Nature activities and wellbeing in children and young people: A systematic literature review

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Abstract

Research suggests that experience of the natural environment may have a range of beneficial outcomes for children and young people. A systematic review of the peer-reviewed empirical literature focused on research involving direct interaction with nature amongst children and young people and its impact on wellbeing; 14 papers, within the domains of childhood and adolescence were identified for inclusion in the review. Within these domains, a range of wellbeing outcomes were identified and grouped into thematic areas of self-esteem and confidence, positive and negative affect, stress reduction and restoration, social benefits, and resilience. Findings related to wellbeing outcomes were synthesised and critiqued, and research and clinical implications discussed.

Keywords

nature; wellbeing; resilience; children; young people

Introduction

Since the emergence of the field of ecopsychology in the 1960s (Greenway, 1999) there has been growing interest in the link between the natural environment and wellbeing. Alongside the usual peer-reviewed papers and academic volumes, there have also been a number of reports and unpublished dissertations that have investigated the nature-human relationship

(e.g., Andrews, 2014; Bowler, Buyung-Ali, Knight, & Pullin, 2010; Townsend & Weerasuriya, 2010). In his review of ecotherapy research, Chalquist (2009) posits that individuals are increasingly disconnected from the natural world which can lead to a variety of difficulties including anxiety and depression. He further suggests that reconnecting to the natural world, as an environmental place, can alleviate these symptoms and allow for improved wellbeing through enhanced self-esteem and joy. Wellbeing is problematic to define, with numerous definitions existing; however research has tended to distinguish between the two perspectives of hedonic and eudemonic wellbeing. Hedonic wellbeing focuses on happiness and the attainment of pleasure and avoidance of pain (Ryan & Deci, 2001). In contrast, eudemonic wellbeing encompasses meaning and self-realisation, and the process of living a fulfilled life (Huta & Waterman, 2013).

Theoretical Background

The biophilia hypothesis suggests that humans have an innate need to affiliate with nature (Wilson, 1984), and this affiliation has become biologically encoded due to human evolution and dependence on the natural environment over time. This has in turn shaped our physical, emotional and cognitive processes (Kellert & Wilson, 1993). Despite modern life involving less connection with nature, it is argued that people's physical and emotional wellbeing still remains highly dependent on contact with the natural environment (Kellert, Heerwagen and Mador, 2008). However, research has shown that not all children feel an affiliation with nature, with some individuals experiencing nature as threatening and psychologically harmful at times (Hand et al., 2016; Kahn, 1997). It may be that learning and experience are required in order to overcome these fears (Kellert & Wilson,1993). Indeed, research suggests the frequency of woodland visits in adults tend to be related to the frequency of woodland visits in childhood (Ward Thompson et al., 2004). In addition,

children who have not experienced natural environments in early years may experience these environments as threatening in later life (Milligan & Bingley, 2007).

Two theories underpinned by the biophilia hypothesis have been suggested for the beneficial effects of nature contact on wellbeing. Attention-restoration theory suggests that the natural environment has a restorative quality that allows for recovery from directed attention fatigue (Kaplan & Kaplan, 1989). Directed attention has been defined as requiring effort and controlling distraction, and is susceptible to fatigue after prolonged mental effort (Kaplan, 1995). In contrast to direct attention, fascination is an involuntary form of attention requiring no effort. A distinction has further been made between hard fascination and soft fascination (Kaplan, 1995). Soft fascination (which can come from looking at a scenic view) allows for reflection and thus can be highly restorative. Hard fascination (such as watching violence) doesn't allow for thinking about anything else, providing distraction only in the short term (Kaplan & Berman, 2010). Attention-restoration theory has been supported by research with schoolchildren, which suggests that contact with nature helps to restore depleted ability to concentrate and impacts on stress reduction (Ohly et al., 2016). Likewise, Ulrich's (1983) psycho-physiological stress reduction theory posits that natural environments can have a restorative effect, involving a shift towards a more positive emotional state, a positive change in physiological activity levels, and sustained attention. It has also been posited that the relationships humans form with nature can be understood in terms of their early attachments. It has been suggested that nature operates as a secure base which can provide comfort and allow people to maintain positive mood states and shift negative ones (Jordan, 2009). This implies that childhood is an important time to engage with nature, in order that a positive relationship with nature can develop.

Children and Nature

There is a large body of literature looking at the impact of natural environments for children and young people, highlighting a number of beneficial impacts of nature contact relating to physical health, cognitive functioning and self-control, psychological wellbeing, self-care and spiritual development (e.g. Chawla, 2015; Li & Sullivan, 2016; Schein, 2014). Children have been identified as a key group who may have specific needs that can benefit from contact with nature, and it is necessary to consider these specific needs, such as risk concerns that may impact on how children access natural environments (Nillson, Baines & Konijnendik, 2007). Research looking at nature interaction amongst children and young people has tended to look at the link to physical health and activity (e.g. Dyment & Bell, 2008) and highlighted the benefits of nature in tackling obesity (Cleland et al., 2008; Potwarka, Kaczynski & Flack, 2008). Links between the natural environment and improved motor development have begun to emerge. This includes research suggesting that the natural elements within outdoor spaces help facilitate the development of motor skills (Fjortoft, 2001), particularly balance and coordination (Fjortoft, 2004).

Research regarding the relationship between nature and mental health and wellbeing in children and young people has been gaining interest. It has been proposed that nature helps to provide young people with a space to release tension and aid self-regulation (Korpela & Hartig, 1996; Korpela, Hartig, Kaiser & Fuhrer, 2001). Views of nature have also been associated with reduced levels of stress and increased ability to focus (Wells, 2000; Wells & Evans, 2003). This relationship between improved focus and possible enhanced cognitive ability as a result of contact with nature is reflected in a growing body of research. This includes research into the link between the natural environment and improved ADHD symptoms, potentially due to an increase in concentration levels (Taylor, Kuo & Sullivan, 2001; Taylor & Kuo, 2009). Yet, despite most research finding beneficial effects of the natural environment on children and young people's wellbeing, research has also highlighted

potential downsides. For example, some children may experience woodland as scary, leading to feelings of anxiety or claustrophobia, (Milligan & Bingley, 2007) or view woodland as a place of increased risk of attack (Burgess, 1996).

The way in which children and young people connect with nature may change over time (Wilson, 2011), with younger children requiring an approach focusing on active exploration of the environment, and multi-sensory play and exploration (Ballantyne & Packer, 2009; Kola-Olusanya, 2005). The importance of nature interaction prior to age 11 has been highlighted as a crucial time in shaping environmental attitudes and behaviours which then continue to adulthood (Wells & Lekies, 2006).

Previous Reviews

Nature experiences in childhood have been found to promote healthy development, wellbeing and positive environmental attitudes (Gill, 2011). This systematized review also highlighted a link between positive views about nature as an adult and time spent in nature as a child, suggesting a far-reaching impact of nature experiences in childhood. Although this review highlighted interesting findings it can be criticised for its search strategy, which involved a non-systematised search and omitting independent assessments of study quality.

Within the area of public health there have been a number of reports calling for increasing children's interaction with nature, with recommendations made to encourage outdoor play (Bento & Dias. 2017; Children's Play Council, 2002), incorporate nature into outdoor play areas (Groves & McNish, 2008; Office of the Deputy Prime Minister, 2003) and open up wild spaces to enhance physical and emotional development of young people (Travlou, 2006). The importance of providing ecotherapy interventions for children has been emphasised, as half of lifetime cases of mental illness begin by age 14 (EcoMinds, 2013; Kessler et al., 2007).

The Current Review

There is a growing evidence base linking nature experiences in childhood with wellbeing, but it is still not clear exactly what aspects of wellbeing are impacted by being in nature. Several possible benefits of nature on wellbeing have been suggested, including recovery or restoration from stress and attention fatigue, improved levels of exercise, facilitation of social contact, promotion of healthy child development, and promotion of personal development and sense of purpose (The Health Council of the Netherlands, 2005). Further investigation is warranted to increase understanding of the link between nature experiences and wellbeing specifically for children and young people.

The present review aimed to: identify the effects of experiences of nature in childhood on wellbeing; provide a summary of the empirical research over the last 40 years (from 1978 to 2018); review the methodology and provide a critical appraisal of findings; and highlight the research, policy and implications for practice from the existing literature.

Methodology

Search Strategy

To identify relevant studies, a systematic review of empirical papers published up to March 2018 was conducted. PsycINFO, MEDLINE, and ERIC were searched using search terms based on those used in existing literature. The search terms were: [natural environment* *or* outdoor*] *and* [wellbeing *or* well-being *or* mental health] *and* [child* *or* youth* *or* teen* *or* adolescen* *or* young people]. Hand-searching of the reference sections of relevant papers was carried out and an internet search using Google Scholar conducted. Identified titles and their abstracts were then examined for inclusion.

Inclusion and Exclusion Criteria

The present review focused on papers in peer-reviewed journals which described some form of outdoor experience that included contact with nature and reported its impact on wellbeing. Terms used to define nature and the environment are problematic in that they vary greatly in usage and meaning. The natural environment has been defined as one relatively unchanged or undisturbed by human culture (Johnson et al., 1997) however there are difficulties with this definition due to no environments on Earth being free from the effects of humans (McKibben, 1990). Therefore for the purpose of this review nature is used to encompass a variety of natural environments, including forest and woodlands, parks and gardens and areas of greenspace (defined as being comprised of vegetation and associated with natural elements; Taylor & Hochuli, 2017). A broad classification for wellbeing was employed, based on definitions encompassing affect and functioning (Aked, Marks, Cordon & Thompson, 2008), self-esteem (Neff, 2011), resilience (Mental Health Strategic Partnership, 2013), and social resources (Fredrickson, 2004). Any studies reporting outcomes related to these areas were included in the review. Studies were excluded if they focused specifically on the link between physical activity and wellbeing as this has a large evidence base (e.g. Lubans, Plotnikoff & Lubans, 2012). Articles focusing specifically on outdoor adventure therapy programs for at-risk youth were also excluded, as this area has a distinct well-reviewed literature base (e.g. West & Crompton, 2001).

Data Extraction and Analysis

Data extraction procedures followed the Cochrane Consumers and Communication Group (2015) template for all studies meeting the inclusion criteria. Quantitative studies were critiqued using the Effective Public Health Practice Project (EPHPP, 2010) quality assessment tool. Qualitative studies were appraised using the critical appraisal template from

the Critical Appraisal Skills Programme (CASP, 2017) and criteria suggested by Yardley (2000).

Structure of Review

The search identified studies across a range of ages, and thus the review has been organised into broad areas of childhood (up to 12 years old), and adolescence (12-21 years). The quality and limitations of the included studies are reported. Nature activities within each respective age group are described and findings within these domains grouped into themes related to wellbeing outcomes and summarised. Due to the scope of this review, only those outcomes related to wellbeing are reported.

Results

Using the methodology reported above, a total of 14 studies looking at the relationship between nature experience amongst children or adolescents were identified. Six were quantitative; one of these being a randomised controlled trial (Greenwood & Gatersleben, 2016), and the remaining four utilising a pretest-posttest design (Barton, Bragg, Pretty, Roberts & Wood, 2016; Hinds, 2011a; Kaplan, 1984; Kelz, Evans & Roderer, 2015; Rose, Williams, Olsson & Allen, 2018). The remaining eight studies utilised qualitative designs, using qualitative interviews and case studies (Berger, 2008; Davidson, 2001; Doucette, 2004; Hinds, 2011b; McArdle, Harrison & Harrison, 2013; Milligan & Bingley, 2007; Passy, 2014; Roe & Aspinall, 2011). A summary table of the studies can be found in Table 1.

Methodological Issues

With the exception of Kelz et al., (2015) and Rose et al., (2018), all the studies were rated as weak using the EPHPP quality assessment tool, with the component ratings for ‘confounders’ and ‘withdrawals and dropouts’ commonly rated as weak (for four out of six of

the studies; see Table 2). A more detailed discussion of the methodological issues can be found below.

Control groups. Only two studies (Greenwood & Gatersleben, 2016; Kelz et al., 2015) included control or comparison groups. A lack of comparison or control groups means that inferences about the causality of positive changes in wellbeing are not possible. Even in the study by Kelz et al., (2015) which included two comparison schools, there were difficulties with these, as they were different types of secondary school from the experimental school and thus there may have been significant differences existing between participants at the schools.

Confounding factors. There are a number of confounding factors that may have impacted on the effect of nature exposure. The papers described nature activities that involved the young people engaging in novel and fun activities in the context of forming supportive group relationships. It is difficult therefore to conclude that beneficial impacts observed in the studies were due directly to the natural environment, and not to the effect of the empowering quality of the activities offered. Furthermore, particularly in the childhood studies identified, there tended to be a focus on children with behavioural and learning difficulties, and the complexity of these additional needs arguably decreases the validity of the conclusions drawn. Further research utilising comparison groups would be needed to consider the contribution of these factors on wellbeing and help distinguish them from the effect of nature exposure on wellbeing.

Follow-up. All of the quantitative studies lacked the inclusion of follow-up measures, although several studies (e.g. Doucette, 2004; Hinds, 2011a; Kaplan, 1984) did acknowledge this as a limitation. A longitudinal design could have improved the studies, allowing for longer term changes to be identified and more light shed on the effectiveness of nature activities. Only Milligan and Bingley (2007) had a longitudinal aspect to their study,

including a follow-up interview one month after their nature workshop, however this is still a relatively short length of time and thus does not allow for the identification of any longer-term change.

Sample. Eleven studies were conducted in Western countries with a predominantly white sample, with the only exception to this being the study conducted by Berger (2008) in Israel. This therefore limits their generalisability to wider populations. Sample sizes varied, with some of the quantitative studies using large sample sizes (Barton et al., 2016; Greenwood & Gatersleben; Kelz et al., 2015), however they did not report details on whether power was reached. All studies with younger age groups had very small sample sizes (with the exception of Passy, 2014) thus limiting their generalisability.

Quantitative methods. Six of the quantitative studies adopted pretest-posttest designs, with only one study involving random assignment to comparison or control groups (Greenwood & Gatersleben, 2016). Studies which failed to randomly assign participants to groups did not account for any confounding variables, thus preventing the ability to infer a causal relationship between nature and wellbeing.

Self-report questionnaires. The reliance of the quantitative studies on self-report questionnaires, and the lack of controlling for or discussing socially desirable responding is a limitation of the research base. The questionnaires used by Barton et al., (2016) may have been subject to a ceiling and floor effect, potentially not allowing any improvement experienced by participants to be fully quantified. Some of the studies relied solely on self-report measures, (Barton et al., 2016; Kaplan, 1984), however others did combine outcome measures with observations or qualitative methods, (e.g. Hinds, 2011a) thereby recognising the limitations of relying solely on self-report measures to capture the complexity of the concept of wellbeing.

Qualitative methods. The qualitative studies used a range of analyses, that varied considerably in the quality of their description of analytic process. A clear description of the qualitative methodology used was provided by Davidson (2001) and Berger (2008) who used grounded theory analyses which was appropriate for the small sample size. However, in Passy's (2010) study, the reporting of the qualitative analysis was poor, with a lack of detailed description of analytic process or quality assurance, therefore lacking in commitment and rigour, (Yardley, 2000). Passy (2010) further failed to give consideration to limitations of the methods used that may have affected the results, thus weakening the overall quality of the study (Wallace, Croucher, Quilgars & Baldwin, 2004). There was also a lack of information about agreement of themes and cross-validation of themes in Passy's (2010) study, arguably compromising the overall quality of the study as it means the authors' preconceptions may have biased the themes decided on (Silverman, 2011).

In line with CASP (2017) criteria, the relationship between researcher and participants was adequately considered by Davidson (2001), who acknowledged the impact of his own perspective on the data collection process and interpretation of events. This was also taken into account by McArdle et al., (2013) through the keeping of a reflexive diary in order to monitor the influence of the researcher's own participation in the data collection process on what was observed.

Childhood

The studies identified within this age group were conducted in a range of countries and tended to include participants identified as having behavioural difficulties. The earliest reported study by Doucette (2004) involved a walk and talk intervention in an outdoor environment (encompassing counselling, ecopsychology and physiological components). Berger's (2008) study, focusing on learning and behavioural difficulties, involved a

therapeutic educational session that took place in a natural setting within or near the school grounds. Only one of the studies identified was with children of preschool age (McArdle et al., 2016), looking at the impact of a woodland activitywith children from a range of backgrounds, including experience of homeless, domestic violence and substance misuse in the family. With the exception of Passy's (2014) study, all of the studies within this age group involved participants described as having additional needs, (such as learning or behavioural difficulties, ADHD, experience of homelessness, domestic abuse, and alcohol and drug use in the family). Research conducted by Passy (2014) looked at ten primary schools with school gardens with each school visited twice to carry out interviews to discuss the impact of the gardens on children's learning, behaviour and wellbeing. A range of outcomes relating to wellbeing were reported and they were grouped and synthesised under the following thematic domains.

Self-esteem and confidence. Strengthened self-esteem and confidence following a therapeutic nature activity was highlighted by Berger (2008). It was argued that this was facilitated by the empowering approach of the programme, which allowed participants to succeed at tasks and receive an acknowledgement of their achievement. Through a case study, Berger details how this was particularly valuable for a child with severe behavioural issues, who was able to take on a leadership role and have opportunities to excel which were not possible in the indoor learning environment. It was noted that nature raised the children's level of motivation and cooperation and they played and worked together in a more spontaneous way. Attachment theory was utilised to integrate counselling and walking outdoors in Doucette's (2004) study where the aim of the activity was to help improve the self-esteem of participants through becoming connected with both the counsellor and the outdoors. Through description of case studies, Doucette highlights how utilising life skills techniques discussed in the walk and talk activity, this helped one of the participant's self-

esteem to increase considerably. However, it is important to note that this appears to be based on observation rather than any empirical measure, although the author argues it was also echoed in the comments of the participant's teacher and family members. Again, through illustration of case studies, Roe and Aspinall (2011) highlight how their participants grew in confidence, demonstrated by increased exploration of the forest environment.

Positive affect. In order to map changes in emotional behaviour over the course of a forest school intervention, Roe and Aspinall (2011) used a case study approach and noted a change in positive affect in the forest. They argue that this was helped by the activities that took place in the forest, such as the construction of dens and shelters, and the opportunity for both time alone and time with others which helped with mood regulation amongst the participants who had suffered trauma. However, although their findings showed positive mood outcomes from the forest setting, it is not possible to attribute this change to the forest setting, because of the lack of a control group. Comments from participants in Passy's (2014) study detailed the pleasure and happiness gained from simply looking at the school garden and being outside of the classroom, as well as the enjoyment gained from the gardening tasks. The calming effect of the school garden was also commented on, particularly for those pupils with behavioural difficulties.

Negative affect. A number of emotional reactions that participants had to the forest setting were identified by Roe and Aspinall (2011). These were classified into different categories, not all of them positive, and some of the affective reactions noticed included anger, fear, disgust and sadness. However, they note that there were many more positive affective reactions to the forest than negative, concluding that the forest setting has much to offer in assisting with behavioural control, as the recorded outbursts of anger were very low in this setting, particularly when compared to behaviour that occurred in the school setting.

Stress reduction and restoration. Both staff and pupils visibly became less stressed in the forest, and consistent with restorative theory, fascination and anticipation featured highly in the forest setting (Roe and Aspinall, 2011). Participants' emotional stability and ability to cope with stress were strongly identifiable in the case studies of the children observed by McArdle et al., (2016).

Social benefits. Social relationships tended to improve over the course of the nature activities. One potential benefit of nature therapy for children with learning difficulties was identified by Berger (2008) as being the process of group building and development of positive communication skills amongst participants in a group setting. This was further reflected by Doucette (2004) where an improvement in social skills was observed for two of the participants. An increase in social cohesion amongst participants was also indicated by Roe and Aspinall (2011), demonstrated by a movement over time towards the social aspect of the camp fire in the forest setting, and improved relationships with staff and peers over time. The social benefits of taking part in a nature activity were described in three case studies by McArdle et al., (2016), where improvements were seen in social communication with other children and adults following participation in the programme. In a separate case study, they outlined the development of one of the boy's social skills over the course of the nature activity, which they argued was evident through his engagement of his peers in imaginative play.

Resilience. Changes in one boy's ability to cope with change, confidence and ability to play with others and encouragement to take small risks and push boundaries was detailed by McArdle et al., (2016) thus supporting a relationship between resilience and the outdoor activity. They argue that self-efficacy and problem-solving ability, (which have been conceptualised as components of resilience; Schwarzer & Warner, 2012) were also evident through children's play and learning that took place over the course of the programme.

Adolescence

Nine papers identified in this review reported studies conducted with adolescents (Barton et al., 2016; Davidson, 2001; Greenwood & Gatersleben, 2016; Hinds, 2011a; Hinds, 2011b; Kaplan, 1984; Kelz et al., 2015; Milligan & Bingley, 2007; Rose et al., 2018). Three of the studies reported wilderness expeditions in Scotland, South Africa and the US, (Barton et al., 2016; Hinds, 2011b; Kaplan, 1984) and three reported outdoor education programs in New Zealand, the UK and Australia (Davidson, 2001; Hinds, 2011a, Rose et al., 2018). These studies reported activities involving total immersion in nature for several successive days or weeks and utilised pretest-posttest designs (with the exception of Davidson's study which employed a qualitative design). The potential therapeutic effects of woodland settings in the UK was explored by Milligan and Bingley (2007), who considered the impact of early childhood experiences of woodland on accessing woodland later in life. Participants in their study took part in a one day workshop involving a woodland walk and craft session in an area of woodland, followed by a therapeutic craft session in a rural village.

In contrast to the above studies which placed participants in unfamiliar outdoor environments, two of the studies explored the impact of familiar outdoor environments on aspects of wellbeing (Greenwood & Gatersleben, 2016; Kelz et al., 2015). The effect of familiar indoor or outdoor settings on aspects of wellbeing was compared by Greenwood and Gatersleben (2016) who looked at everyday environments in the UK that teenagers might find themselves in. The influence of renovating a school-yard to enhance opportunity for contact with nature in Austria was looked at by Kelz et al., (2015) comparing this school with two comparison schools where no changes were being made. Unfortunately none of the studies explicitly looked at whether there was a differential impact on aspects of wellbeing of

familiar natural environments compared with unfamiliar environments. It may arguably be that unfamiliar natural environments could be experienced as more frightening and thus could adversely affect any potential therapeutic effects of being in nature, however research directly comparing familiar and unfamiliar environments is needed to further investigate this.

Wellbeing outcomes in adolescence.

***Self-esteem and confidence*.** Statistically significant increases in self-esteem were found over time by Barton et al., (2016) indicating a positive effect of their wilderness expedition. Interestingly they also found that males had higher levels of self-esteem at the start but female self-esteem showed the most increase following the wilderness expedition. This suggests that contact with natural environments may be particularly important for promoting female self-esteem in adolescence. They posit that this may be due to the wilderness environment providing opportunities for perseverance and determination and generate feelings of accomplishment and pride. However no significant differences in levels of self-esteem were found by Hinds (2011a), suggesting this could be due to the dynamic nature of self-esteem and the activity not explicitly including an element of self-esteem directed therapy. It may also be the case that the self-esteem scale used lacks the sensitivity to detect changes amongst young people and a measure specifically for use with school-age children would have been more appropriate (Chiu, 1988). However, although no changes in self-esteem were found using Rosenberg's scale, the free responses of participants in Hinds' (2011a) study suggested they felt more confident following the experience.

Through a 6-week observation and interview process, Davidson (2001) identified a key theme around building confidence and mental strength. Using case study examples he illustrated how the outdoor education program helped the participants to build confidence in pushing personal achievement limits, and encourage perseverance and success. The theme of

developing confidence was also identified by Milligan and Bingley (2007) who noted that participants commented on how they developed a sense of confidence through being able to decide what the risks were in a woodland environment and face challenges. In line with this, Rose et al., (2018) found that levels of self-efficacy significantly increased following the outdoor program, positing that having the opportunity to try new things and develop new skills may have contributed to this increase.

Positive affect. A wilderness expedition was found to lead to a greater sense of confidence, composure and wellbeing in Kaplan's (1984) study, with participants reporting more positive moods following the expedition. However, the sample used included both adolescents and adults, and from the data reported, a true breakdown of the results is not possible, making it difficult to ascertain the experience of adolescents as compared with adults. Following renovation of a school-yard to include natural features, pupils in the study by Kelz et al., (2015) had significantly higher scores for intra-psychic balance compared to the measurement taken at an earlier time point, and in comparison with a control school. An improvement in positive affect following being in nature was found by Greenwood and Gatersleben (2016), particularly when with a friend compared with being alone.

Negative affect. All of the studies with adolescents tended to identify positive effects of nature on aspects of wellbeing, however Milligan and Bingley (2007) noted that those participants who had been subject to higher parental anxiety and adult supervision in woodland areas in childhood were more likely to experience anxiety and uncertainty in woodland environments. They also identified how certain types of woodland, such as those that were enclosed and dark could be experienced as intimidating by some participants, and concerns about dirt and insects could adversely affect the potential therapeutic effects of the woodland.

Stress reduction and restoration. A series of stressor tasks were given to participants to complete before being randomly assigned to either an indoor or outdoor environment and physiological, cognitive and affective measures of restoration taken by Greenwood and Gaterslaben (2016). Results indicated that those participants in an outdoor setting showed greater restoration, experiencing an improvement in concentration compared with spending time in an indoor setting. However, the authors note that the positive outcomes may not be entirely attributable to the positive effects of the outdoor environment, but also due to the negative impact of being in a windowless classroom. Furthermore, there were no significant differences found in participants' levels of blood pressure, which was taken as a measure of physiological restoration. Blood pressure was also looked at by Kelz et al., (2015), who concluded that levels of physiological stress were lower following restoration of the school-yard, and compared with control schools which had not undergone a redesign. It was also found that perceived restoration increased pre- to post-renovation for two of the subscales: compatibility and fascination. The use of two different scales (looking at both current and situational wellbeing states) to measure any increase in wellbeing is a strength of this study, lending more weight to its conclusions that psychological wellbeing was enhanced following the renovation.

The effect of a woodland setting on stress was explored by Milligan and Bingley (2007) who noted that a strategy used by participants to cope with stress was to find a place where they could be alone. Many participants in their study reflected on how the woodland offered a peaceful place to help relieve stress. Participants also outlined a number of outdoor activities that they felt had restorative value, including walking or simply sitting in a favourite place outdoors.

Social benefits. No significant impact on sociability following nature activity was found by Hinds (2011a), who posited that this may be due to the natural environment promoting a

desire for solitude. It is possible that being alone in a novel remote natural environment impacted on the self-awareness of participants and how alive they felt and feelings of happiness (Hinds, 2011b). This is in line with the findings of Rose et al., (2018) that there was no change in levels of friend and teacher connectedness following their outdoor program. However, results are inconsistent with Greenwood and Gatersleben (2016) who found that being with a friend, compared with being alone or playing a game on a mobile phone, had positive restorative effects in the natural environment. However, children, at differing stages of development, may be more or less inclined to pursue or develop social bonds. For instance there may be some degree of saturation point of peer-group relationship development by middle childhood that would be characterised by ceiling effects within the data (Gifford-Smith & Brownell, 2003).

Resilience. A central theme identified by Davidson (2001) was the enjoyment of overcoming challenges and subsequently feeling competent and positive about themselves. The importance of competence in enhancing resilience has been well documented in research (e.g. Brooks & Goldstein, 2008; Prince-Embury, 2014). A link between nature activities and increased competence was further indicated by Hinds' (2011a) research, with significant differences found for competence at the end of the outdoor nature education program.

Conclusions

This review identified research on outdoor nature activities and the impact of these on wellbeing outcomes for children and young people. All of the studies identified with children under 12 years were qualitative studies, whereas the studies with adolescents tended to be quantitative. The studies reviewed suggest that a range of nature activities have positive outcomes for wellbeing across all ages, specifically seeming to impact on self-esteem and

confidence, positive affect, stress reduction and restoration, social benefits, and resilience. However, results were sometimes inconsistent for these aspects of wellbeing, such as self-esteem, with some studies (e.g. Barton et al., 2016; Berger, 2008) finding improvements in self-esteem, but others (e.g. Hinds, 2011a) showing no increase, perhaps due to the dynamic nature of self-esteem in adolescents, rather than it being a static construct, (Baldwin & Hoffman, 2002).

Only two of the studies reported negative outcomes of nature activities (Milligan & Bingley, 2007; Roe & Aspinall, 2011), highlighting how some participants in their studies experienced negative reactions to natural settings. The reason for some participants having negative experiences of natural settings may be due to the influence of parental anxiety and the media in portraying outdoor natural areas such as woodland as dangerous spaces where people are at risk from attack (Milligan & Bingley, 2007).

The natural environments that participants had contact with in the studies varied considerably, ranging from familiar natural spaces (such as school gardens and familiar outdoor areas) to wilderness experiences in other countries. The content of the nature activities also varied considerably, with some of them involving an explicit therapeutic aspect, and others not. It is unclear from this review whether the therapeutic aspect of these activities leads to an increased beneficial impact on wellbeing, or whether simply being in the natural environment is enough to bring about improvements in wellbeing.

Research and Practice Implications

Future research investigating the mechanisms through which nature affects wellbeing for children and young people could be of interest, particularly the possible mediating effect of connectedness to nature, as this has been suggested to play a role in the relationship between nature and wellbeing in adults (Webber, Hinds & Camic, 2015). Kazdin (2007) details how

important mediators are for developing meaningful and targeted therapeutic interventions, and thus identifying the mediating effect of connectedness to nature could be of useful clinical value for nature activities and interventions.

The research identified in this review highlighted the challenges involved in operationalising and measuring wellbeing. Some of the studies utilised more objective outcome measures to look at aspects related to wellbeing, such as physiological stress reduction through the measurement of blood pressure (Greenwood & Gatersleben, 2016; Kelz et al., 2015). It may be that these more objective measures are useful to include in future research alongside subjective measures of wellbeing. To investigate any longer-term effect of nature programmes on wellbeing, there is also a need for longitudinal aspects to be integrated into research designs.

All of the studies with the younger age groups utilised qualitative methodologies and although more quantitative studies were carried out with adolescents, these were all rated as weak in terms of their quality control (cf. Kelz et al., 2015). The need for studies focusing more broadly on children and young people, rather than just those with additional needs was highlighted by this review. Studies with the general population that allow for comparison between different groups of children and young people, (such as those with special educational needs) could help to draw out whether nature activities are particularly beneficial to specific groups.

Much of the research indicated the potential of nature activities amongst individuals with behavioural difficulties, and thus there may be the potential for nature activities to be utilised with children and adolescents with mental health difficulties. Ecotherapy interventions are becoming increasingly popular for adult populations (Chalquist, 2009; EcoMinds, 2013) and this review provides support for the potential therapeutic value of natural settings when

working with children and young people. It is particularly promising that even in the studies where the nature activity was relatively brief in duration (e.g. Greenwood & Gatersleben, 2016; Hinds, 2011a; Milligan & Bingley, 2007) beneficial impacts on wellbeing were still observed, suggesting even short-term exposure to nature may have a positive effect. Longitudinal research is necessary to determine if there are meaningful long lasting effects of nature activities.

Declaration of Interest

Conflicts of interest: none

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