

Nature-Based Interventions for Adults with Developmental Disabilities

Subjects: Others

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Autistic adults often face higher levels of depression, anxiety, and stress and reduced levels of quality of life and employment in comparison to their neurotypical peers. Nature-based interventions (NBIs), which utilize outdoor environments and activities for health and wellbeing outcomes, could provide possibilities to meet these various needs.

Keywords: autism ; developmental disability ; adults ; nature-based interventions

1. Introduction

Recent literature has identified that research and services addressing mental health, quality of life (QoL), and social wellbeing are important for autistic adults ^[1]. These are key areas to address, as there is evidence that this group experiences lower QoL in comparison to non-autistic adults ^[2]. Autistic adults can also experience higher levels of stress, and can commonly experience co-occurring depression, anxiety, as well as other co-occurring disabilities such as ADHD or intellectual disability ^{[3][4][5]}. Wellbeing and QoL for autistic adults is complex and may differ from neurotypical expectations and norms ^[6]. Unique factors can be involved, including sensory experience, autistic identity, societal acceptance of autism, and access to services ^{[7][8]}.

Barriers to employment for autistic adults have also been reported ^{[9][10]}, and though employment as a normative outcome should be problematized, it is often also related to QoL and wellbeing in autistic individuals ^{[6][8]}. A priority-setting stakeholder consultation with autistic adults found that participants had strong interest and preference for interventions and approaches to mental health and wellbeing such as art therapy, music therapy, physical activity, and animal-assisted therapy ^[1]. Nature-based interventions (NBIs) could also be of interest to this group as a similar modality providing multiple vocational, health, and wellbeing outcomes.

The broad umbrella of NBIs and their many applications have been the subject of a growing amount of literature in recent years, with multiple reviews establishing the relevance of exposure to nature for health and wellbeing ^{[11][12][13]}. Although a unified definition of NBIs is not yet well established, it appears widely accepted that the essential elements of an NBI include an attempt to improve health and wellbeing through exposure to, or engagement with, elements of nature ^[14]. This is underpinned by theories of nature's ability to restore attention and reduce cognitive demand and stress ^[15], as well as the human compulsion towards nature through the biophilia hypothesis ^[16]. NBIs can include not only activities but also the alteration and qualities of the natural environment to enhance wellbeing outcomes, such as purposeful landscape design ^[14].

A multitude of activities are covered under the umbrella of NBIs, such as gardening, forest bathing (*shinrin yoku*), and wilderness therapy ^[17]. Animal-assisted interventions such as equine therapy are also encompassed by the umbrella of NBIs ^[18]. Various terms such as therapeutic horticulture, ecotherapy, green care, blue care (water-based natural settings), and care farming are also subsumed into the concept of NBIs ^{[12][19][20]}. Therapeutic horticulture (TH) (also sometimes termed horticulture therapy or social and therapeutic horticulture) in particular has similarities to arts therapy modalities, using gardening and outdoor activities and settings to facilitate the therapeutic process ^[21]. Vocational horticulture can also be seen as a form of NBI, in which employment-related horticultural skills are developed within the context of therapeutic intervention. In this way, vocational horticulture offers potential employment and meaningful activity, particularly for populations facing barriers to traditional job markets ^{[22][23][24]}. Additionally, TH is frequently delivered in a group community setting, giving it a strong social and relational element that aligns with calls for community-accessible services ^{[1][21]}.

NBI research spans countless configurations of specific interventions or activity types with a wide range of target groups ^[18]. A number of reviews have found NBIs to be worthy of exploration for health and psychosocial wellbeing ^{[25][26][27]},

stress reduction [28], for vulnerable youth [29], multiple long-term conditions [30], and people with dementia [31], to name a few. Some sources have explored the delivery and outcomes of NBIs for adults with various developmental disabilities [32], as well as garden design for autistic adults [33]. Various studies have also explored NBIs for autistic children [34][35][36][37]. Findings that nature can be beneficial for neurodivergent children have also gained recent attention in the media [38]. However, there does not yet appear to be a review of NBIs for autistic adults. Given the potential of NBIs to improve social connection, health, and psychosocial wellbeing—areas of interest and importance for autistic adults—the exploration of the use of NBIs for this population group is warranted.

2. Types of Nature-Based Interventions

A wide variety of NBIs were represented in the literature, including a range of active and passive activities, as well as indoor and outdoor horticultural activities. Forest-based activities were most common among the studies found. A number of NBIs also integrated cooking, arts, and crafts. Horticulture activities were mostly connected to studies relating to vocational skills. Additionally, some studies also noted the connection between the NBI setting or activity and the importance of sustainability and conservation.

2.1. Forest-Based Activities

Studies from Japan focused on forest-based activities at institutions and were facilitated by staff at the site of the program (e.g., residential facility staff). Both studies described walking in a forest environment connected to the facilities, and both studies included using mushroom-growing activities by collecting logs and injecting mushroom spores [39][40][41]. The two studies did differ, however, in group size, time spent in the forest, and the number of additional activities. At a residential facility, the group consisted of up to 10 regular attendees with differing disabilities. These attendees spent a few hours in the forest two to four times a week. In addition to walking in the forest, this group undertook other activities such as mowing and planting trees, flowers, and vegetables [39][40]. By comparison, Uehara [41] described forest activities taking place at a specialized autism treatment center, with a larger group of 22 people attending more regularly (four to six hours each weekday). Additional activities were not reported for that study, but it was noted that activities ran in all weather conditions [41].

O'Brien [42] similarly discussed forest-based activities in the UK; however, the forest location and program were not attached to any particular institution, and the program was open to a wide variety of user groups. The program was run at a large public arboretum involved in environmental conservation. A community shelter with a fire pit and wood oven was built specifically for the program to host participants from five youth groups and five adult groups. The community shelter was reported to be an important feature that facilitated a sense of belonging among participants [42]. Of the groups attending, two included autistic participants of adult age: one group of 10 from a residential facility (with support from carers) and another group of three. Visits to the program were weekly or fortnightly for approximately five hours, and groups were attended between four and eight times. Participants could walk in the arboretum and across a treetop walkway that was accessible to wheelchair users. Other forest-based activities included woodland management, such as clearing brambles, fencing, and planting trees. Activities were facilitated by the forestry commission staff, described as trained youth and community workers. Staff and volunteers also attended an autism awareness course and an inclusion training day.

2.2. Integrating Cooking, Arts, and Crafts

While centered in nature, some NBIs also integrated additional activities, such as cooking, arts, and crafts. These could utilize natural elements, such as sound mapping, carving, or using leaves to make prints [42]. Cooking and eating as a group was also described by O'Brien [42] as a key activity that facilitated social connection and teamwork, by roasting marshmallows over the fire or preparing and cooking pizzas in the outdoor oven.

Himmelheber et al. [43] also highlight arts and crafts as important activities. The program is described as an intensive horticultural therapy camp in the U.S., in which small groups of 10–12 annual campers attend for one week. Although labeled as a horticultural therapy camp, there is little description of horticultural activities, with most focus given to arts and crafts, including games, music, hiking, herb gardening, and carpentry (e.g., building birdhouses) and painting.

2.3. Horticultural Activities

Studies relating to horticultural activities took the form of discrete horticultural skills such as repotting plants, as well as work placements [44][45]. One study describes participants attending an outdoor education training center set on a large farm in the US with the aim of teaching horticultural skills [45]. Activities were conducted indoors in the greenhouse, where

three participants were taught three key horticultural skills: planting seeds, transplanting seedlings, and repotting larger plants. Participants attended for three hours, once a week for nine weeks. Other studies focused on employment capacity and productivity. Mattson et al. ^[44] compared the productivity of employee participants in apple harvesting in contrast to an indoor training center. Guided by horticultural vocational training staff, 30 participants from a nearby vocational training center learned standard apple harvesting techniques. Following this, they spent a month engaged in apple picking, supported by the orchard manager.

2.4. Sustainability

The possibility of mutual human and nature benefits and opportunities for sustainability and conservation in NBIs were noted across three of the included studies. Scartazza et al. ^[46] describe an NBI that actively involves conservation and sustainability at the heart of its purpose. The authors describe the importance of biodiversity for human health and wellbeing, particularly in light of biodiversity loss and climate change. Set in a dedicated garden in Italy, the program was conceived by an interdisciplinary team of professionals, researchers, and local community members and used to improve the wellbeing of people and the local environment. Eight young autistic adults and adolescents were given the role of “Biodiversity Custodians” and connected with farmers and elders in the community to conserve the local area through landrace planting (genetically diverse native plants suited to the conditions of the local environment). The landrace plants in the program are chosen for their adaptive characteristics, such as needing less water and being hardier than commercial counterparts, therefore needing less use of pesticides and providing a more sustainable crop. Over a period of two years, participants attended once a week for four hours at a time and were supported with a 1:1 ratio. Along with assisting in the selection and planting of the landraces, the custodians also collected and saved landrace seeds. These were saved in a seedbank as well as being distributed to the community, furthering the program’s aim to support biodiversity conservation.

Furthermore, Uehara ^[41] notes that many forests in Japan are in need of care and maintenance, and that there is a possibility for mutual benefit for the environment as well as participants when engaging in forest activities. O’Brien ^[42] also described their NBI as being located in an arboretum involved in conservation efforts. Participants in the program are actively involved in woodland management and maintaining the grounds through fencing and clearing bramble. O’Brien notes, “A key aspect of engaging with and shaping nature is also the concept of relational values; people do not only receive benefits from engaging with nature but shape it themselves through caring about nature and taking action to care for nature” ^[42] (p. 2).

3. Nature-Based Intervention Outcomes

Outcomes from NBIs were diverse in nature and related to social connection as well as personal outcomes. In the study by Uehara and Itoh ^{[39][40]}, three men with various developmental disabilities showed improvement after participating in forest-based activities. Improvements were reported in their behavior across emotional stability, communication, and “life rhythm”, described by the authors as “basic life activities such as eating, sleeping, behavior, interactions, and so forth” (p. 24). These categories were measured by observation of staff on a three-point scale, and with interobserver agreement, but it is unclear how these were defined. One participant had a noted an improvement in their walking ability and a decrease in monthly injuries, dropping from 10 incidents at the start of the program to two after one year. Alpha brain waves were also measured to compare between the indoor environment and forest environment. An increase in alpha brainwaves was noted in the three participants when in the forest, indicating a more relaxed state of mind in the forest than indoors. However, statistical procedures for this result were also not clearly defined.

Similarly, Uehara ^[41] found improved communication in a group of autistic adults following forest activities. Improved work attitude was reported in 13 of 22 participants, as well as a reduction in “panic reactions” (a term not explained or defined) following forest activities. The authors noted that “panic reactions had occurred mostly indoors and they seldom occurred in the forest environment.” (p. 63). Some participants showed improved sleep patterns. As with Uehara and Itoh ^[39], these outcomes were also measured by observation of staff on a three-point scale, and with interobserver agreement, but again, it was unclear how these were defined. Tables of findings were also difficult to interpret with limited explanation.

In a qualitative study, O’Brien ^[42] explored experiences of forest-based and arts and crafts activities for a variety of different user groups, including participants with autism, mental health conditions, mental psychosis, drug and alcohol rehabilitation, debt, addiction, and those with low wellbeing and social isolation issues. Observations and interviews were analyzed according to three types of nature engagement in green mind theory ^[47]. Observations and interviews supported all three types of engagement: social engagement, woodland craft engagement, and creative and sensory engagement. The significance of repeat visits was also identified as a theme, with participants expressing a desire for more time to

engage in the program. They noted that their confidence and familiarity with the site and other participants increased with each visit. As analysis was conducted across combined groups, and supporting quotes/examples are mostly attributed to the other cohorts, it is difficult to identify outcomes specific to the autism group. The experience of one autistic woman is described in more detail, in which her experience of building a fire moves from fear to something that she wanted to do more of (p. 11).

In the only quantitative study to use validated measures, Scartazza et al. ^[46] found improvements across both scales. Three autistic participants were evaluated using the International Classification of Functioning, Disability, and Health version for Children and Youth (ICF-CY) and the Observational Rating Scale of Basic Functions (SVFB) following their involvement in horticultural and community activities as biodiversity custodians. In the ICF-CY, significant improvements were reported for tasks such as undertaking a single task independently (75% improvement) and engaging in complex interpersonal interactions (100% improvement). Improvements were also found using the SVFB scale, in initiative in expressing will, shared action, reaction to another's presence, and behavioral unpredictability.

Vocational outcomes were discussed in two studies. Mattson et al. ^[44] compared differences in productivity in an indoors training center against apple harvesting in an orchard. The study found significant differences in productivity between clients with developmental disabilities. Focus was given to six of the seven participants studied, who showed higher levels of productivity in the orchard than in the training center, and who also received a higher wage for their work. Schleien et al. ^[45] found that targeted horticultural skills (planting seeds, transplanting seedlings, and repotting plants) were successfully acquired by three autistic young adults over a nine-week period. Additionally, these skills were mostly retained seven weeks later with no additional training in between. However, mixed results were reported in transferring these skills from the initial training environment (a greenhouse) to a new environment (the adjacent farm) immediately after the training period.

As a process evaluation of a one-week horticulture therapy camp, Himmelheber et al. ^[43] did not report on participant outcomes but instead outlined key aspects of the program's delivery. Three key themes from observations and focus groups with camp staff and volunteers and parents of participants were identified. The first theme identified was "community building", where the camp environment is reported to be a welcoming and safe place that is playful, supported by positive attitudes of staff that encourage participants to try new things, and emphasizes flexibility and inclusion for campers. The second theme was identified as "promoting self-efficacy" and included providing opportunities for leadership where campers help each other, developing and demonstrating confidence, and teamwork and problem solving. Specific praise from staff was also mentioned. The final theme identified was "exposure to natural world", described as organized experiences and reactions to nature. Participants developed knowledge of the natural world around them, including bird types and habits, knowledge of plants, and the properties of certain herbs. The authors noted that across all themes, the skills that participants were developing would be useful in daily life.

4. Challenges and Limitations of NBI Research

MMAT results found a wide variation in study quality. Research methods and design were mostly quantitative. Two qualitative studies were also found. However, regardless of study design, all studies involved observation as the primary method. Quantitative studies largely observed changes in pre- and post-engagement with the program, or over a period of time; however, very limited detail was provided on the scales and process used to make and interpret these observations ^{[39][40][45]}. Comparisons between productivity at different locations were also analyzed quantitatively ^[44]. The only quantitative study to utilize validated instruments was Scartazza et al. ^[46], who assessed participants pre- and post-NBI engagement using the International Classification of Functioning, Disability, and Health version for Children and Youth (ICFCY) and the Observational Rating Scale of Basic Functions (SVFB). Sample sizes in these quantitative studies were quite small, with four out of five quantitative studies having less than 10 participants.

MMAT results for quantitative studies ranged in quality but were commonly rated lower due to a lack of key details about participants and sampling criteria, as well as not accounting for confounding factors. The two qualitative studies ^([42][43]) were higher in quality based on MMAT criteria. However, only O'Brien ^[42] provided a theoretical framework as well as explicating thematic analysis of observations ($n = 53$) and interviews ($n = 29$) in relation to the "five ways of wellbeing" framework.

Despite methodological quality and MMAT rating, key details were often missing across all studies. Participant details such as gender and age were often missing (e.g., Himmelheber et al. ^[43]). Where gender was reported, male participants were more common in the research, with some all-male studies ^{[39][40]}. Race/ethnicity and socioeconomic status were also not reported in any study. Co-occurring health conditions and disabilities were only sometimes identified, including

physical disability, intellectual disability, mental health, and conditions such as epilepsy [39][40]. Communication type and abilities were only described in one study [41]. Overall, participant characteristics beyond broad diagnosis were often not described in detail.

NBIs were found to support social engagement and community building [42][43][46], areas that align with autistic adults' self-reported priorities for mental health [4]. However, many studies did not relate to subjective wellbeing but instead focused on observed behaviors [39][40][41][46] or job productivity and skill development [44][45]. Given the pressing need for services to address the mental health, QoL, and wellbeing needs of autistic adults [1][2] and the wealth of literature linking NBIs to improved health and wellbeing [11][12][13], these are outcomes that future research into NBIs should explore for this population.

Future research should also be aware of ensuring the inclusion of autistic adults in the research process, for example, employing a wider variety of methods beyond observation to engage autistic adults as informants of their own experience of NBIs. Participatory methodologies such as photovoice have been found to be effective in engaging autistic participants [48]. The inclusion of autistic perspectives throughout the research process should also be addressed [49], and research should move beyond measuring autistic traits and behaviors [50]. Research methods that accurately engage with unique aspects of autistic wellbeing and QoL should also be considered [6][7][8]. Researchers should also be mindful of outdated ideas and terminology towards autistic individuals and people with developmental disabilities, which were noted in many of the studies included. This was clear in older studies (e.g., Mattson et al. [44]) but also in more recent studies (e.g., Scartazza et al. [46]), in which participants were described with high- or low-functioning labels that can be misleading and perpetuate stereotypes [51].

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