



The Role of Nature-Based Interventions in Supporting Long-Term Conditions through Green Social Prescribing: A Systematic Review

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Background

According to the Office for National Statistics (1) in 2023 36% of working-age people in the UK have at least one long-term health condition, up from 31% in 2019 and 29% in 2016. The number of economically inactive individuals due to long-term illness has also risen to over 2.5 million, an increase of more than 400,000 (1). These long-term conditions (LTCs) include mental health disorders, musculoskeletal issues, cardiovascular disease, diabetes, chronic respiratory disease, frailty, and chronic pain.

NHS England defines social prescribing as “*an approach that connects people to activities, groups, and services in their community to meet the practical, social and emotional needs that affect their health and wellbeing. It is a key component of Universal Personalised Care and is delivered through link workers who co-produce personalised care plans based on ‘what matters’ to the individual* (2). Evidence (3) suggests that social prescribing can support individuals with long-term conditions by connecting them to link workers, who help them navigate the healthcare system and improve their health and well-being (4). Green Social Prescribing (GSP), a nature-based extension of social prescribing, connects people with outdoor activities such as walking schemes, community gardening, conservation volunteering, green gyms, open water swimming, and outdoor arts and cultural programs (5). Broadly speaking, GSP typically involves referral to nature-based interventions (NBIs) as part of a social prescribing programme that encompasses a diverse array of structured activities designed to harness exposure to nature for the enhancement of human health and wellbeing (6).

The national GSP evaluation reported statistically significant improvements in well-being and mental health, with a £2.42 social return on investment per £1 invested by HM Treasury Shared Outcomes Fund and national partners (7). There is also increasing evidence about the impact of GSP, which involves helping individuals connect with nature-based activities and interventions to enhance their physical and mental well-being (7), and high-quality evidence, including systematic reviews and meta-analyses, also report the benefits of GSP and NBIs for those with long-term conditions (8-10).

This systematic review, undertaken in an accelerated timeframe, aimed to identify published research on the impact of NBIs in supporting LTCs that could be effectively used as a Green Social Prescription. The findings are drawn from published studies reporting on population, exposure and outcomes of NBIs and how these complement existing treatments.

Methods

A systematic review method was conducted to obtain articles regarding the impact of GSP/NBIs on LTCs. The review followed the guidelines outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (11) and was guided by recommendations in the Cochrane Handbook for Systematic Reviews of Interventions (12). Three key databases MEDLINE, CINAHL and CENTRAL were search from inception up to June 2025. The full search strategy was checked for accuracy by three social prescribing experts not part of the author team and is detailed in Table 1.

Table 1. Search Strategy

S#1	social prescri* OR community referral OR community connector OR nature intervention OR community prescri* OR social referral OR non-medical referral OR link worker OR care navigator OR asset-based OR strengths-based OR Community health worker OR Social navigator OR Community navigator OR nature prescription OR park prescription
S#2	environment* OR natur* OR green* OR green space OR natural environment OR open space OR land OR terrestrial OR tree* OR outdoor* OR outside OR park* OR forest* OR wildlife* OR wilderness OR wood* OR plant* OR garden* OR vegetation OR land* OR playground* OR mountain* OR horticultur* OR allotment* OR nature connect* OR exercise OR nature art OR nature craft OR alternative therap* OR wilderness OR sport OR conservation OR photo walks OR care farming OR blue* OR blue space OR sea OR canal* OR water bod* OR blue infrastructure OR aqueduct* OR wetland* OR urban waterway* OR riparian corridor* OR lake* OR river OR coast OR beach OR social farming
S#3	Long term conditions OR chronic disease OR chronic conditions OR chronic illness OR multiple chronic conditions OR chronic musculoskeletal pain OR comorbidit* OR Musculoskeletal disorder* OR arthritis OR chronic back pain OR Cardiovascular disease OR Diabetes OR Chronic respiratory disease* OR COPD or asthma OR Frailty OR Chronic pain
S#4	Health related Quality of life OR Quality of life OR Physical activity OR Social Isolation OR Anxiety OR Depression OR Mental health OR Self-Efficacy OR emotional wellbeing OR mental health OR biomarkers OR NHS OR healthcare OR GP OR hospital or Employ* OR employability skills OR job readiness OR career development OR soft skills OR transferable skills OR workplace competencies OR professional skills OR job market skills OR economic activity OR unemploy*
S#4	S1 and S2 and S3 and S4
Filters	Peer reviewed, English language

We conducted an additional search that excluded the keywords ‘referring’ and ‘referral route’ (see S#1 in Table 1) to explore more broadly the impact of nature and green space on LTCs. Although this search returned 149,199 results, we were not confident that the literature identified would be sufficiently relevant to the NBI approach underpinning GSP.

Table 2. Additional results without the S#1 key terms

Database Search Totals (without referral as a key search term)	
MEDLINE	112, 007
CINAHL	35, 124
CENTRAL	2068
TOTAL	149, 199

We used the **PEO framework (Population, Exposure, and Outcome)** to define and structure the research question, focus the search strategy and establish eligibility criteria (see Table 3). The **Population** refers to the group being studied i.e., those people living with LTCs, the **Exposure** refers to the NBI, and the **Outcome** of the intervention refers to variables such as quality of life, biomarkers and unemployment.

Table 3. Eligibility criteria

Framework	Criteria
Population	Patients with long term conditions (>1 year and impacts a person’s life (3)) which included: mental health disorders, musculoskeletal issues, cardiovascular disease, diabetes, chronic respiratory disease, frailty, and chronic pain
Exposure	Nature Based Interventions (NBIs) that involved organised programmes that intentionally utilise nature to promote health and wellbeing AND Prescription or referral to an intentional nature-based (blue and/or green) intervention (6)
Outcome	Physical health, mental health, healthcare usage, employment



Types of Nature Based Interventions (Exposure):

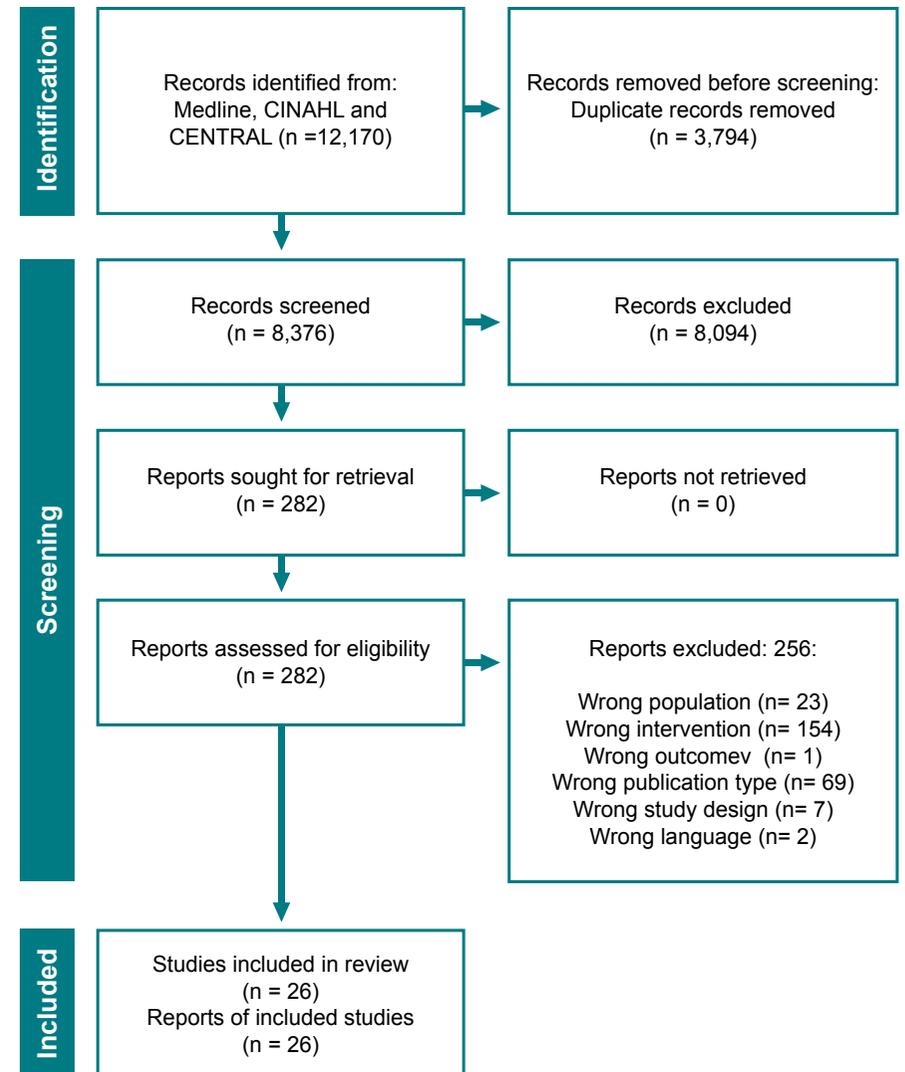
As an ‘exposure’ NBIs are generally characterised as organised programmes that intentionally utilise nature to promote health and wellbeing. Accordingly, we included only those studies that clearly reported the deliberate use of NBIs. A subset of these interventions, referred to as Nature-Based Health Interventions (NBHIs), are defined as structured health programmes with explicitly stated therapeutic goals (13). NBHIs are typically delivered in natural environments, facilitated by trained healthcare professionals, and conducted over multiple sessions as part of a formal treatment plan. It is important to note, however, that not all NBIs are professionally guided, nor do all GSP models exclusively refer individuals to NBHIs. To ensure clarity and consistency, we examined each included study for evidence of professional facilitation or formal referral mechanisms.

The title and abstract of search results were screened by two blinded reviewers. The full text of those considered relevant and potentially relevant were then screened, again by two blinded reviewers. At this stage, articles were identified as either excluded, with reasons provided or included. Any potential disagreements regarding the eligibility of articles were referred to a third reviewer to determine final inclusion. Once included studies had been identified, the following data were extracted: (i) study design, (ii) participants, (iii) exposure - intervention details (including if the nature aspect was intentional (14)), (iv) referral route, (v) control group details if relevant and (vi) results of outcomes. For systematic reviews the results of included papers were extracted as reported and the full text of each study was not retrieved. This was to ensure the review was completed in an accelerated timeframe. Findings were synthesised using a thematic analysis approach.

Results

A total of 8,374 studies were identified during the search. The full text of 282 were screened for inclusion with 256 of these articles being excluded at this stage. The main reasons for exclusion were wrong intervention (not green/nature based) and wrong publication type (e.g. not a full study). The remaining 26 articles met our inclusion criteria (8-10, 13, 15-36). Figure 1 details the search results.

Figure 1: PRISMA Diagram: Detailed Search Results (11)



Overview of the Study Foci

A total of 9 primary studies located focused on LTCs such as cancer (18, 32), mental ill-health (15-17, 20, 22, 24, 25, 29, 32, 36, 37), pain, (35) and healthy aging (29). Some of these primary studies were also included in the systematic reviews located and this is highlighted in the Table 4. In total, there were 19 systematic reviews (8-10, 13, 15, 17, 19, 21-28, 30, 31, 33, 34) which reported on a range of LTCs such as cancer, chronic pain, obesity, mental health, Children and young people's (CYP) mental health, musculoskeletal disorders, cardiovascular events (such as stroke and hypertension), fibromyalgia, respiratory disease, obesity, mobility impairments, psycho-physiological stress and other chronic conditions such as Parkinsons disease. Only one review reported on the use of GSP as an intervention for frail older people (25). The papers revealed a diversity of NBIs which included Nature Adventure Rehabilitation (NAR) such as sailing and outdoor activities (22), the use of publicly accessible green spaces (17), blue prescriptions (15), community gardening and/or gardening programmes (25, 29, 38), woodland nature walks (16), horticultural therapy (32, 35), conservation (8), community-based walking or walking in nature (18, 39-43), nature-based rehabilitation (24), forest therapy (23), conservation therapy (34), and camping/hiking (36).



Evidence for Referrals: Types and Pathways

Our review revealed that many studies did not explicitly report formal referral pathways, such as those employed in structured GSP models involving link workers or general practitioners. In some cases, interventions were integrated into rehabilitation programmes within clinical settings, such as hospitals or outpatient clinics. A range of terms were reported that described the referral routes or pathways to NBIs or NBHIs. For example, whilst all papers reported on the impact of NBIs, only three papers reported specifically on GSP or nature-based prescriptions (9, 17, 20).

Of the 26 papers reviewed, two (15, 18) did not specify whether the NBIs were explicitly guided by health professionals. A before and after cohort study (20) used validated tools, including the ONS-4 and the Hospital Anxiety and Depression Scale (HADS), to measure the impact of green social prescribing (GSP) on individuals with mild to moderate mental ill-health in the community and reported that GSP is beneficial for mental health and well-being. One systematic review (17) included referrals of individuals with LTCs by health professionals to 'green spaces'. This review reported significant improvements in psychological outcomes, social networking, and overall psychological benefits.

Another systematic review (9) included individuals with underlying LTCs and concluded that nature-based prescriptions have positive effects on various LTCs, including improvements in blood pressure, depression, anxiety, and physical activity. However, the way in which NBIs were used as part of an intervention differed. For example, there were 11 papers that reported on the intentional use of nature for physical exercise (9, 15, 17, 18, 20-22, 28, 30, 31, 36).

Many reports focused primarily on the outcomes of the intervention, often omitting details about the referral pathways through which participants accessed the nature-based programmes. In some cases, the referral route was clear (9, 17, 20) while in others, participants were referred for research purposes or the referral route was unclear (13, 16, 24, 32).

As highlighted, the evidence base relating specifically to GSP was limited, largely due to poorly defined referral pathways. However, the evidence on the impact of NBIs for individuals with LTCs provides meaningful insights into how nature can be purposefully integrated as a component of GSP. The next section provides an overview of evidence that reports benefits of NBIs on LTCs.



Cross-Cutting Themes

The emergence of cross-cutting themes within a systematic review typically stems from a rigorous process of thematic synthesis, initiated through meticulous data extraction. These themes often transcend individual studies, offering integrative insights across diverse interventions, populations, and contexts. In this review, our aim was to identify recurring concepts that could illuminate broader systemic or contextual dimensions. While we identified a substantial body of research highlighting the benefits of NBIs for wellbeing, the heterogeneity of reported outcomes and the diversity of NBIs evaluated posed challenges in isolating coherent cross-cutting themes.

Nevertheless, a considerable proportion of included studies employed mental health as a key outcome, reinforcing the broader applicability of NBIs in supporting individuals living with LTCs. Similar outcomes were reported in a rapid review of instrumentation and outcomes of NBIs (6) which identified that most measure mental wellbeing as an outcome. According to the World Health Organization, mental health is defined as a state in which individuals can realize their abilities, manage everyday stresses, work productively, and contribute meaningfully to their communities (44). Good mental health is thus acknowledged as a cornerstone of general wellbeing, influencing emotional resilience, physical health, and social functioning (45). Furthermore, mental wellbeing represents a distinct and measurable construct, strongly associated with enhanced life satisfaction, vitality, and reduced psychological distress (46).

The range of LTCs positively impacted by NBIs and NHBIs underscores the bidirectional relationship between mental health and overall wellbeing, suggesting that such interventions can yield broad health benefits across the lifespan. Although the diversity of NBIs and limited detail on referral pathways constrained our ability to identify unified cross-cutting themes, we were able to categorise the literature by referral pathway, and whether the intervention was led by a health professional. The literature is also organised by LTC in Table 4. Narrative synthesis aligned with the key domains of physical wellbeing, pain management, social connectedness, mental health, and overall quality of life then follows.

Table 4. Evidence grouped into LTCs

LTC	Author (year) and study design	Participants and referral	NBI and deliverer	Control where appropriate	Outcomes	Setting
Mental ill health (n = 11)						
Mental ill health	Darcy (2025) One group pre-post design	223 adults. Majority were aged 18–64 (87%) and female (59%). 74% self-reported a mental health condition; 21% had other long-term health conditions. 65% lived in the most deprived areas (IMD deciles 1–4). 44% were unemployed or unable to work due to ill health /disability. Participants were referred to an NBI via GSP.	Horticultural and care farming (51%), Sports and exercise outdoors (32% green exercise, bush craft).	NA	ONS4 Wellbeing Scale showed improvements HAD's (anxiety and depression) showed improvements	Community based nature activities – local providers in the North Yorkshire GSP programme
Mental ill health	Husk (2016) Cochrane Review	Adults 18 and over. Total number of participants across all included studies was 3648. Characteristics were poorly reported; eight studies did not report gender or age and none reported socio-economic status. Three quantitative studies reported that participants were referred through health or social services, or due to mental ill health (five quantitative studies), however participants' engagement routes were often not clear.	Studies shared the key elements of environmental enhancement and conservation activities (EECA) intended to improve the outdoor natural or built environment at either a local or wider level: • take place in urban or rural locations • involve active participation • can be entirely voluntary, or not (such as through offenders doing Community Service); and • are NOT experienced through paid employment. The range of activities varied considerably.	NA	Quantitative studies - a range of different health and well-being outcomes included. Only one study reported physiological measures. No studies reported physical health measures. Qualitative studies - nine themes identified through thematic analysis: personal achievement, personal/ social identity, developing knowledge, benefits of place, social contact, physical activity, spirituality, psychological benefits and some limited risks of participation. Qualitative research evidence identified positive experiences and a range of perceived health and well-being benefits, the quantitative studies, which were few in number and of weak quality, suggested little or no impact on the outcomes of interest.	Various study settings across UK, US, Canada and Australia.

LTC	Author (year) and study design	Participants and referral	NBI and deliverer	Control where appropriate	Outcomes	Setting
Anxiety, depression and/ or stress	Jessen (2025) Systematic Review and Meta-analysis	19 articles included in the review, a total of 1901 participants. Referral route not reported in the review.	NBHIs were defined as structured health interventions with a clearly stated treatment goal. The NBHIs should take place in natural environments, facilitated under the guidance of trained healthcare professionals, and are required to take place as part of a programme over multiple sessions.	Not reported in the review	A large improvement of anxiety after participation in an NHBI (standardised mean change= -0.8, 95% CI= (-1.56; -0.04), p=0.039. A large decrease in depression symptoms after participating in an NHBI (standardised mean change= -0.87, 95% CI= (-1.18; -0.56). A small, non-significant improvement in perceived stress after participating in an NBHI (standardised mean change= -0.32, 95% CI= (-0.74; 0.09). A moderate improvement in overall mental health after participation in an NBHI (standardised mean change= 0.58, 95% CI= (0.39; 0.77). Most studies rated as low quality.	Therapy gardens, parks, lakesides, natural settings, botanical gardens, blue spaces. England, Denmark, Sweden, Finland, Korea, The Netherlands, Serbia, USA, Chorea.
Schizophrenia	Kaleta (2025) Systematic Review of Reviews.	61 reviews were included. One review on symptom severity as a mediating factor of NBIs. Referral route not reported in the review of reviews.	Horticultural therapy.	NA	Symptom severity was important, as the effect sizes were larger for those with moderate severity compared to those with mild severity	Not reported
PTSD	Gelkopf (2013) RCT	22 veterans with PTSD. The rehabilitation staff contacted all the relevant clients, and the phone numbers of those who consented to participate were then passed on to the lead crew member of Etgarim, who arranged for individual appointment.	Nature Adventure Rehabilitation (NAR) which included Sailing and outdoor activities.	20 veterans with chronic combat-related PTSD on wait list.	Participants in the NAR group experienced a significant decrease in depression levels compared to the WL control group. The NAR group showed a significant improvement in daily functioning, including parenting, work/study, Significant improvements in QAL, emotional control and sense of control & hope. Improved behavioural changes in social exchanges	Sailing and outdoor spaces



LTC	Author (year) and study design	Participants and referral	NBI and deliverer	Control where appropriate	Outcomes	Setting
PTSD	NICE (2018) Systematic Review	1 study (Detweiler) on PTS and depression (49 veterans, averaging 46.4 y old (SD = 11.9)) 1 paper already included in the table (Gelkopf, 2013) Referral route not reported in review.	Horticultural therapy	NA	No statistically significant findings on quality of life, PTSD and cortisol	Unclear
PTSD	Shorer (2023) Qualitative	10 male military veterans. The participants were in an existing support group led by professionals to prescribe the NBI	Nature assisted therapy, adventure-based activities such as hiking, camping and navigating outdoors	NA	Improved coping with PTSD symptoms, enhanced self-worth and improved interpersonal relationships. Increased psychological resilience and hope.	Outdoor areas, forests, hiking trails.
Mental disorders or ADHD or Autism	Mygind (2019) Systematic Review	Children and young people. 2 papers on ADHD 1 paper on mental disorder 1 paper on Autism Referral route not reported in review.	Park walking Stay at care farms 9 weeks adventure therapy 13 week outdoor adventure programme	Pre-post Pre-post RCT but unclear Pre-post	Cognitive performance enhanced in both studies No effect on mood compared with control No differences between intervention and control Mixed social functioning outcomes.	USA parks Netherlands care farms Unclear Israel - unclear
Mental health problems or chronic illnesses	Høegmark (2022) Quasi-Experimental	Two groups (n = 9, n = 11) with a total of 20 men aged 18 to 78. Referral route unclear but - The participants were given the opportunity to choose between participation in the 'Wildman Programme' or one of the traditional rehabilitation offerings in the healthcare center so suggests recruitment was completed in a healthcare facility.	Nature-based Group-based rehabilitation course where participants met once a week for 3 h during a period of nine weeks. Based on an NBMC-approach including Nature experiences, body awareness, mind relaxation and supporting community spirit.	Quasi-experimental study and thus not randomized. But control was traditional rehabilitation offerings in the healthcare centre.	Perceived stress scale significantly improved. WHOQOL-BREF Phys, Psych, Total sig improved. Soc and Env no significant improvement.	The group had a permanent base at a nature school by a campfire surrounded by a forest and the group met at the base 5 out of the 9 times in the course. The other group gatherings took place in forest, beach, tunnel valley, meadowland and hill.

LTC	Author (year) and study design	Participants and referral	NBI and deliverer	Control where appropriate	Outcomes	Setting
LTCs alongside psychological difficulties.	Bhatti (2025) Qualitative	n=10 CYP aged 9-13 with LTCs alongside psychological difficulties. Purposive sampling to recruit participants from paediatric psychology service of a UK NHS hospital. Clinicians introduced the study to eligible children's parents/ carers.	One day nature-based therapeutic intervention within a woodland nature reserve. Inc: mindfulness, forest school activities, nature arts and crafts, sensory games, cooking.	NA	IPA of 10 SS interviews. Four emergent experiential themes: 1) Challenging illness identity 2) freedom to choose 3) sense of connection 4) mindful presence. Participants perceived positive impacts of NBTIs on their mental and physical well-being and sense of self.	Woodland setting
Obesity and Mental ill health	Buckley (2020) Systematic Review	Adults over 18 with a diagnosed LTC, actively under the care of a healthcare professional (1 obesity, 7 mental health conditions). HPs 'prescribed' green space for the supported self-management of people living with LTC. For the purpose of this review 'prescribed' is being defined as agreement with the use of something as a treatment or for management, as well as advice as to its delivery.	Green spaces that were publicly accessible and free of cost and green space. Interventions using parks, gardens, forest/woodlands and wetlands resulted in improved psychological, physical and social wellbeing for people with LTC.	NA	Positive psychological effects for green space interventions in people with mental health conditions. Sig improvements in physiological outcomes of blood pressure and blood glucose, general fitness, weight reduction and pain severity. Positive outcomes with measures of social networking and development of social skills, re-immersion into society and increased likelihood of return to work.	Urban parks (n=3), gardens (n=2), forest/ woodlands (n=2) and wetlands (n=1)
Cancer (n=2)						
Breast and Lung	Nakau (2013) One group pre-post design	22 patients (4 males, 18 females) with breast cancer or lung cancer. They were city dwellers who lacked access to green environments in their normal life. Referral / recruitment unclear.	Forest therapy, horticultural therapy, yoga meditation and supportive group therapy study sessions once a week for 12 weeks	NA	FACIT-Sp (wellbeing). Sig improvements in spiritual and functional wellbeing 2/5 sub scales) Cancer fatigue physical, affective, aspects and total score sig improved. SF-36 6/8 improvements physical functioning (PF), role-physical (RP), general health perception (GH), vitality (VT), role-emotional (RE) and mental health (MH) POMS-SF tension/anxiety (TA) and confusion (C) improved 2/6. STAI all sig improved Natural Killer (NK) Cell Activity – sig improved.	Japan World Exposition '70 Commemorative Park (Suita, Osaka Pref, Japan), environments such as forests, lawns, streams and gardens.

LTC	Author (year) and study design	Participants and referral	NBI and deliverer	Control where appropriate	Outcomes	Setting
Cancer (type not specified)	Carreño (2023) RCT	16 adults 18 and 70 years; ii) at least 6 months post-treatment and not more than 5 years post-diagnosis; iii) non-active tumour in remission phase; iv) not having developed a tumour in the respiratory tracts or in areas that are incompatible with practicing water sports. Participants were recruited into the research rather than 'referred' for an NBI	Walking, beach bathing, swimming snorkelling	Sitting and relaxing without a view for 30 mins	Mental Health Profile of Mood (POMS), Anxiety, depression. Physical activity included Heart Rates, BP, sleep quality were improved.	Coastal towns in Spain and Mediterranean blue spaces
Neurological Conditions (n=1)						
Parkinson's disease, dementia, and multiple sclerosis.	Heckmann, (2024) Systematic Review	Patients with chronic neurological diseases such as stroke in the rehabilitation phase, Parkinson's disease, dementia, and multiple sclerosis. Referral route not reported in review.	Forest therapy	NA	Stroke rehab – 1 RCT improvements in anxiety and depression 1 RCT fatigue decreased more in IG. 1 non-intervention study – greater exposure to greenness associated with higher survival rates. Dementia – 2 qual papers – positive experiences of wellbeing and self-esteem. 1 sys review- Some evidence that garden use led to lower levels of agitation. But low-quality studies.	Various Forest area Outdoor environment Boston, US Outdoors Nature Garden use in a nursing home
Pain (n=1)						
Lower back	Rören (2024) Randomized, controlled, cross-over trial.	Adults over 18 with 1) non-specific chronic lower back pain 2) indication for in-patient rehabilitation, 3) up-to-date tetanus vaccination and 4) being able to walk 2km. Referrals unclear but study was conducted at Cochin Hospital and Saint-Anne Hospital (Paris, France).	Horticultural Therapy (HT) and handiwork activities. Participants assigned to different orders of: 2, 90-minute HT sessions and 2, 90-minute handiwork sessions. The 2 sessions of each activity were performed in the same week, interspersed with 1 week without either activity. Study lasted for 3 weeks.	NA	Primary outcome: change in ACC perfusion in ml (blood)/100g (tissue)/min after each activity compared to baseline The rumination score was one of the 2 scales of the Rumination Reflection Questionnaire (0–60, 0: no rumination, 60: maximal rumination), the catastrophizing score was the sub-score of the Coping Strategy Questionnaire (0–20, 0: no catastrophizing 20: maximal catastrophizing) ACC blood perfusion did not decrease after HT or handiwork.	Physical medicine and rehabilitation (PRM) department of Cochin Hospital, Paris, France.

LTC	Author (year) and study design	Participants and referral	NBI and deliverer	Control where appropriate	Outcomes	Setting
Multiple LTCs (n=11)						
Cancer and Depression	Kotera (2021) Systematic Review	2 papers in the review on LTCs 1 paper on adult cancer survivors 1 paper on depressed patients Referral route not reported in review.	2 trail walks per week for 8 weeks with a guide 2 hours walk a week for 8 weeks	NA NA	Significant reduction in state anxiety but not in generalized anxiety Depression reduced from pre- to post-walk, and post-walk to 3-month follow-up.	Canada forest Park with a lake and ornamental plantings; urban woodland.
Learning disabilities, mental ill-health, recovery from hospital stays, low confidence, anxiety, psychiatric disorders, depression, risk behaviours, autism, physical ill-health or impairments, homelessness, alcohol or substance misuse, low self-esteem, low wellbeing, low physical activity levels,	Rogerson (2020) Summary of 6 pre-post study designs	Adult attendees to one of six wellbeing projects in the UK that focused on interaction with nature. Multiple LTCs Referral unclear.	Conservation, ecotherapy, craft-focussed, community gardening, food growing, wilderness therapy, tree planting, walking, meditation.	NA	WEMWBS SWEMWBS Pooled effect size was large: $g = 0.812$ (95% CI [0.599, 1.025]), and differences in wellbeing changes associated with project duration, age or sex were not statistically significant. Compared to those reporting 'average-high' starting wellbeing, participants reporting 'low' starting wellbeing exhibited greater improvements (BCa 95% CI [-31.8, -26.5]), with 60.8% moving into the 'average-high' wellbeing category.	Various – cities, wilderness, countryside, coast, woodlands,

LTC	Author (year) and study design	Participants and referral	NBI and deliverer	Control where appropriate	Outcomes	Setting
Cancer survivors or psychiatric disorders or frailty	Howarth (2020) Systematic Review	77 studies included in the review. Referral route not reported in review.	Included: 'allotment gardening' (n=8) and 'Community gardens' (n=11). Most common garden interventions reported: horticultural therapy (n=17) and 'structured gardening' (n=17)	NA	Reported outcomes: mental health, physical impact, nutritional behaviour changes and overall general well-being. Review found over 35 validated health and well-being outcome measures reported. Most papers examined the impact of gardens on mental health (36%). General well-being represented 32% of the total outcomes reported. There was an even split between those papers reporting on specific physical outcomes (14%) and those reporting on nutrition as an outcome (18%). The heterogeneous outcomes may explain the paucity of meta-analyses (3.7%). Review indicates that gardens and gardening could have a positive dual benefit on a range of mental, social and psychological outcomes.	Various: across UK, USA, Brazil, South Korea, Taiwan, Japan and the Netherlands.



LTC	Author (year) and study design	Participants and referral	NBI and deliverer	Control where appropriate	Outcomes	Setting
PTSD, TBI, and hearing impairment, ASD, Psychosocial problem and vulnerability, Polytrauma, mild depression, Depression, anxiety, social exclusion, obesity, and sensory problems, Aggressive behaviours, and social, emotional, and behavioural problems, Mobility and visual impairment, cognitive disabilities, High risk of mental health conditions, loneliness, alcohol and drug use	Alejandre (2023) Systematic Review	950 service users ranging from 2 to 85 years of age. This included 726 young people and 197 military veterans Referrals varied but were all intentional to blue spaces. Veterans Prescribed by recreational therapists through signposting or direct referral. Veterans with PTSD were directly referred by a team of recreational therapist, nurse, psychologist, and social worker. Some veterans with PTSD and children were prescribed by physicians or a team of GPs, nurses, and psychologists through direct referral or a holistic link worker. Socioeconomically deprived and ethnically diverse children were prescribed by paediatricians using a holistic link worker or a combination of signposting and link worker. Service users who experienced substance abuse were directly referred by substance abuse specialists.	Blue Prescription Programme (BPP) including individual or group activities that take place in or around blue spaces or natural water environments, such as Surfing, swimming, kayaking, boating, canoeing, nature walks near water	NA	Physical Health Increased physical activity Improved body weight Enhanced fitness and mobility Development of new skills (e.g., surfing, fishing) Cognitive (Mental) Health Reduced loneliness Improved mood and emotions Increased self-efficacy and self-esteem Better problem-solving abilities Reduced symptoms of depression, anxiety, and PTSD Decreased stress levels Enhanced relaxation Reduced intake of harmful substances and medications Social Health Improved social skills Enhanced interpersonal competencies Increased prosocial behaviours Environmental Knowledge Increased contact with nature Enhanced pro-environmental knowledge	Blue spaces or natural water environments.
Chronic pain and cancer	Jones (2022) Systematic Review	Range of populations including • Adult patients • People with chronic pain • Cancer patients Referral route not reported in review.	A range of nature-based interventions (NBI's) nature-based interventions described as interventions that involve actual or simulated elements of nature. These interventions incorporate strategies involving various types of natural environments such as greenspaces, blue-spaces and brown-spaces.	Controls included • 'standard care' • Control room • Controlled view (ie no nature) • No intervention (ie no NBI)	Lechtzin et al. (2010): • Pain Scores: Numeric rating scales to measure pain intensity during bone marrow aspirate and biopsy. • Categorical Pain Outcomes: Measures of pain relief and patient satisfaction. • No significant findings Khan et al. (2016): • Vital Signs: Heart rate, blood pressure, and other physiological measures. • Hospital Stay: Duration of hospital stay in days.	Natural environments such as greenspaces, blue-spaces and brown-spaces across different countries: Germany (x2), US (x4), UK, Finland, China

LTC	Author (year) and study design	Participants and referral	NBI and deliverer	Control where appropriate	Outcomes	Setting
					<ul style="list-style-type: none"> • Analgesic Consumption: Amount of pain medication used. • Significant improvements with intervention. • Qualitative Measures: Small group discussions and focal interviews to assess patient experiences. <p>Han et al. (2016):</p> <ul style="list-style-type: none"> • Heart Rate Variability: Measures of autonomic nervous system function. • Natural Killer (NK) Cell Activity: Immune system function. • Pain and Depressive Symptoms: Self-reported measures. • Health-Related Quality of Life: Standardized questionnaires. • Significant improvement in HR, NK, pain, depression and quality of life. <p>Tanja-Dijkstra et al. (2017):</p> <ul style="list-style-type: none"> • Experienced Pain: Numeric rating scales immediately after exposure to virtual reality. • Recollected Pain: Pain recalled one week post-test. • McGill Pain Questionnaire: Detailed pain assessment. • VR improved pain scores. <p>Wells et al. (2019):</p> <ul style="list-style-type: none"> • Pain Scores: Daily pain intensity measures. • Pain Catastrophizing: Measures of rumination, helplessness, and magnification related to pain. • Nearby nature buffered the relation between catastrophizing and pain intensity 	



LTC	Author (year) and study design	Participants and referral	NBI and deliverer	Control where appropriate	Outcomes	Setting
					<p>Scates et al. (2020):</p> <ul style="list-style-type: none"> • Stress and Pain Questionnaires: Developed by researchers to assess constructs of stress and pain. • Increases in relaxation, feelings of peace, and positive distractions. • Qualitative Interviews: Open-ended questions to gather patient experiences. <p>Verzwyvelt et al. (2021):</p> <ul style="list-style-type: none"> • Pain and Distress: Numeric rating scales. • Heart Rate and Blood Pressure: Physiological measures. • Salivary Cortisol: Biomarker of stress. • No significance differences in heart rate, systolic, or diastolic blood pressure, saliva cortisol, pain, or distress. <p>Li et al. (2021):</p> <ul style="list-style-type: none"> • Pain Intensity: Measures of pain perception. • Pain Threshold and Tolerance: Electrical pain stimuli tests. • Anxiety and Stress: Self-reported measures. • Heart Rate and Heart Rate Variability: Physiological measures. • Scenic Beauty Estimation (SBE): Participant preferences regarding experimental environments. • Pain threshold and tolerance improved after visiting greenspace. No significant effect for image viewing. No significant difference was observed in pain-related psychophysiological indices between the experimental settings. 	



LTC	Author (year) and study design	Participants and referral	NBI and deliverer	Control where appropriate	Outcomes	Setting
					<p>Lipponen et al. (2022):</p> <ul style="list-style-type: none"> • Heart Rate Variability: Measures of autonomic nervous system function. • Self-Reported Pain: Standardized questionnaires. • Work Exhaustion: Measures of stress and fatigue. • Individual interventions resulted in increase in α-amylase activity. Pain did not decrease. <p>Results of the review were theoretical. Stress reduction theory and attention restoration theory are the most discussed and applied theoretical frameworks when studying NBIs and pain.</p>	
PTSD, depression, emotional and psychiatric difficulties, social exclusion, amputees and SCI, addiction, breast cancer, learning disabilities, ASD, TBI	Britton (2018) Systematic Review	<p>21 included papers focussed on LTCs.</p> <p>Recruitment to interventions included advertising, blue care providers, health care providers, local community, conference and not specified.</p> <p>Referral route not reported in review.</p>	Beach activity, canoeing, dragon boat racing, fly-fishing, kayaking, sailing, scuba-diving, surfing and swimming	NA	<p>Mental health and psychosocial wellbeing outcomes improved overall.</p> <p>Enhanced social relations.</p> <p>Improved environmental connectedness limited evidence.</p> <p>Mixed benefits to physical health:</p> <ul style="list-style-type: none"> -some evidence that strength was improved - some evidence for pain reduction- no negative physiological effects for cancer patients - drop in HR for vulnerable youth. <p>Evidence lacking in long term impact.</p>	Blue spaces



LTC	Author (year) and study design	Participants and referral	NBI and deliverer	Control where appropriate	Outcomes	Setting
Coronary artery disease, poor mental health, stress, depression, high BP	Corazon (2019) Systematic Review	8 papers included LTCS Referral route not provided in the review.	Park/ Forest / Garden walks, Horticultural Therapy, Relaxation in nature, nature-based therapy		<p>1 paper reported an improvement in stress and energy in people with stress</p> <p>1 paper improvement in emotions in people with depression.</p> <p>1 paper improvement in mood in people with high BP</p> <p>1 paper decrease in anxiety and depression in people with stress.</p> <p>1 paper no change in cortisol in patients with coronary artery disease.</p> <p>2 papers decrease in cortisol in people with poor mental health. And high BP.</p> <p>1 paper decrease in DBP in people with CAD.</p> <p>1 paper no effect on BP or pulse rate in people with stress.</p>	Various
Adults and adolescents (>12 years) with or without a formal mental or physical diagnosis.	Djernis (2019) Systematic Reviews	Review included 12 papers on LTCs. <ul style="list-style-type: none"> • 3 papers on Mental ill health. • 2 on cancer patients. • 1 pain • 2 CV • 5 substance misuse Referral route not provided in the review.	Horticultural activities, nature walks, mindfulness meditation, nature activities and exercise, forest therapy, nature-based therapy, Nomadic hiking, adventure trips, adventure therapy. All with mindfulness.	Education on hypertension, no treatment, usual routine, same activities but indoors not outdoors, treatment as usual	<p>Only pooled data from all studies (not just people with LTCs):</p> <p>Physical, psychological and social outcomes all significant effect sizes.</p>	Garden, park, forest



LTC	Author (year) and study design	Participants and referral	NBI and deliverer	Control where appropriate	Outcomes	Setting
Psychiatric disorders cardiovascular disorders Musculoskeletal disorders Cancer Neurological disorders Sexual ill-health Respiratory disorders substance use disorder	Nguyen (2023) Systematic Review	92 unique studies (122 reports): Psychiatric disorders (13; 14%), Cardiovascular disorders (12; 13%), Musculoskeletal disorders (6; 7%), Cancer (4; 4%), Neurological disorders (4; 4%), Sexual ill-health (2; 2%), Respiratory disorders (1; 1%), Substance use disorder (1; 1%). An instruction by a health or social provider to patients to spend time in a nature setting, such as a park, or any programme organised by health or social institutions for their patients or clients that features nature-based interventions.	NBIs defined as interventions that used nature-based therapy to improve health outcomes and involved exposure to a nature environment, including green spaces and blue spaces; multimodal programmes where one component is nature-based activities.	No intervention or intervention taking place in a non-nature setting	Nature prescription programmes showed evidence of cardiometabolic and mental health benefits and increases in walking. Nature prescription programmes resulted in a greater reduction in systolic and diastolic blood pressure. Nature prescriptions also had a moderate to large effect on depression scores. Nature prescriptions resulted in a greater increase in daily step counts than control conditions but did not improve weekly time of moderate physical activity.	South Korea (18; 20%) USA (16; 17%) Japan (10; 11%) UK (7; 8%) China (5; 5%) Other (36; 39%) Forests and nature reserves (32; 35%) Parks (26; 28%) Small gardens, such as at home, a nursing home, or a community centre (15; 16%) Botanical gardens (10; 11%) Farms (5; 5%) Other urban green spaces (5; 5%) Greenhouses (2; 2%) Beaches (2; 2%) Activities done by participants Walking (42; 46%) Farming or gardening (27; 29%)



LTC	Author (year) and study design	Participants and referral	NBI and deliverer	Control where appropriate	Outcomes	Setting
Mental ill health, stroke	Mygind (2019) Systematic Review	Adults 3 Mental diagnoses	2 Guided walking Outdoor adventure group	NA Unclear in review	Decreased stress and enhanced happiness. Improved mood.	Scotland, England Australia
		Stroke	Forest bathing	Unclear in review	Depression and anxiety decreased.	South Korea
		TBI or Stroke	Nature Walking Outwood bound	Unclear in review	Positive effect when walking in nature compared with urban. No reduction in stress. Attention test worse after park walk.	Sweden Australia
		3 Hypertension	Forest Bathing Nature walking Forest Therapy	Unclear in review Pre-post design	Decreased psychophysiological stress indicators. ET-1, a vasoconstrictor reduced. Platelet activation, no effect. Immune functions mixed results – but many improved. Higher mood. Increased heart rate variability more than the same activities in control conditions.	China Japan South Korea
		3 Depression	2 Nature Walking 1 Forest Therapy	Unclear in review	Enhanced short term memory upon walking in a park relatively to an urban environment. Higher levels of positive affect, but similar levels of negative affect. Improved mood indicators and affective valences compared to indoor activity. Attention capacity increased. Reduction in depressive symptoms.	USA Austria Korea
		Avoidant personality disorder	Outdoor adventure therapy	Unclear in review	Enhanced psychophysiological stress indicators.	Norway
		Schizophrenia	Adventure therapy	Unclear in review	No results provided in review	Canada
		Chronic pain	Forest Therapy	Unclear in review	No results provided in review	South Korea
		Cancer	Outward bound programme	Unclear in review	Small effects on self-reported depression and perceived pain. Enhanced psychophysiological stress indicators.	USA
		Referral route not provided in the review. (Gelkopf, Taylor and Kuo, Zachor, Van den Berg, Guthrie results in review but already reported in the table).				

LTC	Author (year) and study design	Participants and referral	NBI and deliverer	Control where appropriate	Outcomes	Setting
Evaluation team members (CETM) involved in community-based social healthcare practices.	Menhas (2023) Qualitative	24 comprehensive evaluation team members (CETM) involved in community-based social healthcare practices. Interviews with community people who were part of the “comprehensive evaluation team” were conducted by researchers using a purposive sampling strategy.	Nature-based Social prescriptions included Tai Chi and Qigong in green community gardens, parks, walks, gardens and wetlands. Other interventions that were socially prescribed did not involve nature.	NA	Key themes reported for socially prescribed NBI's were <ul style="list-style-type: none"> • overall health and quality of life. • promoting healthy aging • Improved mental health • Improved social interaction • Improved awareness of nature 	Green community gardens, parks, walks, gardens and wetlands. Yiwu, Zhejiang Province, China



Benefits identified across the papers fall into five categories: physical well-being, pain management, social aspects, mental well-being and improved quality of life.

Impact of NBIs on Physical Outcomes

The evidence reported that NBIs demonstrated positive impacts on physical health across several domains for individuals with LTCs. Papers that reported physical wellbeing as an outcome included a range of health measures for people with LTCs. Evidence from multiple papers indicated increased levels of physical activity, improved heart rate and blood pressure, and reduced BMI underscoring NBIs' potential to complement traditional medical approaches through holistic, lifestyle-oriented improvements in physical wellbeing. Specifically, two papers reported that NBIs improved overall physical activity (8, 15), and one paper described an improvement in heart rate (26). Improved blood pressure was reported in two papers (17, 26) and one systematic review (9) reported benefits across all aspects of physical wellbeing. A range of fitness and functional tests were used to demonstrate impact of NBIs in a pre-post observational study (32).

Impact of NBIs on Mental Health

The evidence suggests that NBIs have consistently shown positive effects on mental health, offering low-intensity, community-based support for individuals experiencing stress, anxiety, depression, and social isolation. A total of 11 papers specifically reported on the impact of NBIs on mental wellbeing. Studies reported improvements in stress (13, 15, 19, 24, 26, 31) depression (9, 13, 15, 18, 22, 23) and anxiety (13, 15, 18-20, 23, 26, 28, 31, 32). One systematic review reported that horticultural therapy (HT) effectively enhanced subjective happiness among frail and pre-frail nursing home residents (25).

Impact of NBIs on Social Connectivity

Our systematic review highlighted that NBIs were linked to enhanced social connectivity, particularly through their capacity to foster meaningful interactions in non-clinical, community settings. For example, social aspects were included as outcomes in six papers. These related specifically to the impact of NBIs on employability, self-efficacy and the development of social skills. Three papers reported on the impact of NBIs on outcomes that could influence future employability (15, 17, 22). A total of two papers reported improved social skills as a result of a NBI (15, 17). The evidence indicates that NBIs can act as a bridge between individuals and their communities, encouraging participation, collaboration, and sustained engagement with others in supportive environments.

Impact of NBIs on Chronic Pain Management

NBIs show promising potential for chronic pain management by offering non-pharmacological, holistic approaches that address both physical and psychological dimensions of pain. Importantly, NBIs may also foster social connection and a sense of agency, helping individuals cope more effectively with persistent pain. Evidence reported on the impact of NBI's on chronic pain management was limited. Only four papers reported (9, 10, 22, 30) pain management as an outcome out of which, two (17, 35) found that nature-based activities improved pain management, However, one systematic review (26) included papers that reported no improvement with pain management.

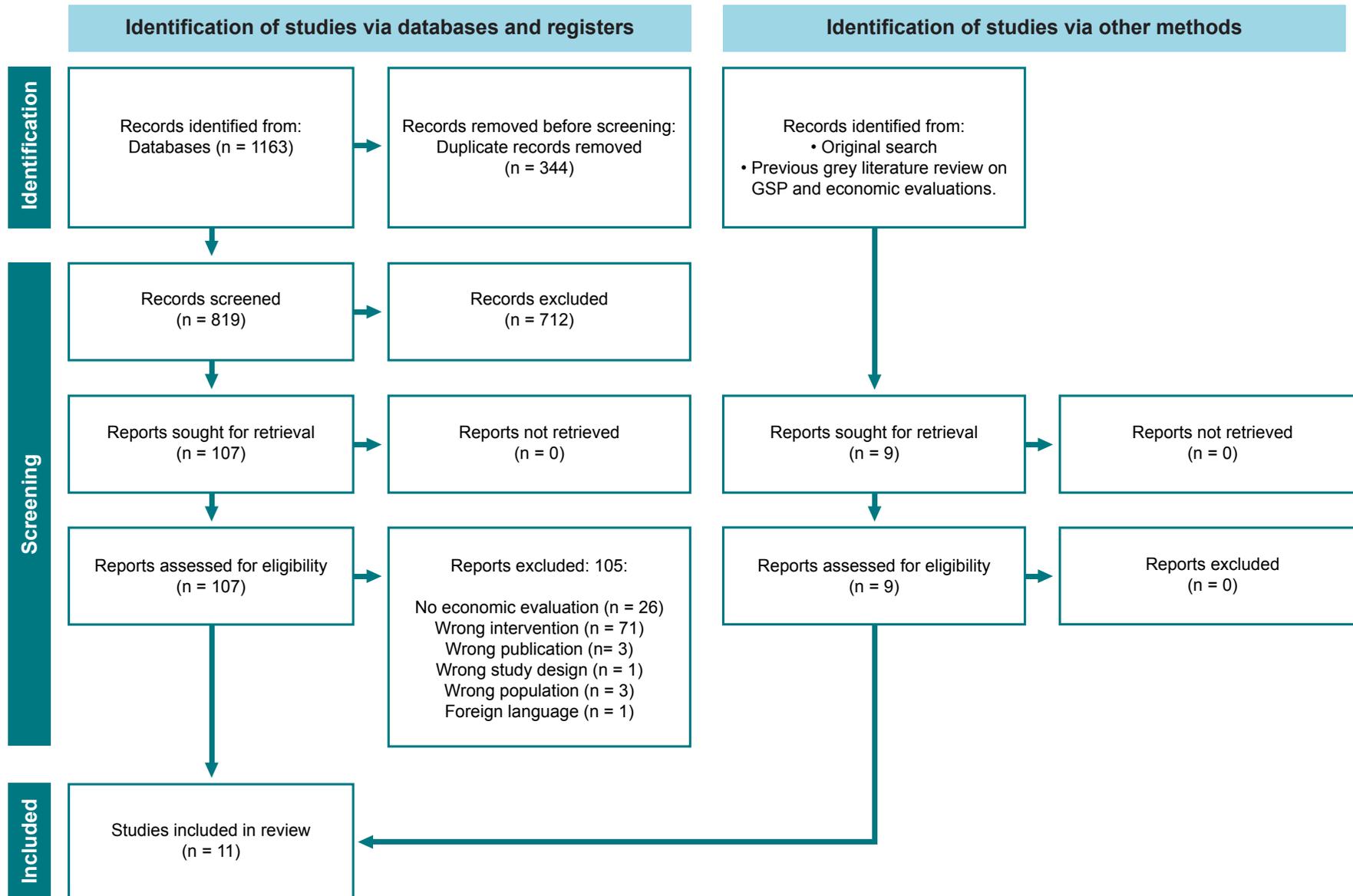
Impact of NBIs on Quality of Life

When considered collectively, the evidence presented in this systematic review suggests that NBIs have a beneficial impact on overall quality of life by addressing the interrelated dimensions of physical, mental, and social wellbeing (10). Although only one study explicitly reported improvements in quality of life (31), the broader evidence, particularly concerning NBIs' effects on individuals with LTCs, reveals consistent outcomes such as improved mood, reduced stress, increased physical activity, and enhanced social connectedness. These gains contribute to greater life satisfaction, emotional resilience, and a strengthened sense of purpose, especially for those experiencing social exclusion or health disparities.

Evidence on the Cost-benefits of NBIs

Only one of the 26 included papers conducted an economic evaluation alongside their intervention (15). Therefore, to add rigour to our systematic review, we replaced the outcome key terms (S#4 in Table 1) to economic terms to specifically search for economic evaluations. The new terms were as follows: cost-effectiveness analysis OR cost-benefit analysis OR cost effectiveness OR economic evaluation OR cost description analysis OR cost-utility analysis OR value for money OR benefit-cost ratio OR SROI OR Social Return on Investment. We then re-ran the full search. The results of this additional search are illustrated in Figure 2 over the page:

Figure 2: PRISMA Detailed Search Results; Economic Evaluations (11)



Results of the Review for Evidence that Report Economic Evaluations

Our initial search revealed one paper that included NBIs with an economic evaluation (15). Our additional search with specific economic evaluation key words and searching a previous relevant systematic review yielded another 10 articles (7, 47-55). Primary studies (n=6) considered economic evaluations of NBIs focussing on improving mental health (7, 47, 50-53). We included five reviews, three considered mental health (15, 49, 54, 55) and one obesity (48). The papers revealed a range of NBIs which included surf therapy (15), walking (48), community gardening and/or gardening programmes (51, 52), running (47), outdoor activities such as bushcraft, campfire cooking, woodland walks and conservation (49, 50), outdoor walking and climbing (53). One review reported non-specific economic evaluations for “environments rich in wildlife” and “nature-based initiatives for people with mental health issues” (54). Sendal (55) presented an economic evaluation of the Wildlife Trusts’ Natural Health Service.

Two review papers did not provide details of the referral type or pathway (15, 48). The remaining papers all included details that the referral was completed by a health professional, such as a GP, nurse or mental health practitioner to a green social prescription intervention.

As with the previous search results, there was a high level of heterogeneity in the included paper which made thematic synthesis challenging. Therefore, the results are reported narratively using the economic evaluation method as overarching themes.





Costs and savings economic approach

Seven studies reported the cost savings of NBIs on LTCs (15, 47-49, 52-54) with all but one, very small study, demonstrating positive savings. A surf therapy intervention was £215 cheaper per person compared with mental health care (15). A community-based multicomponent intervention to improve mental health conditions resulted in a reduction of 28% of inpatient admissions, 15% reduction in Emergency Department visits and 90% reduction in inpatient days, however these reductions were not translated to monetary values (47). Activity monitors estimated cost per participant per kg weight lost was \$51.43 in a tackling obesity intervention which was \$77.72 cheaper than the standard group weight-loss education approach (48). The range of NBIs included in the economic evaluations are listed below:

- Blue prescription specifically surf therapy (15)
- General gardening (52)
- Outdoor walking and climbing (53)
- Horticultural and agricultural schemes, walking groups and regeneration projects in local parks (Ecominds) (49, 54)

Return on investment economic approaches

Our systematic review located a range of economic evaluation methods that have been applied to assess the impact GSP and NBIs. Traditional approaches such as cost-effectiveness analysis (CEA) and cost-utility analysis (CUA)—often using metrics like Quality-Adjusted Life Years (QALYs)—have been used to some extent (three studies), but they are limited in capturing the broader social and environmental benefits of nature-based interventions as the list below indicates:

- QALYs
 - Branching out (woodland) (49, 54)
- WELLBYs
 - National evaluation of GSP (7)

Social Return On Investment (SROI)

More holistic frameworks like Social Return on Investment (SROI) have gained traction. SROI attempts to quantify the wider social value generated by interventions, including improvements in wellbeing, community cohesion, and environmental quality. SROIs have been used to quantify the impact of a range of services such as:

- Nature-based activities for example bushcraft, campfire cooking, woodland walks, conservation, foraging, woodland gym and mindfulness (50)
- Gardening (51)
- The Wildlife Trusts' Natural Health Services such as mindfulness (55)
- Outdoor walking and climbing (53)
- A range of activities including volunteering, gardening, recovery work, wellbeing through nature, life skills and wildlife habitat (49)
- Environments rich in wildlife (Wildlife Trust), NBIs (Natural England) (54)

Papers located that report on costs and savings are reported in Table 5 over the page:

Table 5: papers that report on costs and savings

Study	Population	NBI	EE Method	Outcome
Alejandre (15)	Children and young people with physical and mental illness	Blue prescription – surfing	Cost savings	<ul style="list-style-type: none"> Surf therapy was perceived as beneficial by health sector stakeholders, practitioners, general public, and policymakers because the cost (£50/session) was less than the mental health care cost (£265/year) for children.
Awara (47)	Adults with mental illness	Running (as an option in a multicomponent intervention)	Cost savings	<ul style="list-style-type: none"> Patients experienced reduced inpatient admissions (88% vs. 60%) and Emergency Department visits (82% vs. 67%) in the post-rehabilitation year, compared to the pre-rehabilitation year. There was a significant reduction in inpatient days by 90%, translating into substantial cost savings.
Bhardwaj (48)	Adults with obesity	Walking / physical activity (the intervention was an activity monitor - SenseWear)	Cost savings	<ul style="list-style-type: none"> The estimated costs per participant per kg lost was \$129.15 for Group Weight-Loss education group, \$51.43 for SenseWear Armband, and \$55.42 for both. Group Weight-Loss education group was approximately \$60 more than for the SenseWear Armband alone
Jones (52)	Adults with mental ill health	Gardening	Cost savings	<ul style="list-style-type: none"> Total GP appointments before intervention were 96 (average 8 per person), during the intervention 60 (average 5.16 per person). Due to added cost of intervention and still GP visits, increase in cost by £399.17 per person per annum. Only 9 participants.
Hartfiel (50)	Adults with mental ill health	Nature-based activities for example bushcraft, campfire cooking, woodland walks, conservation, foraging, woodland gym and mindfulness	SROI using: Logic model using SWEMWBS, 7-day PA, GSES and Social trust. Outcomes were monetised using Social Value Calculator and Mental Health SVC.	<ul style="list-style-type: none"> Minimum cost scenario: Social Value Calculator (SVC) base £1: £4.02 Conservative case £1: £1.74. MHSVC £1: £4.67. Maximum cost scenario: SVC base £1: £2.57. Conservative £1: £1.11 MHSVC £1: £2.99
Haywood (7)	People with mental ill health	7 test and learn sites offering a range of GSP	SROI using WELLBYs	<ul style="list-style-type: none"> £1: £2.42 If resources leveraged by the Test and Learn sites £1: £1.88 in the project overall.
Ireland (51)	Adults with mental ill health	Gardening	SROI using: confidence, social activity, physical activity, healthy eating, qualifications, volunteering, employment, respite care, care, medication, GP, hospital, crisis intervention, support worker, care packages.	<ul style="list-style-type: none"> £117,961 on an investment of £57,906, giving a return on investment of £1: £2.04. Sensitivity analysis £1: £1.25 The value of social returns to Mind were £ 7,258 compared to an investment of £8,885 giving a return of £1: £0.82
Sendall (55)	Adults with mental ill health	The Wildlife Trusts' Natural Health Services	SROI	<ul style="list-style-type: none"> Wild at Heart Clifton Park in Rotherham session £1: £1.19 benefit in terms of reduced costs to the NHS. Assuming one year each in the scheme, £1: £0.34 benefit in terms of reduced costs to the NHS. Where assumed to have participated for longer, £1: £0.86. £1: £2.16 of benefit in terms of reduced costs of treating mental health related conditions.

Study	Population	NBI	EE Method	Outcome
Makanjuola (53)	Adults with mental ill health	Outdoor walking and climbing	Cost saving SROI using: SWEMWBS Mental health social value calculator v.1.0 Self-efficacy GSES Social value calculator v.4.0	<ul style="list-style-type: none"> The total annual cost saving was GBP 272 per face-to-face client and GBP 27 per online client SWEMWBS: The social value was GBP 15,640 per client per year for face-to-face clients and GBP 4758 for online clients The SROI ratios ranged from GBP 4.12 to GBP 7.08 for every GBP 1 invested for face-to-face clients and from GBP 2.36 to GBP 3.34 for every GBP 1 invested for online clients
Bragg (49)	A mix of adults with mental and physical ill health	A range of activities including volunteering, gardening, recovery work, wellbeing through nature, life skills and wildlife habitat.	Cost savings SROI QALYs	<ul style="list-style-type: none"> Ecominds “value of approx. £7000 per person”. Community gardening NHS savings over £113,000 per year per participant Master Gardener £1: £10.70 Volunteers £1: £2.55 Green Gyms £1: £4.02 City Farm £1: £2.35 Gardens: £1: £9.42 “economic pay-off to the NHS”. Care Farms: £1: £3.59 / £3.39 Woodland health promotion £6800 per QALY “highly cost effective”.
Natural England (54)	Adults with mental ill health	Horticultural and agricultural schemes, walking groups and regeneration projects in local parks (Ecominds). Environments rich in wildlife (Wildlife Trust), NBIs (Natural England) Formally led, woodland activities (Branching out)	Cost saving SROI QALYs	<ul style="list-style-type: none"> Ecominds - savings (through reduced NHS costs, benefits reductions, and increased tax contributions) of around £7,082 per participant, savings of £1.46m for 246 people who found full-time work following participation. Wildlife Trust - £1: £4.20 and £11.94 Natural England £1: £2.35 to £10.70 per £1 Branching Out - the cost per Quality Adjusted Life Year gained (QALY) was £8,600.54 In comparison to the NICE threshold of £20-30,000 per QALY.

How reliable is the data?

Our search strategy was based on Cochrane methods which employs systematic, explicit methods to minimize bias across all stages of the review process, including the identification, selection, and synthesis of relevant studies. We searched for high-quality evidence, including systematic reviews, randomized controlled trials (RCTs), and other experimental studies. These types of evidence effectively control for bias and confounders, enhancing the reliability of the findings. We extracted papers that reported on the intentional use of nature and excluded those papers that reported on the incidental use of nature within exercise programmes.

From the literature that reported on LTCs (excluding cost benefit literature), three studies used experimental designs such as pre-post controlled trials (24, 32, 34) and two RCTs (22, 35). A total of 19 papers were systematic reviews (8-10, 13, 15, 17, 19, 21-28, 30, 31, 33, 34). We included three robust qualitative studies (16, 29, 36) that used interviews to gain insight into the experiences of people with LTCs who used nature or gardens as a therapy for wellbeing. These papers used high quality, recognised qualitative methods and offer valuable insights into complex phenomena by capturing the depth and context of human experiences of people with LTCs, and often revealed why NBIs were successful in improving mental wellbeing for people with LTCs that quantitative methods may overlook.

Conclusions

This systematic review identified that NBIs as a part of a referral pathway can complement existing medical treatments by addressing psychosocial determinants that influence the development and management of LTCs. A range of NBI activities have been evaluated, which used in a pathway can help mitigate symptoms of depression, anxiety, and chronic stress. By reconnecting individuals with accessible natural spaces and supportive community networks, nature-based prescribing supports a more holistic, preventative model of care that aligns with NHS priorities around personalised and integrated health systems. The evidence suggests that integrating non-clinical nature-based approaches through a social prescription can improve overall wellbeing, particularly for people with poor mental health, reduced mobility, obesity, cancers and pain and can be used to complement existing treatments. However, there was only one study that reported on the impact of NBIs for frail, older people. Similarly, there is limited research focused on employability as an outcome. Only one systematic review highlighted the use of NBI for individuals with chronic pain. Although various cost-benefit analyses and Social Return on Investment (SROI) evaluations have been conducted, the variability in outcomes for individuals with long-term conditions highlights the need for more robust SROI methodologies to aggregate data and effectively demonstrate cost benefits to services and commissioners.

Recommendations

Based on the findings of this systematic review, six key recommendations have been identified to guide future research and practice in NBIs for individuals with LTCs as part of GSP. These include the need to clearly articulate referral pathways to improve transparency and implementation; enhance the consistency and rigour of economic evaluation methods to better demonstrate cost-effectiveness; and establish clearer guidance on best practices in NBI delivery. Additionally, there is a call to expand research into the role of NBIs in supporting employability among people with LTCs and to strengthen the evidence base for underrepresented populations, such as frail older adults. Finally, future research should focus on uncovering the mechanisms that underpin successful NBIs and conducting experimental or quasi-experimental studies to compare the effectiveness of nature-based versus non-nature-based interventions in improving outcomes for individuals with LTCs

- 1. Adequately describe referral pathways:** While a range of evidence supports the benefits of NBIs for individuals with LTCs, many studies lacked clarity regarding the referral pathways. To strengthen future research and practice, it is essential that researchers clearly describe and contextualise how participants are referred to NBIs, whether through traditional social prescribing routes, such as link workers or GPs, or via direct referrals from clinicians to NBI delivery organisations. This transparency is crucial for understanding both the cost implications and the operational models underpinning successful implementation.



2. **Improve Economic Evaluation Methods:** Our review revealed considerable variation in the methods used to conduct cost-benefit analyses of NBIs resulting in a wide range of reported outcomes. To better understand the true economic value of NBIs compared to other services, there is a need for more consistent and rigorous approaches to economic evaluation that can accurately capture their cost-effectiveness across diverse long-term condition outcomes.
3. **Expand Focus on Employability:** There were limited studies that reported on the impact of NBIs in helping individuals with LTC return to work. There is a need for future research to investigate how NBIs may support individuals with LTCs in returning to work.
4. **Strengthen Evidence for Specific Populations:** Research has tended to focus on the impact of NBIs & GSP on mental health, however, this has often precluded specific outcome measures for LTC. Further research is needed to understand the impact of NBIs on frail, older adults, as they are currently underrepresented in existing studies.
5. **Future Research Explicating Mechanisms for Successful NBIs:** While existing research has primarily focused on the outcomes of NBIs, there is a lack of evidence exploring the underlying mechanisms that contribute to their success. To address this gap, further experimental and qualitative studies are needed to examine the contextual and causal factors that influence the effectiveness of NBIs for individuals living with LTCs.
6. **Further reviews to explicate comparators between nature and non-nature interventions for people living with LTCs:** Our review highlighted the positive impact of NBIs on individuals living with LTCs, suggesting their potential suitability within GSP offers. To better understand the unique role of nature in promoting health and wellbeing, further systematic reviews are needed to compare the effectiveness of NBIs with non-nature-based interventions, particularly in enhancing social connectivity among people with LTCs.

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