*α = 0.87) | | |
| Improves my overall health | 6.11 (1.22) | |
| Improves my overall fitness | 5.90 (1.37) | 5.71 (1.45) |
| Improves my muscle strength | 5.12 (1.77) | |
| ***Prevention of a Worse Condition***[a] ***(***α = 0.96) | | |
| Reduces my chances of premature death | 4.52 (2.16) | |
| Reduces my chances of having a heart attack | 4.50 (2.16) | 4.47 (2.15) |
| Reduces my number of illnesses | 4.40 (2.14) | |

*Note. Response code: 1 = Not at all like me and 7 = Very much like me.

### *4.3 Research Question Two*

To assess the extent that visitors were impacted by social factors in CW, visitors evaluated an empirically validated single-item 7-point Likert scale related to *crowding* (1= strongly disagree, 7= strongly agree) (Manning, 2011; Dogru-Dastan, 2022, Vaske, 2008) (Table 2). Visitors then assessed a multi-item empirically validated 7-point Likert scale for *place attachment* (1= completely disagree, 7= completely agree), which consisted of three sub-constructs (six item total): 1) place identity (two items), 2) place dependence (two items), and 3) social and community bonding (two items) (Manfredo et al, 1996; Brownlee et al., 2015) (Table 2). Overall, visitors indicated they perceived minimal levels of crowding in CW with a construct mean of 2.02. On the other hand, place attachment was rated relatively high indicating visitors felt attached to CW. The mean scores for *place identity* were highest with a construct mean of 5.72 and individual item means ranging from 5.47 to 5.97. The mean scores for *place dependence* were fairly high with a construct mean of 4.29 and individual item means ranging from 4.24 to 4.34. The mean scores for *social and community bonding* were moderate with a construct mean of 4.14 and individual item means ranging from 3.89 to 4.38.

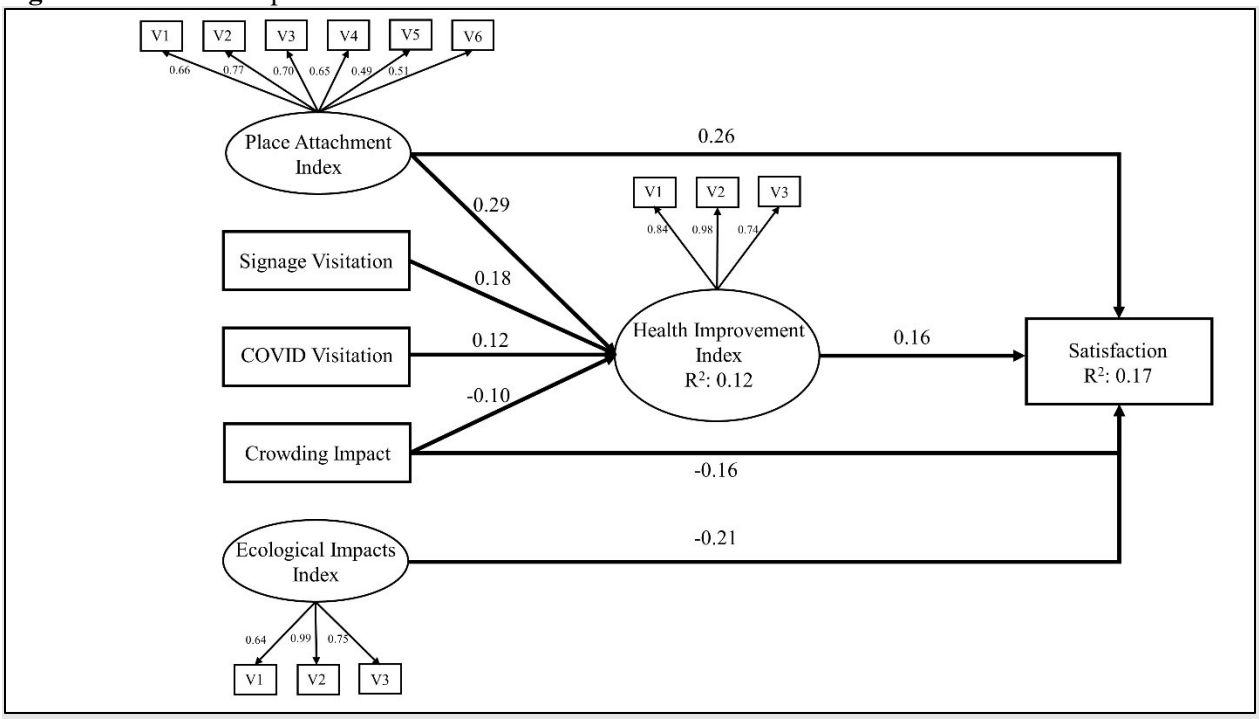
Next, to understand the extent that visitors were impacted by situational factors in CW, visitors assessed two separate empirically validated single-item 7-point Likert scales related to increased or decreased visitation due to: 1) *the COVID-19 pandemic* (1= decreased usage, 7= increased usage) (Ferguson et al., 2022a) and 2) *signage* (1= strongly disagree, 7= strongly agree) (Taff et al., 2017) (Table 2). Visitors largely agreed that the signage in CW enhanced their recreation experience, with a construct mean of 5.00. Additionally, visitors perceived a slight visitation increase in CW during the pandemic, with a construct mean of 4.82.

Finally, to assess the extent that visitors were impacted by ecological factors, visitors evaluated an empirically validated multi-item 7-point Likert scale related to *trail degradation*, *damage to the resource*, and *visible litter, garbage, or vandalism* (1= no impact, 7= major impact) (Ferguson et al., 2022a; Shuster et al., 2006) (Table 2). Generally, visitors perceived to be slightly impacted by ecological factors in CW, with mean scores ranging from 2.17 to 2.50. The highest mean was for *visible litter, garbage, or vandalism* (M=2.50), followed by *trail degradation* (M=2.17), and *damage to the resource* (M=2.10).

### *4.4 Research Question Three*

We used structural equation modeling (SEM) to examine the relationship between influencing factors, health improvement outcomes, and overall satisfaction at CW. First, we employed confirmatory factor analysis (CFA) to create a measurement model for place attachment, ecological impacts, and health improvement outcomes (Table 2). Next, utilizing theory based structural regression pathways (see section 2.0), the variables derived from the CFA were connected with each other and several additional constructs from the survey: effect of signage on visitation, increased visitation due to COVID-19, crowding, and satisfaction. Results demonstrate significant relationships between influencing factors, health improvement outcomes, and overall satisfaction (Table 2; Figure 1). Figure 1 showcases the final SEM achieved through maximum likelihood estimation, encompassing all CFAs and structural regression pathways. The SEM demonstrated good fit to the data ($\chi^2$:187.6; df=90; p<.001; CFI=0.97; TLI=0.96; RMSEA=0.04; SRMR=.05).

**Figure 1.** Structural Equation Model for CW Visitors[a]




[a] Note: $\chi^2$:187.6; *df*=90; p<.001; CFI=0.97; TLI=0.96; RMSEA=0.04; SRMR=.051

*Note: All loadings were significant at p<.001.

*Note: SEM included several error covariances between measured place attachment variables based on theoretical constructs: Place identity (V1 with V2), place dependence (V3 with V4), and community and social bonding (V5 with V6). The parameter estimates in this figure are standardized.

The pathways in the model suggest that situational factors (i.e., signage and COVID visitation) contribute significantly to the variance in health improvement outcomes but were not directly related to satisfaction. We had initially included direct pathways from signage visitation and COVID visitation to satisfaction, but they were non-significant. We chose to eliminate those direct pathways in favor of a more parsimonious model. Further, health improvement outcomes fully mediated the relationship between situational factors and overall trip satisfaction. Social factors (i.e., place attachment and crowding), however, accounted for considerable variance in health improvement outcomes, but also had direct effects on satisfaction. Health improvement outcomes partially mediated the effects of social factors on satisfaction. Finally, the latent variable for ecological impacts had a direct negative relationship

with satisfaction and no significant relationship with health improvement outcomes. Combined, these findings suggest that as CW visitation increased during the pandemic, health outcomes also increased significantly, serving to alleviate certain negative impacts of crowding on satisfaction. Furthermore, place attachment has a substantial positive effect on satisfaction for CW visitors, both directly and indirectly, via its positive effect on health improvement outcomes.

**Table 2.** CW Confirmatory Factor Analysis for Structural Equation Model

| Code[a] | Item | Loading[b] | Item M (SD) | Construct M (SD) |
|---|---|---|---|---|
| ***Signage***[c] | | | | |
| | Signage has enhanced my experience in CW | --- | 5.00 (1.35) | --- |
| ***COVID Visitation***[d] | | | | |
| | COVID-19 changed my recreation usage of CW | --- | 4.82 (1.40) | --- |
| ***Crowding Impact***[e] | | | | |
| | Level of crowding you experienced in CW | --- | 2.02 (1.24) | --- |
| ***Place Attachment***[f] (α = 0.83) | | | | |
| V1 | CW means a lot to me | 0.66 | 5.97 (1.22) | 4.71 (1.32) |
| V2 | I feel very attached to CW | 0.77 | 5.47 (1.41) | |
| V3 | No other place can compare for the types of rec I do here | 0.70 | 4.34 (1.63) | |
| V4 | I wouldn't substitute any other area for the types of rec I do here | 0.65 | 4.24 (1.07) | |
| V5 | The people in the CW area are important to me | 0.49 | 4.38 (1.07) | |
| V6 | I have many ties to the people in the CW area | 0.51 | 3.89 (1.82) | |
| ***Ecological Impacts***[g] (α = 0.82) | | | | |
| V1 | Trail degradation (mud, social trails, erosion, etc.) | 0.64 | 2.17 (1.49) | 2.25 (1.72) |
| V2 | Damage to the resource (plants, trails, etc.) | 0.99 | 2.10 (1.64) | |
| V3 | Visible litter, garbage, or vandalism | 0.75 | 2.50 (2.01) | |
| ***Health Improvement***[h] (α = 0.87) | | | | |
| V1 | Improves my overall health | 0.84 | 6.11 (1.22) | 5.71 (1.45) |
| V2 | Improves my overall fitness | 0.98 | 5.90 (1.37) | |
| V3 | Improves my muscle strength | 0.74 | 5.12 (1.77) | |
| ***Satisfaction***[i] ($R^2$=0.17) | | | | |
| | Satisfaction with your overall CW recreation experience | --- | 6.44 (0.74) | --- |

[a]Note. Variable code refers to SEM model, see Figure 1.
[b]Note. Standardized factor loadings. All loadings were significant at $p<.05$.
[c]Note. Response code: 1= Strongly disagree and 7= Strongly agree
[d]Note. Response code: 1= Decreased usage and 7= Increased usage
[e]Note. Response code: 1= Not at all crowded and 7= Extremely crowded
[f]Note. Response code: 1= Completely disagree and 7= Completely agree
[g]Note. Response code: 1= No impact and 7= Major impact
[h]Note. Response code: 1= Not like me and 7= Very much like me
[i]Note. Response code: 1= Poor and 7= Perfect

### *4.5 Research Question Four*

A series of binary logistic regression (BLR) analyses were used to further explore the influence of social, situational, and ecological factors upon health outcomes. Based on the SEM results, we hypothesized that signage, COVID visitation, crowding, and place attachment would be significant in predicting visitors' perceptions of health outcomes. Moreover, we knew from the SEM that place attachment had the strongest relationship with health outcomes, so we broke down place attachment by its three sub-constructs (i.e., place identity, place dependence, social and community bonding). The health

outcomes dependent variable was also broken down into its three sub-constructs (i.e., psychological health, health improvement, health prevention).

For each of the three health outcome sub-constructs, we created a dichotomous variable, 0=1-3 on the Likert sale and 1=4-7 on the Likert scale. For model selection, we used the forward selection criteria and only retained significant variables in the model. We chose this method to ensure model parsimony and allow for the most significant predictors to be iteratively selected and included into the models When determining the likelihood of perceived health outcomes, we held the mean scores for the independent variable constant to predict how average visitors to CW would respond.

**Table 3.** CW Binary Logistic Regression Models

| | Nagelkerke R Square | β | Wald | Odds Ratio |
|---|---|---|---|---|
| ***Health Improvement Model***[a] | | | | |
| Signage | | 0.338 | 4.860* | 1.402 |
| COVID visitation | 0.182 | 0.457 | 7.457** | 1.580 |
| Place identity | | 0.552 | 14.414*** | 1.737 |
| *Constant* | | -3.630 | 9.854** | 0.027 |
| ***Psychological Model***[b] | | | | |
| Place identity | 0.087 | 0.608 | 12.026** | 1.836 |
| *Constant* | | 0.117 | 0.018 | 1.124 |
| ***Health Prevention Model***[c] | | | | |
| Place dependence | 0.086 | 0.250 | 13.035*** | 1.284 |
| Social and community bonding | | 0.180 | 7.153** | 1.197 |
| *Constant* | | -0.849 | 6.744** | 0.428 |

*Note. Significant at .05 level, **significant at .01 level, ***significant at .001 level

S=reported mean for *signage* factor
C=reported mean for *COVID* factor
PI=reported mean for *place identity* factor
PD=reported mean *place depend* factor
SCB=reported *mean soc and comm* factor

[a]*Ln*(odds)=-3.630 + 0.338(S) + 0.457(C) + 0.552(PI)
[b]*Ln*(odds)=0.117 + 0.608(PI)
[c]*Ln*(odds)=-0.849 + 0.250(PD) + 0.180(SCB)

The first model showed signage, COVID visitation, and place identity were related to an increased likelihood that visitors would perceive *health improvement* outcomes. Signage, COVID visitation, and place identity significantly predicted health improvement outcomes, with an odds ratio of 1.40:1, 1.58:1, and 1.74:1, respectively (Table 3). The model indicates that at the reported mean levels for signage, COVID visitation, and place identity, there is a 97% likelihood that visitors will perceive health improvement outcomes.

The second model indicates place identity was related to an increased likelihood that visitors would perceive *psychological health improvement* outcomes. Place identity significantly predicted psychological health outcomes, with an odds ratio of 1.84:1 (Table 3). The model indicates that at the reported mean level for place identity, there is a 97% likelihood that visitors will perceive psychological health outcomes.

In the third model, place dependence and social and community bonding were related to an increased likelihood that visitors would perceive *health prevention outcomes*. Place dependence and social and community bonding significantly predicted health prevention outcomes, with an odds ratio of 1.28:1, and 1.20:1, respectively. The model indicates that at the reported mean levels for place identity and social and community bonding, there is a 72% likelihood that visitors will perceive health prevention outcomes.

## 5.0 Discussion

Visitation to PPAs around the United States has been consistently increasing, even prior to the onset of the COVID-19 pandemic (NPS, 2020). This visitation trend persists today and concerns regarding high-quality resource protection and visitor experiences are mounting. The primary goal of this study was to explore the extent to which social, situational, and ecological factors relate to perceived health outcomes and visitor satisfaction. Our findings suggest that as local PPA visitation increased during the pandemic, health and wellbeing outcomes also increased significantly, serving to mitigate certain negative impacts, and ultimately enhance overall experience quality. Study findings have theoretical and managerial implications, particularly related to health and wellness and visitor use management.

### *5.1 Theoretical Implications*

Our study aim was not theory testing specifically, nevertheless study findings have theoretical implications for perceived health outcomes in recreation, social ecological systems (SES), and stress reduction. We used the Perceived Health Outcomes in Recreation Scale (PHORS) to explore visitors' attainment of health and wellbeing outcomes (Hill & Gomez, 2020). Results from both research questions three and four found place attachment to be the strongest predictor of health improvement outcomes. Findings suggest attachment to place is important in achieving visitor health outcomes, corroborating numerous studies (Han, Li, & Chang, 2021Kyle et al., 2004, Li et al., 2021; Scannell & Gifford, 2017; Yuan & Wu, 2021). Our results confirm Li et al. (2021), who also examined positive relationships between health outcomes and place attachment during the pandemic. We found place attachment was also a significant predictor of visitor satisfaction and generally our sample of visitors were highly attached to CW, which can be attributed to most of the sample living locally or being affiliated with the university. Crowding, another social factor, was partially mediated by health improvement outcomes and directly related to satisfaction. Studies in the field of outdoor recreation and tourism commonly find crowding to have a negative impact on experience quality (See review Dogru-Dastan, 2022). It's important to note that crowding had a small, but negative influence on health improvement outcomes. Finally, out findings further validate the use of the PHORS in outdoor recreation research.

Research questions two through four built on previous SES research that found social, situational, and ecological impacts have a considerable influence on recreation behaviors and experiences (Ferguson et al., 2018; 2022a; 2022b). Our findings are valuable to future research that aims to investigate SES, as our independent variables were inspired by various social and ecological systems and sub-systems germane to examining outdoor recreation experiences. For research question three, we employed SEM to examine the relationships between social, situational, and ecological factors, health improvement outcomes, and satisfaction. Results suggest that improved health outcomes partially mediate the effects of social impacts (place attachment and crowding) on satisfaction. Also, improved health outcomes fully mediated the relationship between situational impacts (e.g., signage and increased visitation) upon satisfaction indicating that these were important factors in predicting both health improvement outcomes and satisfaction. These findings verify other SES studies that highlight how recreation experiences are dynamic and often not influenced by one social factor like crowding (Ferguson et al., 2022a; Morse et al., 2022). Moreover, our study examined visitor experiences on a larger spatial and temporal scale, which varies from other outdoor recreation studies that often sample at one location, for a short period of time. We sampled for a full calendar year, at multiple intercept locations, a methodological approach was influenced by SES literature. .

Our findings also add value to theories that connect human health and wellbeing to contact with nature, like stress reduction (Ulrich, 1991). Results from research question one show that most visitors had a positive perception of their health outcomes during their visit to CW. These findings align with other studies that have found outdoor recreation or exposure to green space to have positive effects on human health and wellbeing (Bratman et al., 2019; Van den Bosh & Sang, 2017). About 90% of visitors indicated they recreate in CW because it reduces stress and almost 90% recreate because it "causes me to be more satisfied with my life". Visitors to CW are perceiving positive benefits to their mental health and wellbeing. This corroborates Labib et al., 2022, who found several studies that show a positive

relationship between mental health (like reduced depression, stress, anxiety, etc.) and spending time in natural settings during the pandemic. In summary, our findings from all four research questions suggest important relationships between social, situational, and ecological factors, health outcomes, and visitor satisfaction which have theoretical and managerial implications.

### *5.2 Managerial Implications*

The most pertinent findings for management relate to place attachment, ecological impacts, health outcomes, and signage. Visitors to CW are highly attached to the resource which relates to increased health outcomes and satisfaction. Managers should continue to foster place attachment, knowing that it has a positive effect on visitor experiences. Maintaining trails and signs so that the trail remains accessible is likely to keep visitors connected with the resource. Managers should also consider the value of CW to its users and include this relevant stakeholder group in future management decisions.

Based on the outcomes from research question three, ecological impacts should be a top priority for CW resource managers. In our SEM model, ecological impacts had the strongest negative influence upon overall satisfaction and were not mediated by health improvement outcomes. Visible litter, garbage, and/or vandalism was noted to be the most impactful ecological condition followed closely by weather conditions. Based on anecdotal evidence from both managers and visitors, garbage and feces left by dog walkers is a common problem in CW. Providing bags, additional trash cans, and educational signage reminding dog owners to clean up after their pets may help to increase visitor satisfaction. Studies have shown that place attachment is linked to pro-environmental behavior and civic engagement (Buta, Holland, & Kaplanidou. 2014; Eder & Arnberger, 2012). Because these are highly attached visitors, they may be more responsive to pro-environmental behaviors, like cleaning up dog waste.

Our study findings point to the valuable role CW plays in providing visitors with a place to achieve both mental and physical health outcomes. Managers of CW and other PPAs across the country should consider the role their park plays in providing access to healthy nature experiences. Our study took place during the COVID-19 pandemic. Should another pandemic arise, managers can anticipate increased visitation and visitors seeking to achieve health outcomes. Moreover, if managers are hoping to provide visitors with easy access that improves wellbeing, they should utilize trail signs.

As mentioned in the methods section, the influence of signs on health outcomes and satisfaction was important for CW managers and health and wellness practitioners at the university. Results from the SEM show that signs have a positive influence on both health improvement outcomes and satisfaction. As appreciation for signage increased, so did the ability to attain health improvement outcomes and increased satisfaction, thus improving overall visitor experience quality. The signs in CW are a simple design and provide visitors with directions and maps for accessing trails. Other PPA managers should consider how directional signs can provide benefits to visitors and increase satisfaction. Study findings suggest a strong return on investments into CW signage and maintenance of CW. Signage increases satisfaction and health outcomes in CW, epitomizing the mantra, healthy parks, and healthy people.

### 5.3. Implications for future research

This study has important implications for future research including broadening to other PPAs, expanding the study sample, and further investigating the impact of PPAs on human health and wellbeing. This study focused on visitors to a relatively small and local PPA during the pandemic. We want to acknowledge that a limitation of this paper is that the study location and sample are unique, most of the visitors were affiliated with the university or lived locally which can explain their place attachment. The applicability of our results may be constrained. Thus, future studies should examine similar relationships between social, situational, and ecological factors, health outcomes, and satisfaction during a more stable timeframe (not during a pandemic) and within various PPA types (e.g., National Parks, State Parks).

While a fair number of studies examine the positive benefits of outdoor recreation on human health, we believe there is more to uncover. Specifically, what about outdoor recreation and nature exposure influences health outcomes and how can PPA managers best provide opportunities for those outcomes? Future studies might consider how ecosystem health, trail design, and access to PPAs influence the health outcomes of visitors. Finally, we realize that our sample were made up of students

and residents of a New England university town. Examining health outcomes of a more diverse sample of outdoor recreation visitors in a different location, like an urban proximate PPA, could broaden the application of outdoor recreation for improving wellbeing.

## 6.0 Conclusion

Our findings present compelling evidence that as PPA visitation increased during the pandemic, health and wellbeing outcomes also increased significantly, serving to mitigate certain negative impacts, and ultimately enhance overall experience quality. We also found that the health outcomes attained by most visitors are essential to visitor satisfaction. These findings not only contribute to the existing body of evidence supporting the connection between nature and improved health outcomes but also emphasize the notion that healthy parks play a pivotal role in promoting the wellbeing of individuals. PPAs should be recognized as valuable resources that actively contribute to public health and managers should consider how visitor health outcomes are enhanced by trail accessibility and preserving ecological conditions. Additionally, our study underscores the significance of informative signs within CW, as they not only enrich the overall visitor experience but also aid in achieving health-related objectives. These insights provide invaluable guidance for PPA managers in their efforts to optimize the health benefits and enjoyment of their parks.

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