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Mental health benefits of nature-based recreation: a systematic review

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ABSTRACT

The demand for mental health services around the world has risen dramatically. Many researchers and practitioners are looking for alternative mental health treatments, including nature-based recreation. However, reviews examining nature-based recreation's therapeutic effectiveness are limited. The purpose of this study was to conduct a systematic review of available research regarding the potential mental-health benefits of nature-based recreation. Following the preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) guidelines, a global standard established to ensure consistency and quality in literature reviews, a systematic search generated 51 articles for review. Most articles ($n = 46$, 90%) observed at least one positive association between nature-based recreation and mental health, including improvements in affect, cognition, restoration, and well-being, and decreases in anxiety and depression symptoms. Trends regarding the setting, population, methodology, and theoretical orientation of existing research, as well as recommendations for future research, are discussed in this review.

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In recent years, the demand for mental health services has outpaced the treatment supply, placing a significant burden on mental healthcare provider resources (Nathe 2018; Wishner and Burton 2017). Internationally, mental health staff shortages have directly impacted the quality of outcomes experienced by those seeking traditional mental health services (Salvage 2007). Studies have also shown that the prevalence of diagnosable serious mental illness is substantially greater among people experiencing poverty (Center for Behavioral Health Statistics and Quality 2016). This is particularly concerning in places like the United States, where the cost of healthcare has steadily grown, placing financial strain on individuals and families across the country (National Conference of State Legislature 2017). Consequently, professionals face a growing demand for widely accessible no- and low-cost opportunities to improve mental health and alleviate symptoms of mental illness.

A growing body of research indicates that spending time in nature or natural settings – especially through recreation activities – contributes to positive psychological outcomes (Keniger et al. 2013; van den Bosch and Bird 2018); however, a thorough review of this

literature has not been published. Periodic reviews of a body of literature encourage critical scholarship and assessment of broad statements about the impact of nature on well-being (Hodge et al. 2017). One such critical method is the systematic review. Systematic review methods offer a replicable approach to synthesizing and facilitating an evaluation of evidence on a topic (Moher et al. 2015). Previous systematic reviews addressing the association between nature-based recreation and mental health have either focussed on specific settings (Thomsen, Powell, and Monz 2018), were narrowly focussed on theory application (Ohly et al. 2016; Stevenson, Schilhab, and Bentsen 2018), provided a selective evaluation of existing literature (Barton and Pretty 2010), or looked at physical health outcomes more generally (Bowler et al. 2010). Therefore, the purpose of this study was to conduct a systematic review of the current state of knowledge regarding the association of nature-based recreation and mental health. Thus, this review was driven by a central research question: What is the association between nature-based recreation and mental health?

Definition of terms

For the purposes of this study, nature-based recreation was defined as 'all forms of leisure that rely on the natural environment' (Jenkins and Pigram 2003, 328), and nature was considered to be any outdoor area with greenery or other natural features that contrast with the built environment. Scholars frequently disagree regarding the conceptualization of 'nature', particularly regarding the extent to which a setting must be removed from environments in which human modification has occurred (Cronon 1996). For example, not everyone would agree that a densely populated, urban-proximate beachfront would qualify as nature, particularly when compared to a remote wilderness area. Additionally, questions remain regarding the unique qualities of a setting and whether or not the outcomes of nature-based recreation in highly contrasting environments, such as densely forested mountains and arid desert landscapes, reasonably ought to be compared. However, to ensure a comprehensive analysis of existing research related to diverse perspectives on nature and natural environments, the conceptualization of nature within this review remained broad, including settings from national parks to urban gardens and lush hillsides to remote deserts.

Definitions of mental health are also contentious and the meaning of mental health as a construct and domain of health has been disputed among scholars. For example, some approach mental health from the perspective of the absence of a mental health condition while others conceptualize mental health as the presence of components necessary for human functioning (Galderisi et al. 2015).

To incorporate studies from both perspectives, this systematic review conceptualized mental health in two ways. First, the National Alliance on Mental Illness's definition of mental health as 'a condition that affects a person's *thinking, feeling, or mood*' was adopted (National Alliance on Mental Illness 2018, emphasis added). This definition allowed us to focus on cognitive, affective, and mood-related diagnoses. Additionally, the three most common mental illnesses experienced by adults in the United States – anxiety, depression, and attention deficit hyperactivity disorder – were included as search terms to identify and evaluate outcomes related to nature-based recreation that are most relevant to the general population (National Institute of Mental Health 2018).

Second, the World Health Organization's (WHO's) definition of mental health as 'a state of *well-being* in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community' (emphasis added) was also applied (WHO 2004). The WHO definition oriented the review toward a strengths-based perspective on mental health. This perspective also captured non-clinical conceptualizations of mental health challenges (e.g. stress) as a barrier to functionality. Overall, mental health outcomes were the dependent variables and were inclusively defined to capture clinical and non-clinical conceptualizations.

Methods

Selection of studies

To answer the research question, the authors performed a systematic review of relevant literature in multiple disciplines. Systematic review methods differ from other forms of reviews, such as traditional literature reviews and commentaries, by their explicit research question(s) and 'methodological rigor' (Moher et al. 2015, 1). For this systematic review, the authors approached the research question by establishing a five-step a priori system for identifying and critically evaluating relevant literature.

Step one was a comprehensive literature search using three major electronic databases (Scopus, Proquest Dissertations and Theses Global, and PsychInfo). Searches were conducted February 18, 2018 in each database using the same search terms.¹ These databases were selected based on their broad scope, and search terms were informed by the definition of the independent and dependent variables: nature-based recreation and mental health. Search terms were also strategically selected to yield search results relevant to these constructs. Selection of databases and search terms were achieved through group consensus and under the guidance of a university librarian with expertise in systematic reviews and the content area to ensure the literature search would be comprehensive. This initial search yielded 3,034 results which were uploaded into a shared file in EndNote Basic (a free citation management platform), to which all authors had access.

In step two, one researcher removed all duplicate results ($n = 235$), leaving 2,799 unique sources. Remaining articles were evaluated in steps three, four, and five using the following pre-determined inclusion and exclusion criteria: Original research published in English (e.g. peer-reviewed journal articles, book chapters, and technical reports) and unpublished dissertations and theses were included in the review; systematic reviews and meta-analyses were excluded to eliminate redundancy. The original research articles examined in these sources would be captured during the search and selection process for this review if they were relevant. The search was not delimited by population, data type (i.e. studies reporting quantitative and/or qualitative data were included), or date of publication. Sources that primarily included non-academic or secondary knowledge (e.g. books, newspaper articles, newsletters, magazines, and government reports) were excluded, because this review sought to examine academically rigorous and primary sources of evidence. Additionally, methodological studies (i.e. those intended to validate a specific methodology or method) were excluded. Lastly, studies that included clinical or therapeutic interventions without including a non-nature-based control group (e.g. wilderness therapy programmes) were also ineligible for inclusion, because any relationship

found between nature-based recreation and mental health outcomes would be confounded by the intervention.

In step three, two members of the research team reviewed each source using the inclusion and exclusion criteria. The review in this step focussed on the title, keywords, and abstracts of each source. Title, keyword, and abstract review reduced the sample to $n = 185$ articles. In step four, the research team engaged in a full review of the source. If, during the course of the full review, one researcher was unsure if a source met the inclusion criteria, all researchers conversed via email or during a face-to-face meeting to come to a consensus about whether to include the source. Step four rendered a sample of $n = 63$ articles. In step five, members of the research team began coding the 63 articles. During this process, 12 additional sources were excluded for failing to meet the inclusion criteria. Thus, the final sample thus included $n = 51$ sources.

Article coding

Using a coding protocol established a priori, members of the research team coded the final sample ($n = 51$) articles in batches of 10 articles. Research team members coded each of their 10 articles independently. All codes were stored in an online spreadsheet that all researchers could access and edit electronically. A priori coding categories consisted of the following: Bibliographic information (i.e. author(s) name(s), year of publication, and journal) were recorded in the spreadsheet. Theories, study design, and analytic approaches used in each study were recorded, and studies were coded based on whether a control group was used to isolate the effect of nature-based recreation on mental health (e.g. 0 = no control, 1 = controlled). Sample size and the following sample characteristics were also coded for each source: (1) population (e.g. university students, senior citizens, etc.), (2) setting (e.g. national park, or urban greenspace), (3) age of participants (age range or mean age and standard deviation), (4) gender (percentage of female, male, and other participants), and (5) race or ethnicity (percentage of participants as described in the source). Finally, results from each source were coded for relationship direction (0 = no effect, 1 = positive, and 2 = negative) and significance based on reported p values (0 = non-significance, 1 = significance).

Results

Descriptive results

The final sample of 51 sources included 40 peer-reviewed journal articles (78%), 10 dissertations or theses (20%), and one book chapter (2%) published between 1984 and 2018. Methodologies varied within the sample, including 37 quantitative studies (72%), 10 qualitative studies (20%), and 4 mixed-method studies (8%). Only 15 of the studies (29%) included a control group to isolate the effects of nature. While one study did not report a population, 23 studies (45%) were conducted with residents in the United States, and 27 studies (53%) were conducted in other nations, predominantly in Europe and Japan. Most studies ($n = 43$, 84%) exclusively included adults. On average, studies that included both men and women included approximately equal numbers of each gender in their samples. Sample sizes varied dramatically from three to 3,060 participants.

Fifteen different theories, frameworks, or models appeared in the 51 articles; however, 30 sources (59%) did not use a theory or theoretical framework to structure the research (see Table 1). Attention Restoration Theory guided eight studies (16%), The Biophilia Hypothesis guided four studies (8%), and the Ecopsychological Model and Restoration Outcomes Scale each guided two studies (4%). The remaining 11 studies each used a different theoretical framework. Table 1 identifies each of the 15 theories and the corresponding articles.

Review of quantitative evidence

Of the 40 sources reporting quantitative findings relevant to the research question, 35 sources (87.5%) reported at least one significant relationship between nature-based recreation and positive mental health outcomes (see Table 2). No sources reported a significant relationship between nature-based recreation and negative mental health outcomes. Considered together, these observations suggest that nature-based recreation has either neutral or, more likely, positive effects on mental health outcomes. The mental health outcomes examined in the literature can be divided into nine categories (refer to Table 2). The most common study outcome was anxiety and/or stress reduction. Sixteen studies examined the effects of nature-based recreation on anxiety and stress, and the majority ($n = 12$, 75%) reported reduced anxiety and stress levels after time spent recreating in nature. Affect, which refers to positive emotion (e.g. happiness) or mood, was also commonly studied. Ninety percent of the items examining this outcome ($n = 10$) reported at least one observation of increased positive affect. Studies examining the effects of nature-based recreation on clinically diagnosed mental health issues ($n = 9$) found less of a relationship between mental health outcomes and nature-based

Table 1. Theories and theoretical tools used to guide the research.

Theory/Framework	No Studies*	Sources
Attention Restoration Theory	8	Atchley, Strayer, and Atchley (2012), Curtin (2009), Gathright, Yamada, and Morita (2006), Lee et al. (2011), Mårtensson et al. (2009), Morrow, Rodriguez, and King (2017), Weng and Chiang (2014), Von Lindern (2015)
Biophilia Hypothesis	4	Curtin (2009), Lee et al. (2011), Merkl (1995), Ojobo et al. (2015)
Ecopsychological Model	2	Jakubec et al. (2016), Lee et al. (2011)
Restoration Outcome Scale**	2	Colley, Brown, and Montarzino (2017), Irani (1996)
Benefits Based Management	1	Irani (1996)
Conservation of Resources Theory	1	Korpela and Kinnunen (2010)
Effort-Recovery Model	1	Korpela and Kinnunen (2010)
Ego-Resiliency	1	Warber et al. (2015)
Human Capabilities Approach	1	Jakubec et al. (2016)
Experience-Based Model of Recreation Behaviour	1	Tarrant (1993)
Heuristic Model	1	Glassman (1995)
Laslett's proposed Theory of Aging	1	Boyes (2013)
Multiple Mediation Model	1	Korpela et al. (2014)
Nature Therapy Theory	1	Bielinis et al. (2018)
Super and Elsner's Human Dimensions of Ecosystem Management	1	Irani (1996)

*Some sources were based on multiple theories or theoretical tools.

**The restoration outcome scale is based on attention restoration theory and stress recovery theory (Colley, Brown, and Montarzino 2017).

Table 2. Mental health outcomes observed through quantitative analysis.

Outcome Category	No. of studies*	Sources reporting no significant relationship**	Sources reporting both significant and non-significant relationships**	Sources reporting a significant relationship**
Affect	10	Baur (2011)	Tarrant (1993)	Bielinis et al. (2018), Korpela et al. (2014), Lee et al. (2011), Li et al. (2012), Mang (1985), Mao et al. (2012), Pasanen, Tyrväinen, and Korpela (2014), Warber et al. (2015)
Anxiety/Stress	16	Irani (1996), Von Lindern (2015)	Ewert (1988), Harris (1996)	Bielinis et al. (2018), Gathright, Yamada, and Morita (2006), Guan et al. (2017), Kaplan (1984), Kelley, Coursey, and Selby (1997), Korpela and Kinnunen (2010), Ojobo et al. (2015), Park et al. (2011), Vella, Milligan, and Bennett (2013), Warber et al. (2015), Weng and Chiang (2014), Yu et al. (2017)
Cognition	4	N/A	N/A	Atchley, Strayer, and Atchley (2012), Mang (1985), Mårtensson et al. (2009), Weng and Chiang (2014)
Depression	8	Cashel, Lane, and Montgomery (1996), Jakubec et al. (2016), Park et al. (2011)	N/A	Bielinis et al. (2018), Christensen, Wilson, and Holt (2013), Kelley, Coursey, and Selby (1997), Kerr et al. (2012), Wilson and Christensen (2012)
Mental Health	3	Baur (2011)	Gustafsson et al. (2012)	Zebrack, Kwak, and Sundstrom (2017)
PTSD	1	Hyer et al. (1996)	N/A	N/A
Psychological Resilience	1	N/A	Buchecker and Degenhardt 2015	N/A
Restoration	3	N/A	N/A	Bielinis et al. (2018), Colley, Brown, and Montarzino (2017), Von Lindern (2015)
Well-Being	4	N/A	Buchecker and Degenhardt (2015)	Butler-Collins (2017), Kaplan (1984), Wolsko and Lindberg (2013)

Note: Table formatting adapted from Stern, Powell, and Hill (2014).

*Some sources examined more than one mental health outcome.

**Significance was determined if a significance of $p < 0.05$ was reported in the source.

recreation. Three of the eight studies examining depression and one study examining Posttraumatic Stress Disorder (PTSD) failed to observe a significant positive relationship between improvements in the symptoms of those mental health conditions after participation in nature-based recreation.

Within the sample of 40 quantitative sources, nature-based recreation was operationalized in six ways (see Table 3). The most common way to operationalize nature-based recreation was to measure participation in outdoor recreation (e.g. river rafting, hiking, fly-fishing). The second and third most common ways to operationalize nature-based recreation was to measure participants' exposure to natural greenspaces (such as wilderness areas or forests) or participation in a structured wilderness programme, (such as Outward Bound programmes), respectively. Measuring participation in forest bathing activities was the fourth most common way to operationalize nature-based recreation. Forest bathing is a Japanese concept based on the word, 'Shinrin-yoku', and traditionally

Table 3. Operationalization of nature-based recreation in studies reporting quantitative analysis.

Location	No. of studies*	Sources reporting no significant relationship	Sources reporting both significant and non-significant relationships	Sources reporting a significant relationship
Outdoor recreation	15	Hyer et al. (1996)	Buchecker and Degenhardt (2015), Ewert (1988)	Butler-Collins (2017), Christensen, Wilson, and Holt (2013), Gathright, Yamada, and Morita (2006), Korpela et al. (2014), Li et al. (2012), Mang (1985), Morrow, Rodriguez, and King (2017), Vella, Milligan, and Bennett (2013), Weng and Chiang (2014), Wilson and Christensen (2012), Wolsko and Lindberg (2013), Zebrack, Kwak, and Sundstrom (2017)
Natural Green-Spaces	8	Irani (1996), Jakubec et al. (2016)	Buchecker and Degenhardt (2015)	Hartig, Kaiser, and Strumse (2007), Harris (1996), Korpela and Kinnunen (2010), Mårtensson et al. (2009), Pasanen, Tyrväinen, and Korpela (2014)
Defined wilderness programme	7	Cashel, Lane, and Montgomery (1996)	Gustafsson et al. (2012)	Atchley et al. (2012), Butler-Collins (2017), Kaplan (1984), Kelley, Coursey, and Selby (1997), Warber et al. (2015)
Forest bathing	5	N/A	Park et al. (2011)	Bielinis et al. (2018), Guan et al. (2017), Mao et al. (2012), Yu et al. (2017)
Urban Green-Spaces	4	Baur (2011)	Buchecker and Degenhardt (2015)	Colley, Brown, and Montarzino (2017), Kerr et al. (2012)
Nature visualization	4	N/A	Tarrant (1993)	Lee et al. (2011), Ojobo et al. (2015), Von Lindern (2015)

Note: Table Formatting (Stern, Powell, and Hill 2014).

*Some sources operationalized nature-based recreation in multiple ways.

involves, ‘a visit to a forest field for the purpose of relaxation and recreation’ (Li et al. 2007). Additionally, other studies operationalized nature-based recreation as exposure to urban greenspaces (including city parks, workplace courtyards, or home backyards) or as natural visualization, in which participants were asked to examine images of natural landscapes or recall past experiences in nature.

Review of qualitative evidence

Ten articles used qualitative methods including ethnographic approaches, semi-structured interviews, open-ended assessments, and participant observation. Four studies used mixed-methods. One of the mixed methods studies presented all findings through quantitative representations and was thus included in the analysis of quantitative studies in this review. As such, the final sample size of qualitative articles included 13 studies.

The majority of the qualitative and mixed-method studies were homogeneous regarding gender, with more than half of the studies ($n = 7$, 54%) including female participants only. The remaining six studies (46%) included approximately equal proportions of females and males. Seven of the 13 studies (54%) reported participants’ race or ethnicity. Six of these studies reported samples that were predominantly white (i.e. 79% or more of the sample), and one study worked with First Nations youth. Studies were also heavily represented by small sample sizes, with eight of the 13 studies including 20 participants or less, which is appropriate for many qualitative approaches.

Table 4. Qualitative thematic results.

Author(s)	N	Findings
Smith (2016)	3	For female veterans with PTSD, elements of teamwork, planned activity, and relaxation increased sense of well-being derived from a river rafting experience
Rodriguez (2017)	4	Reports of stress-reduction as a result of outdoor camping experiences
Hinds (2011)	5	Sense of well-being derived from stress-free environment and social aspects of a Scottish wilderness trip
Boyes (2013)*	7	Positive effect of outdoor adventure activities on well-being for New Zealand Senior Citizens
Glassman (1995)	9	Psychological healing through nature themes included childhood wilderness memories, identity, sense of connectedness, sense of freedom, power, strength, place attachment, gender, and spirituality.
Merkl (1995)	9	Positive responses to nature experiences: stress reduction and increased sense of well-being
Hennigan (2010)	12	Time in natural settings improved body image by way of distancing women from the cultural context, increasing embodied experiences, and connection to nature.
Curtin (2009)	20	Wildlife viewing experiences contributed to increased sense of well-being how/why?
Warber et al. (2015)*	36	Increased well-being and holistic health benefits associated with a nature immersion experience how/why?
Krenichyn (2006)	41	Physical activity in an urban park was described as stimulating the senses and restorative
Ritchie et al. (2015)	43	Increased overall connectivity with 'the good life' as defined by cultural paradigms of the host indigenous communities (loosely operationalized as resilience and well-being).
Wolf, Stricker, and Hagenloh (2015)*	157	Improvement in sense of well-being resulted from structured National park experiences
Bittner (2013)	200	Meaningful units (mu) represented key themes: spiritual connectedness (89 mu); emotional expression of self (71 mu); psychological translation of well-being (67 mu)

*Denotes mixed-method studies.

Results of the thematic coding process indicated that participants experienced positive psychological outcomes or well-being following nature-based experiences in all 13 studies. Specific terminology used by the authors to describe these positive effects included 'psychological healing', 'stress-reduction', 'restorative', and 'increased sense of well-being'. Table 4 contains a summary of the key themes resulting from this inductive analysis.

As Table 4 illustrates, qualitative findings echoed the findings of the quantitative studies. However, while both types of studies included relatively homogenous samples with participants that were predominantly white, more qualitative studies represented specialized or often marginalized populations in outdoor recreation settings than quantitative studies, including women, the elderly, and people of colour. For example, qualitative studies explored the effects of river rafting on female veterans with PTSD (Smith 2016), outdoor recreation on women's experiences with body image (Hennigan 2010), outdoor activity on senior citizens' well-being (Boyes 2013), and outdoor expeditions on First Nation youths' resilience and well-being (Ritchie et al. 2015). As such, qualitative research within this body of literature highlights the mental health benefits of nature-based recreation for individuals in marginalized communities, findings that may have been overlooked in broad, quantitative studies.

Discussion

In this review, we systematically identified, reviewed, and evaluated research connecting nature-based recreation to mental health. From this review, 51 studies provided insight

into the state of the field. Most studies reporting quantitative findings ($n = 35$, 87.5%) observed at least one significant, positive relationship linking nature-based recreation to mental health benefits. Additionally, all studies reporting qualitative results ($n = 13$, 100%) reported at least one observed mental health benefit after participation in nature-based recreation. Thus, findings from this systematic review show that nature-based recreation is typically associated with mental health improvements.

In light of this finding, future research efforts should begin employing more rigorous methods and more precise research questions to strengthen the argument for using nature-based recreation in mental health illness prevention and treatment initiatives. For example, most of the quantitative evidence examined in this review originates from cross-sectional surveys, reflecting a lack of experimental and quasi-experimental studies that utilize a non-nature-based recreation control group. Cross-sectional research can be a powerful tool for uncovering relationships between constructs, but arguments based on data gleaned from such methods without using a control group cannot claim causality or refute the possibility that confounding variables such as social dynamics, novelty, or length or consistency of exposure, may be causing mental health benefits instead of nature-based recreation. Experimental studies are needed to isolate the effect of nature-based recreation on mental health from other variables that might influence or even cause this relationship.

Additionally, this review sheds light on a general lack of longitudinal studies. Several studies employed pre-post designs (e.g. Atchley, Strayer, and Atchley 2012; Butler-Collins 2017; Guan et al. 2017). Studies with these designs can provide stronger evidence to support a relationship between mental health and nature-based recreation than cross-sectional studies, but they do not show how long the mental health benefits of nature-based recreation persist. Only one study (Zebrack, Kwak, and Sundstrom 2017) included a one-month follow-up measurement to answer this question, and this study did report a significant positive relationship between outdoor recreation and mental health.

As noted in the results, there are several promising theories that may explain the benefits of nature exposure. However, more than half of the studies in the review do not use a theory or are exploratory in nature. There is a clear need to not only to use existing theory in research, but to continue to develop new theories and build upon existing theories. As highlighted by our analysis, the most commonly used theory to explain the relationship between nature-based recreation and mental health is attention restoration theory. Attention restoration theory suggests that natural environments are particularly likely to exhibit characteristics of a restorative environment that can help one recover from mental fatigue or exhaustion in order to improve mental functioning (Kaplan 1995). Thus, this is one particularly promising area for further theory development. Studies that systematically and rigorously test the utility of attention restoration theory in different nature-based recreation contexts and/or with different types of nature-based recreation activities may be particularly useful in advancing our understanding of how nature-based recreation can lead to mental health benefits.

Furthermore, future studies should consider approaching the question regarding the association between nature-based recreation and mental health with increased specificity. For instance, future studies could seek to compare the effects of different nature-based recreation activities in the same setting on mental health outcomes, and similar studies could be conducted on the same activities performed in different natural settings. This

research would serve to better specify any causal linkages between nature-based recreation and mental health as well as provide useful recommendations for practice. Likewise, researchers should examine the effects of nature-based recreation on mental health outcomes within more diverse populations. Samples examined in this review were over representative of white, college educated participants, which has been met with criticism across social science research (Henrich, Heine, and Norenzayan 2010). To explore whether observed relationships between nature-based recreation and mental health outcomes are generalizable, future research should strive to be more inclusive regarding race, ethnicity, identity, and socioeconomic status. In sum, increasingly specialized studies could shed light on what types of nature-based recreation in what settings have the most potential to positively impact mental health for individuals in specific populations.

Limitations

There were limitations to this systematic review, specifically through the constraints of the search parameters. For example, certain studies may have been unintentionally excluded from the search if the study involved particular forms of recreation, such as fishing or rock climbing, without couching the study within broader nature-related concepts, such as wilderness, outdoor recreation, or nature-based recreation. Additionally, mental health can be conceptualized in many ways. Due to the specific focus of this review, the authors did not include physiological, personal development, satisfaction, or spiritual health outcomes that could contribute to, or indicate, mental health. Furthermore, we excluded studies that incorporated clinical therapy interventions and those that did not control for nature, as the effect of nature could not be distinguished from the effect of the clinical intervention(s). However, we do believe that future research could examine whether clinical treatments have various levels of effectiveness when administered in nature.

While the use of a theory, model, and/or framework within each study was coded for in this review, the researchers did not code for researcher commentary within the studies regarding the efficacy of theories within the context of their respective data analyses. Future reviews would benefit from not only coding for theoretical efficacy within the data, but also consider the potential value of theory development related to the mental health benefits of nature-based recreation as a direction for future research. Therefore, future systematic reviews and/or meta-analyses on the relationship between nature and mental health are warranted.

Conclusion

This systematic review provides substantial support for the assertion that nature has a positive impact on mental health. Specifically, the findings indicate the strong potential for nature-based recreation to positively affect mental health outcomes, such as well-being, cognition, resilience, and restoration as well as decrease levels of anxiety, depression, and stress. Distinct predictors of these outcomes included outdoor recreation, exposure to outdoor green-spaces, participation in a wilderness programme, frequency and time spent in nature, forest bathing, and nature visualization. Though this review illustrates the strong potential for nature-based experiences to yield positive mental health

outcomes, more work remains if we are to increasingly infuse higher dosages of nature-based recreation into the existing paradigms of mental health treatment.

Note

1. (nature-based tour* OR outdoor recreat* OR nature-based recreat* OR wilderness OR ecotour* OR forest bath* OR friluftsliv*) AND (mental health OR disorder OR psychosocial OR anx* ADHD OR attention deficit* OR depress* OR distract* OR attent* OR concentrate* OR sadness OR apathy OR mood OR stress* OR well-being OR wellbeing).

Disclosure statement

No potential conflict of interest was reported by the authors.

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