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Review Article

Contextual Factors and Programme Theories Associated with Implementing Blue Prescription Programmes: A Systematic Realist Review

Julius Cesar Alejandre,[1] **Sebastien Chastin**,[2,3] **Katherine N. Irvine**,[4] **Michail Georgiou**,[2] **Preeti Khanna**,[5] **Zoë Tieges**,[6,7] **Niamh Smith**,[2] **Yong-Yee Chong**,[8] **Frances Claire Onagan**,[9] **Lesley Price**,[10] **Sharon Pfleger**,[11,12] **Rachel Helliwell**,[13] **Judith Singleton**,[14] **Samuel Curran**,[15] **Allan Estandarte**,[16] **Emily Sophia Smith**,[17] **and Karin Helwig**[1]

[1]*Department of Civil Engineering and Environmental Management, School of Computing Engineering and Built Environment, Glasgow Caledonian University, Glasgow, UK*
[2]*Department of Physiotherapy and Paramedicine, School of Health and Life Sciences, Glasgow Caledonian University, Glasgow, UK*
[3]*Department of Movement and Sport Sciences, Ghent University, Ghent, Belgium*
[4]*Social, Economic and Geographical Sciences Department, The James Hutton Institute, Aberdeen, UK*
[5]*Department of Food and Nutrition, Institute of Home Economics, University of Delhi, New Delhi, India*
[6]*SMART Technology Centre, School of Computing Engineering and Built Environment, Glasgow Caledonian University, Glasgow, UK*
[7]*Geriatric Medicine, Usher Institute, University of Edinburgh, Edinburgh, UK*
[8]*Centre for Sport and Exercise Sciences, University of Malaya, Kuala Lumpur, Malaysia*
[9]*Department of Health, Health Promotion Bureau, Manila, Philippines*
[10]*Department of Nursing and Community Health, School of Health and Life Sciences, Glasgow Caledonian University, Glasgow, UK*
[11]*Public Health Directorate, National Health Service Highland, Inverness, UK*
[12]*School of Pharmacy, Robert Gordon University, Aberdeen, UK*
[13]*Centre of Expertise for Waters, The James Hutton Institute, Aberdeen, UK*
[14]*Faculty of Health, School of Clinical Sciences, Queensland University of Technology, Brisbane, Queensland, Australia*
[15]*International Services, Scottish Environment Protection Agency, Stirling, UK*
[16]*Department of Marketing, Faculty of Business and Economics, University of Antwerp, Antwerpen, Belgium*
[17]*Faculty of Health Sciences, McMaster University, Ontario, Canada*

Correspondence should be addressed to Julius Cesar Alejandre; julze.alejandre@gcu.ac.uk

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Nature-based social prescribing such as "blue prescription" promotes public health and health improvement of individuals with long-term health conditions. However, there is limited evidence explaining the relationship of contexts, mechanisms, and outcomes of implementing blue prescription programmes (BPPs) in health and social care settings that could inform policy and practice. We conducted a systematic realist review by searching PubMed, Web of Science, PsycInfo, Scopus, MEDLINE, and CINAHL for articles published in English between January 2000 and June 2022 about health and social care professionals providing referral to or prescription of blue space activities (e.g., swimming, fishing, surfing, etc.) with health-related outcomes. Components and descriptions of BPP implementation were extracted and used to develop themes of contextual factors used to develop programme theories and a logic model demonstrating the mechanisms of BPP implementation. Sixteen studies with

adequate to strong quality were included from 8,619 records. After participating in BPPs referred to or prescribed by health and social care professionals, service users had improvements in their physical, cognitive (mental), social health, and pro-environmental knowledge. Service user-related contextual factors were referral information, free equipment, transportation, social support, blue space environments, and skills of service providers. Programme-related contextual factors were communication, multistakeholder collaboration, financing, and adequate service providers. Programme theories on service user enrolment, engagement, adherence, communication protocols, and programme sustainability explain the mechanisms of BPP implementation. BPPs could promote health and wellbeing if contextual factors and programme theories associated with service users' characteristics and programme delivery are considered in the design, delivery, and evaluation of BPPs. Our study was registered with PROSPERO (CRD42020170660).

1. Introduction

Robust evidence suggests that contact with blue spaces (water environments) helps promote health and wellbeing. The "Blue Space and Health/Wellbeing Model" [1] demonstrates that human exposure to blue spaces could be indirect (e.g., window view), incidental (e.g., commute along a river path), or intentional (e.g., beach visit) which are measured in terms of duration, frequency, and intensity [2]. Human (e.g., improved mood, self-esteem, engagement in physical activity, social interactions, and decrease in mortality) [3–5] and planetary health outcomes (e.g., proenvironmental knowledge) from these exposures is explained by mitigation (e.g., noise abatement), instoration (e.g., physical activity), and restoration (e.g., stress reduction) pathways [6] that are influenced by environmental (e.g., type, quality, and weather) or personal (e.g., age, gender, and ethnicity) effect modifiers and also facilitated by societal (e.g., quality improvement of water environments), local (e.g., building infrastructure for safe access to blue spaces), and personal (e.g., blue gyms) [7] feedback actions [1].

Consequently, social prescribing (SP), an umbrella term for health and social care interventions that promote health and wellbeing by connecting individuals to nonmedical and community-based interventions [8], utilised the health-promoting benefits of nature [9] to deliver nature-based social prescribing (NBSP) [10]. Moreover, NBSP, especially those that use blue space activities, could be considered a personal feedback action based on the Blue Space and Health/Wellbeing Model [1]. SP is usually delivered using signposting, direct referral, link worker, or holistic link worker pathways, typically initiated by healthcare professionals (i.e., general practitioner/GP) [11]. SP implementation could also be described by programme theories on patient enrolment (first successful referral), engagement (attendance to first session), and adherence (maintained participation over time) [11–13]. There are also suggestions that successful referral uptake and sustainable SP implementation require link workers who facilitate the delivery of social prescriptions and liaise with health and social care facilities and third sector organisation, as well as financial and partnership support [11, 14–16].

SP could help motivate individuals engage with health-promoting behaviours (e.g., physical activity and socialisation) [14, 16]. Findings from a meta-synthesis of evidence suggested that SP improved individuals' sense of belongingness, self-confidence, and sense of purpose, thereby, decreasing feelings of loneliness and isolation [17, 18]. Another systematic review suggested that SP could improve prosocial behaviours, specifically in forging social networks and cohesion through the social cure process, aside from physical and mental wellbeing [19, 20]. Additionally, SP could alleviate the healthcare burden by depressurising the healthcare workload and decreasing healthcare usage [14, 20]. A nationwide SP programme in the UK proved that the intervention had good value for money indicating a social return of £3.42 for every £1 investment in the service [21].

Furthermore, NBSP or nature prescription delivers the health-promoting benefits of nature by referring individuals to activities that connect them with nature [9, 10]. Until recently, nature prescription was called green prescription, characterised by connecting people to green spaces (e.g., parks, forests). NBSP delivers environmental, economic, and social co-benefits [22]. A systematic review suggested that NBSP is a low-cost intervention promoting prosocial (e.g., social connectedness) and proenvironmental behaviours (e.g., conservation volunteering) by providing opportunities for social and nature connections simultaneously [10, 23, 24]. There is much evidence on the health benefits of nature exposure conducted prior to the COVID-19 pandemic, and research during the pandemic also suggested similar benefits. An increase in health-related use of blue/green spaces during lockdowns suggested that these spaces helped people cope with mental health stressors [25–27]. Populations sampled in the UK and Spain associated exposure to nature with mental health improvements and better sleep quality during the COVID-19 pandemic [28, 29]; and fewer mental and physical symptoms suggest a buffering effect on the impacts of isolation [30–33]. Large proportions of blue/green spaces were also attributed to lower COVID-19-related cases and deaths in Poland [34].

Despite robust evidence on the general, physical, and mental health benefits of contact with blue spaces [1, 31, 35, 36], many implementation models of NBSP overlooked the health-promoting benefits of blue spaces (e.g., lakes, rivers, seas, wetlands, canals, etc.). Systematic reviews on NBSP focused on the health outcomes of using green spaces [37]. In Scotland, the Green Health Partnership focused on green space activities (e.g., park runs and forest walks) for obesity prevention, mental health promotion, and the improvement of public health [38]. Moreover, the implementation and evaluation of SP have several contextual barriers which could be extended to NBSP. An implementation model that considers the suitability of social activities with service users, referral pathways, skills of

human resource, financing mechanisms, stakeholder partnerships, comparable outcome measures, evaluation frameworks, and contextual factors that influence uptake of service users is needed [11, 15, 16, 39–43].

To our knowledge, these evidence gaps have not been investigated for NBSP that uses blue spaces (or blue prescription programme/BPP). One systematic review highlighted barriers in implementing blue space activities (e.g., accessibility, equipment, and training of service providers) [44]; however, there is no model describing the mechanisms of BPP implementation. Hence, we conducted a systematic realist review to investigate the health benefits, service user suitability, referral pathways, and contextual factors associated with BPP implementation to inform the development of programme theories and a logic model that would explain the mechanisms of programme implementation.

2. Methods

A systematic realist review investigates why interventions work in certain circumstances by interrogating contexts, mechanisms, and outcomes of programme implementation [12]. We followed Berg's [45] steps for conducting realist reviews.

2.1. Question Identification and Purpose of Review. We defined BPP as individual or group activities that take place in or around blue spaces or natural water environments (e.g., surfing, swimming, kayaking, etc.) (interventions), which were referred to or prescribed by health and social care professionals (e.g., GPs, pharmacists, social workers, etc.) (population) using the four SP referral pathways and with health- and wellbeing-related outcomes. Our setting (context) was health and social care facilities where many individuals are referred to or prescribed with health and social care interventions. We included case reports, qualitative, case-control, cohort, pre-post intervention studies, nonrandomised, and randomised controlled trials published in English. We limited the publication period from January 2000 to June 2022 as research on the health-blue space nexus emerged in the early 2000s [36, 44]. We excluded studies where activities were not conducted in natural water environments and were referred/prescribed by nonhealth or nonsocial care workers through advertisements and recruitments.

2.2. Articulating Initial Programme Theories. Programme theories (PTs) (e.g., logic models or if-then statements) are analytical units in realist reviews that suggest "context-mechanism-outcome" relationships to describe how interventions work [12, 13, 46, 47]. PTs inform the development of logic models used in planning, designing, and evaluating complex interventions [48]. Logic models are composed of inputs, activities, outputs, and outcomes [49]. We used the following PTs on SP based on literature and analysed if these are true to BPP implementation models by investigating their occurrence in the included studies. Based on this, we redeveloped the initial PTs to form the final PTs that could best explain BPP implementation.

2.2.1. Initial PT1 (Patient Enrolment). If the referral is presented in an acceptable manner, it is compatible with the patient's needs and expectations, and the patient believes that it will improve their condition, then they may enrol [11].

2.2.2. Initial PT2 (Patient Engagement). If transportation is provided making the socially prescribed activity accessible to the patient, then they will engage [11].

2.2.3. Initial PT3 (Patient Adherence). If the service providers are skilled and there are improvements on patient's condition, then they are more likely to keep attending [11].

2.2.4. Initial PT4 (Link Worker Coordination). If there are link workers facilitating the delivery of social prescriptions and liaising with health and social care facilities and third sector organisations, then the referral uptake will be successful [11, 14–16].

2.2.5. Initial PT5 (Partnership with Community-Based Organisations). If the partnership between health and social care facilities and community-based organisations is financially supported, then the delivery of social prescribing programmes will be sustained [14–16].

2.3. Searching and Appraising Evidence. We followed the PRISMA guidelines for record screening [50]. We searched PubMed, Web of Science, PsycINFO, MEDLINE, Scopus, and CINAHL using keyword strings (Table 1) and conducted a snowball search by screening reference lists of systematic reviews collected from database searches [51, 52]. Records were uploaded, deduplicated, and screened using Rayyan QCRI [53]. Title and abstract screening were conducted by: JA, KH, SCh, MG, PK, ZT, NS, YYC, FCO, AE, ES, and 13 volunteer researchers of the Blue-Green Prescribing Reviewers Group. Full-text screening were independently conducted in pairs by: JA-KH, JA-SCh, JA-ES. KNI resolved conflicting decisions.

Studies were categorised based on their methodological approaches to suit the QualSyst tools [54]. Quality assessment was independently conducted in pairs by: JA-KH, JA-SCh, JA-KNI. Conflicting ratings were reconciled by one-to-one discussion. We adopted strong (≥0·80), good (0·71–0·79), adequate (0·51–0·70), and limited (≤0.50) quality thresholds for quantitative papers [55] and used adequate (≥0·55) and low (≤0·54) for qualitative studies [56]. Components of mixed-method studies were assessed separately [54, 56].

2.4. Data Extraction. Using Microsoft Excel, JA electronically recorded authors' names, publication year, methodological approaches, participants/service users, location,

Table 1: Keywords, search strings, and yielded records from database searches.

Databases	Keywords and search strings	Yielded records
PubMed	((((((prescri*[tiab]) OR "non-drug prescribing" [tiab]) OR "cognitive therapy" [tiab])) AND ((blue*[tiab]) OR water*[tiab]) OR river*[tiab]) OR pond [tiab]) OR lake [tiab]) OR sea [tiab]) OR beach [tiab]) OR fountain [tiab]) OR ocean [tiab]) OR coast* [tiab]) OR marin*[tiab]) OR aqua*[tiab]) OR wild*[tiab]) OR marsh*[tiab]) OR shore [tiab]) OR sub-aqua [tiab]) OR riparian [tiab]) OR aqueduct [tiab]) OR surf*[tiab]) OR harbour [tiab]) OR harbor [tiab]) OR swim*[tiab]) OR diving[tiab]) OR snorkel*[tiab]) OR boat* [tiab]) OR fishing [tiab]) OR port [tiab]) OR canal[tiab]) OR kayak*[tiab]) OR canoe*[tiab]) OR sail*[tiab]) OR natur*[tiab]) OR "built environment"[tiab])) AND (((((general[tiab]) OR physical[tiab]) OR mental[tiab]) OR psychological[tiab]) OR social[tiab])) AND (((health [tiab]) OR wellbeing[tiab]) OR well-being[tiab])	755
Web of Science	TS=((((((prescri*) OR "non-drug prescribing") OR "cognitive therapy")) AND ((blue*) OR water*) OR river*) OR pond) OR lake) OR sea) OR beach) OR fountain) OR ocean) OR coast*) OR marin*) OR aqua*) OR wild*) OR marsh*) OR shore) OR sub-aqua) OR riparian) OR aqueduct) OR surf*) OR harbour) OR harbor) OR swim*) OR diving) OR snorkel111) OR boat*) OR fishing) OR port) OR canal) OR kayak*) OR canoe*) OR sail*) OR natur*) OR "built environment")) AND (((((general) OR physical) OR mental) OR psychological) OR social)) AND (((health) OR wellbeing) OR well-being)	1,787
Medline	((((((prescri*.ti,ab.) OR non-drug prescribing.ti,ab.) OR cognitive therapy.ti,ab.)) AND ((blue*.ti,ab.) OR water*.ti,ab.) OR river*.ti,ab.) OR pond.ti,ab.) OR lake.ti,ab.) OR sea.ti,ab.) OR beach.ti,ab.) OR fountain.ti,ab.) OR ocean.ti,ab.) OR coast*.ti,ab.) OR marin*.ti,ab.) OR aqua*.ti,ab.) OR wild*.ti,ab.) OR marsh*.ti,ab.) OR shore.ti,ab.) OR sub-aqua.ti,ab.) OR riparian.ti,ab.) OR aqueduct.ti,ab.) OR surf*.ti,ab.) OR harbour.ti,ab.) OR harbor.ti,ab.) OR swim*.ti,ab.) OR diving.ti,ab.) OR snorkel*.ti,ab.) OR boat*.ti,ab.) OR fishing.ti,ab.) OR port.ti,ab.) OR canal.ti,ab.) OR kayak*.ti,ab.) OR canoe*.ti,ab.) OR sail*.ti,ab.) OR natur*.ti,ab.) OR built environment.ti,ab.)) AND (((((general.ti,ab.) OR physical.ti,ab.) OR mental.ti,ab.) OR psychological.ti,ab.) OR social.ti,ab.)) AND (((health.ti,ab.) OR wellbeing.ti,ab.) OR well-being.ti,ab.)	677
CINAHL	((((((TI prescri* OR AB prescri*) OR TI "non-drug prescribing" OR AB "non-drug prescribing") OR TI "cognitive therapy" OR AB "cognitive therapy")) AND ((TI blue* OR AB blue*) OR TI water* OR AB water*) OR TI river* OR AB river*) OR TI pond OR AB pond) OR TI lake OR AB lake) OR TI sea OR AB sea) OR TI beach OR AB beach) OR TI fountain OR AB fountain) OR TI ocean OR AB ocean) OR TI coast* OR AB coast*) OR TI marin* OR AB marin*) OR TI aqua* OR AB aqua*) OR TI wild* OR AB wild*) OR TI marsh* OR AB marsh*) OR TI shore OR AB shore) OR TI sub-aqua OR AB sub-aqua) OR TI riparian OR AB riparian) OR TI aqueduct OR AB aqueduct) OR TI surf* OR AB surf*) OR TI harbour OR AB harbour) OR TI harbor OR AB harbor) OR TI swim* OR AB swim*) OR TI diving OR AB diving) OR TI snorkel* OR AB snorkel*) OR TI boat* OR AB boat*) OR TI fishing OR AB fishing) OR TI port OR AB port) OR TI canal OR AB canal) OR TI kayak* OR AB kayak*) OR TI canoe* OR AB canoe*) OR TI sail* OR AB sail*) OR TI natur* OR AB natur*) OR TI "built environment" OR AB "built environment")) AND (((((TI general OR AB general) OR TI physical OR AB physical) OR TI mental OR AB mental) OR TI psychological OR AB psychological) OR TI social OR AB social)) AND (((TI health OR AB health) OR TI wellbeing OR AB wellbeing) OR TI well-being OR AB well-being)	608

Table 1: Continued.

Databases	Keywords and search strings	Yielded records
PsycInfo	((((((prescri*.ti,ab) OR "non-drug prescribing".ti,ab) OR "cognitive therapy".ti,ab)) AND ((blue*.ti,ab) OR water*.ti,ab) OR river*.ti,ab) OR pond.ti,ab) OR lake.ti,ab) OR sea.ti,ab) OR beach.ti,ab) OR fountain.ti,ab) OR ocean.ti,ab) OR coast*.ti,ab) OR marin*.ti,ab) OR aqua*.ti,ab) OR wild*.ti,ab) OR marsh*.ti,ab) OR shore.ti,ab) OR sub-aqua.ti,ab) OR riparian.ti,ab) OR aqueduct.ti,ab) OR surf*.ti,ab) OR harbour.ti,ab) OR harbor.ti,ab) OR swim*.ti,ab) OR diving.ti,ab) OR snorkel*.ti,ab) OR boat*.ti,ab) OR fishing.ti,ab) OR port.ti,ab) OR canal.ti,ab) OR kayak*.ti,ab) OR canoe*.ti,ab) OR sail*.ti,ab) OR natur*.ti,ab) OR "built environment".ti,ab)) AND (((((general.ti,ab) OR physical.ti,ab) OR mental.ti,ab) OR psychological.ti,ab) OR social.ti,ab)) AND (((health.ti,ab) OR wellbeing.ti,ab) OR well-being.ti,ab)	3,128
Scopus	((((((TITLE-ABS("prescri*")) OR TITLE-ABS("non-drug prescribing")) OR TITLE-ABS("cognitive therapy"))) AND ((TITLE-ABS("blue*")) OR TITLE-ABS("water*")) OR TITLE-ABS("river*")) OR TITLE-ABS("pond")) OR TITLE-ABS("lake")) OR TITLE-ABS("sea")) OR TITLE-ABS("beach")) OR TITLE-ABS("fountain")) OR TITLE-ABS("ocean")) OR TITLE-ABS("coast*")) OR TITLE-ABS("marin*")) OR TITLE-ABS("aqua*")) OR TITLE-ABS("wild*")) OR TITLE-ABS("marsh*")) OR TITLE-ABS("shore")) OR TITLE-ABS("sub-aqua")) OR TITLE-ABS("riparian")) OR *TITLE-ABS("aqueduct")) OR TITLE-ABS("surf*")) OR TITLE-ABS("harbour")) OR TITLE-ABS("harbor")) OR TITLE-ABS("swim*")) OR TITLE-ABS("diving")) OR TITLE-ABS("snorkel*")) OR TITLE-ABS("boat*")) OR TITLE-ABS("fishing")) OR TITLE-ABS("port")) OR TITLE-ABS("canal")) OR TITLE-ABS("kayak*")) OR TITLE-ABS("canoe*")) OR TITLE-ABS("sail*")) OR TITLE-ABS("natur*")) OR TITLE-ABS("built environment"))) AND (((((TITLE-ABS("general")) OR TITLE-ABS("physical")) OR TITLE-ABS("mental")) OR TITLE-ABS("psychological")) OR TITLE-ABS("social"))) AND (((TITLE-ABS("health")) OR TITLE-ABS("wellbeing")) OR TITLE-ABS("well-being"))	1,664
Total		8,619

prescriber/referrers, referral pathways, facilities, intervention format, blue space activities, facilitators, barriers, timescale/duration, dose/frequency, health conditions of service users, and health-related outcomes.

2.5. Synthesising Findings. We employed realist synthesis to analyse and synthesise extracted data [12, 13]. JA used hybrid coding in NVivo 12 [57] to develop themes of contextual factors (CFs) associated with BPP implementation from the extracted data. JA mapped out the existence of developed CFs in the collected evidence to associate these with the initial PTs. The association of CFs and initial PTs informed the redevelopment of the initial PTs to establish the final PTs (i.e., "if-then" statements) explaining BPP implementation [12, 13, 46, 47]. CFs and final PTs were refined by JA during consultations with co-authors, specifically KH, KNI, and SCh, members of the research advisory team (RH, SP, and SCu), and other stakeholders from the Hydro Nation Steering Group. We then developed an overall BPP logic model based on the CFs and final PTs [48, 49].

Our study was registered with PROSPERO (CRD42020170660).

3. Results

3.1. Search. We collected 8,619 records from combined sources (Figure 1). The 4,532 duplicates and 3,917 irrelevant reports were excluded during the title and abstract screening. The 167 and 288 reports were further excluded at full-text screening. Sixteen studies were included in the review.

3.2. Quality Assessment. Quality assessment results are reported in Table 2.

Four quantitative studies had strong [63, 72, 73, 74], three had good [68, 70, 71], and three had adequate quality [66, 67, 69]. Quantitative papers were downgraded due to limitations in blinding investigators and subjects, controlling confounders, and reporting variance estimates.

Seven qualitative studies had adequate quality [59–65] and were downgraded due to limitations in study design, sampling strategy, data collection, analysis, presenting conclusions, verification, and reflexivity procedures.

3.3. Characteristics of Included Studies. Extracted data were tabulated according to inputs (facilities, health and social care professionals, duration, and timescale), activities (referral pathway, overall programme format, and blue space activity), and health outcomes. This aided the development of the final PTs and the logic model. We also extracted data on service user characteristics and their health status (Table 3).

Eight studies were conducted in the US [59–61, 64, 70, 72, 73, 74], five in the UK [63, 65, 66, 68, 69], and three in Portugal [62, 67, 71]. Nine hundred and fifty ($n = 950$) service users between 2 and 85 years of age participated ($n = 726$ young people; $n = 197$ military veterans). Blue space activities were referred to or prescribed by health, social care, and health trained special education teachers in healthcare [59–61, 64, 65, 68, 70, 72, 73, 74], social care [63, 65, 67, 68, 70, 71] and specialised educational settings [66, 68, 69] using single or combinations of SP referral pathways. One study was in all three settings [68].

3.4. Service Users, Referral Pathways, and Health Outcomes of BPPs in Healthcare Facilities. Ten studies were in military hospitals, GP practices, paediatric, and rehabilitation clinics [59–61, 64, 65, 68, 70, 72, 73, 74]. Veterans with hearing impairment, anxiety, depression, TBI, and PTSD were prescribed with fly-fishing by recreational therapists through signposting or direct referral [59, 64, 74]. Veterans with PTSD were directly referred to running, boating, kayaking, and paddling by a team of recreational therapist, nurse, psychologist, and social worker [60]. Some veterans with PTSD [73] and children who were obese, had sensory problems, depression, anxiety, and PTSD [68] were prescribed with surfing by physicians [73] or a team of GPs, nurses, and psychologists [68] through direct referral or a holistic link worker. Socioeconomically deprived and ethnically diverse children with obesity, loneliness, and poor mental health were prescribed with play at a beach [70, 72] by paediatricians using a holistic link worker [70] or a combination of signposting and link worker [72]. Service users who experienced substance abuse were directly referred to sailing by substance abuse specialists [65]. Participants had improvements in their physical activity [70, 72], body weight [70], and mobility [61]. Others had improved symptoms of depression, anxiety, and PTSD; decreased loneliness and stress [65, 72, 73, 74]; better sleep quality [74]; increased relaxation [64, 72, 74]; and self-efficacy [59, 64, 65]. Others had decreased intake of antidepressants and pain medications [60, 61]. Some had increased contact with nature [59, 72].

3.5. Service Users, Referral Pathways, and Health Outcomes of BPPs in Social Care Facilities. Five studies were in social care institutions, foster or residential care homes for young people, and community wellbeing centres [62, 63, 67, 68, 71]. Young people and adults with mobility and sensory impairments and who were at higher risk to psychosocial problems, anxiety, and depression were directly referred to surfing by either a team of a social or residential care worker and therapist [62]; social workers and adolescent educators [67]; residential care worker [71] or a social child support specialist [62, 67, 68]. Adults and elderly service users who had anxiety and depression were referred to guided river walks, bird/otter watching, and canoeing by mental health workers through a link worker [63]. Service users experienced improved daily functioning [68]; fitness and physical activity [67, 68]; mental and emotional wellbeing [67, 68, 71] self-esteem [68], interpersonal competencies and prosocial behaviour [62, 67, 68, 71] proenvironmental knowledge; and nature

connection [62, 63]. Some reported health outcomes showed no significant effects on depression, anxiety, self-esteem, emotion regulation, social connectedness, sleep quality, and physical activity [71].

3.6. Service Users, Referral Pathways, and Health Outcomes of BPPs in Specialised Educational Institutions. Three studies were in specialised educational facilities and pupil referral units [66, 68, 69]. Young people with behavioural problems, ASD, depression, anxiety, and sensory problems were referred to surfing by psychologists, health-trained educators, or social and child support specialists using direct referral or holistic link worker [66, 68, 69]. Service users improved in terms of physical fitness [68, 69]; mental and emotional wellbeing [69]; attitude, social competence, and self-esteem [66, 68, 69]; and proenvironmental knowledge [69].

3.7. Coexistence of Contextual Factors and Initial Programme Theories in Included Studies. We identified 20 service user- and programme-related CFs (Table 4). Programme format (CF3), characterised by the type of blue space activity, duration, and frequency, was found in 15 studies, except in Mowatt and Bennett [64]. Health and wellbeing improvements (CF11) experienced by service users during and after the programme were found in 14 studies, except in Pereira et al. [71] and Lopes et al. [62]. Prescription information (CF1), service user's perceptions (CF2), compatibility of blue space activities (CF5), skilled service providers (CF8), coordination with link workers and service providers (CF12), and funding and policy support (CF20) were found in at least two studies.

Initial PTs on patient engagement (PT2) and patient adherence (PT3) were present in all studies. Patient enrolment (PT1) was present in 14 studies, except in Mowatt and Bennett [64] and Pereira et al. [71]. Link worker coordination (PT4) was present in nine studies [60–62, 64, 67, 70-73]; whilst partnership with community-based organisations (PT5) was present in 10 studies [59, 60, 62, 63, 66–70, 74].

The association and coexistence of CFs and initial PTs in each study informed the redevelopment of initial PTs to articulate the final PTs that could best explain BPP implementation (Table 5). Final PTs on service user enrolment (PT1), engagement (PT2), adherence (PT3), communication protocols (PT4), and long-term programme sustainability (PT5) could best explain BPP implementation. We redeveloped these final PTs with the assumption that individuals with physical and/or mental health conditions sought health and social care service in health, social care, or specialised educational facility, eventually enrolling in and engaging with BPPs.

3.8. Final PT1: If Service Users' Apprehensions and Optimistic Expectations are Positively Influenced by Information on BPPs Provided by Prescribers, Then They May Enrol. The final PT1 does not differ from the initial PT1 [11], especially on the provision of acceptable and compatible referral information. However, our study identifies that there is a need to resolve service users' apprehensions towards BPPs by presenting positive information about the intervention. Some service users were optimistic regarding BPPs, but others had apprehensions, fear, and anxiety [62, 73] due to its novelty, unfamiliar environments, and lack of experience. Knowledge sharing about the type, structure, and benefits of BPPs, coupled with maps, pedometers, and activity guides informed service users' decision to enrol [70, 72]. This information was further reinforced by written prescriptions and link worker communication [70]. However, some healthcare workers raised concerns about the time requirement for filling out paper prescriptions and providing counselling. It was suggested that blue prescriptions could be integrated into an electronic prescribing system [70]. Information on programme structure is important for service users since some are delivered as structured [59, 63, 67, 70, 71, 73, 74] or unstructured programmes [64, 70, 72]. Having a predictable and structured programme of activities was found suitable for service users who experienced stressful and unpredictable events [71]. Information on logistics was useful since some were stay-in activities requiring meals and lodging [59, 60, 64, 69, 74], although some were stay-out [61–63, 65, 68, 70, 72, 73].

3.9. Final PT2: If Service Users Are Provided with Free Logistics, Equipment, and Transportation to Access a Socially Supportive and Client-Centred Blue Space Activity and Environment, Then They May Engage. Similar to initial PT2 [11], final PT2 highlights the importance of transportation to help service users access and eventually, engage with BPPs. Additional contextual factors influencing service user engagement include programme compatibility with service users, other determinants of accessibility (e.g., provision of equipment, food, and accommodation), and the social and blue space environments. Service user engagement was associated with their preference, skills, and psychosocial fulfilment [68, 69]. Consulting people with disabilities on how to make the design of assistive infrastructures more accessible, compatible, and adaptive to their needs facilitated engagement of service users [59, 62]. Service users had a strong interest in BPPs because these were free [70]; however, some required costly equipment (e.g., surfboards, canoes, and kayaks). Providing equipment, transportation, and camping fees encouraged engagement especially for activities in distant locations [59, 63, 68, 70–74]. Travelling in groups facilitated socialisation that relieved anxious participants [63]. Wildlife and blue space environments facilitated relaxing experiences, distraction, engagement of human senses, self-strength, and acclimatisation [59, 60, 63, 65, 71, 74]. Weather and sea conditions were uncontrolled effect modifiers that impacted engagement [1, 69, 71].

3.10. Final PT3: If Service Users Experience Social Support and Health Improvement through Blue Space Activities Delivered by Knowledgeable and Skilled Service Providers, Then They May Adhere. The final PT3 is similar to the initial PT3 [11] on the influence of skilled service providers and health

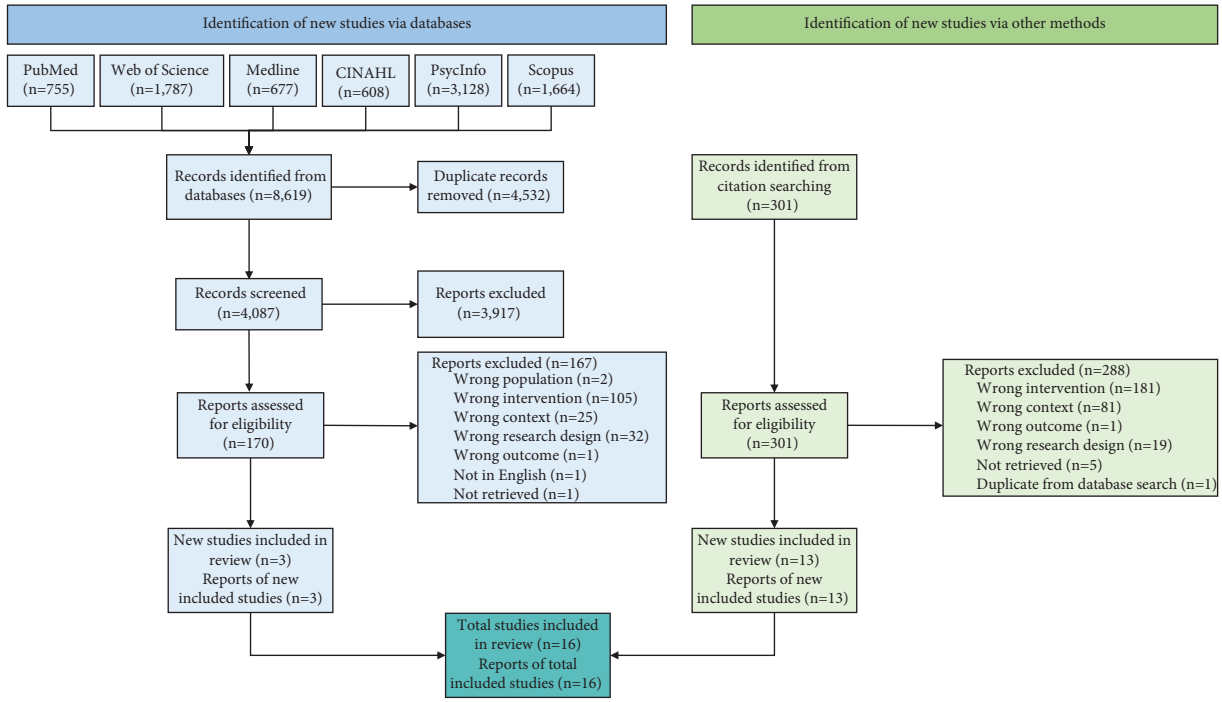

Figure 1: Study selection.

improvement on service user adherence. Skilled service providers ensured standardised programme delivery through regularly evaluated guidelines [69]. Some service providers were trained in working with service users who have disabilities (i.e., proper use and introduction of surfing boards for children with ASD) [62, 66]. Our study added that the values of service providers and social support provided to service users influence their adherence. Positive values of service providers were appreciated by the service users [59, 62, 63, 65, 69, 72, 73]. The encouragement, enthusiasm, and positive motivation through constructive observations created a friendly atmosphere and empowered service users to explore new activities [62, 63, 65, 71–73]. Staff responsiveness facilitated connections with service users [64, 75] through open communications [71, 72]. This was perceived as genuine care and willingness to help [73]. Improvements in physical, cognitive (mental), social health, and proenvironmental knowledge were also associated with service user's adherence [60–63, 65–69, 71–74].

3.11. Final PT4: If Communication Protocols Are in Place between Service Users, Prescribers, Link Workers, and Service Providers, Then BPPs May Be More Visible and Successfully Implemented in Health and Social Care Facilities. Final PT4 highlights the importance of communication protocols between service users, prescribers, service providers, and carers as tools for programme coordination, making BPPs visible in health and social care facilities [73, 71]. Initial presentation of BPPs to prescribers facilitated planning of referral processes, requirements, and responsibilities [67, 70]. Electronic communications between prescribers and service providers served as feedback channels to discuss service users' health conditions [70]. BPP champions acted as programme leads and maintained coordination and programme visibility in health and social care facilities [70]. Some link workers facilitated inclusive communication between prescribers, service users, and service providers by using preferred and appropriate media (e.g., telephone, emails, text messaging) [64, 70, 72]. Communications between service users and their carers were opportunities for awareness raising and socialisation [62]. In- and out-group socialisation through interest-based grouping and matching contributed to self-improvement, confidence, and improved communication skills [62, 64, 67, 70–73].

3.12. Final PT5: If BPPs Receive Organisational, Stakeholder, Funding, and Policy Support, Then These Are More Likely to Be Sustainably Implemented. Final PT5 highlights the importance of organisational (e.g., staff, volunteer), stakeholder, financial, and policy support on programme sustainability. 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 healthcare cost (£265/year) for children [62, 67, 69, 71, 75]. However, this economic evaluation was not robust and requires further appropriate assessment [67]. Some BPPs were created through health and third sector partnerships facilitating shared resources and financial support that covered implementation requirements (e.g., meals, transportation, and equipment) [59, 60, 62, 68–70]. Adequate skilled staff and volunteers were the backbone of BPPs. The service provider to service user ratio depended on participant intake, type of activities, and financial capacity [63, 66–68, 70]. Depending on activities, resources (e.g., finances, equipment, volunteers, and staff), and the number of service users, some BPPs were delivered in 2 : 1 service

Table 2: Quality assessment results (format from [58]).

		Quality assessment criteria based on QualSyst tools																				
First author, year	Methodological approach	Study question	Study design	Sampling strategy	Sample/comparator descriptions	Randomisation	Blinding of investigators	Blinding of subjects	Outcome/ exposure measured	Appropriate sample size	Appropriate and systematic analysis	Variance estimates	Confounding controlled	Results	Conclusions	Study context	Knowledge framework	Data collection	Verification	Reflexivity	Total scores	Quality scores	Quality
Bennett, 2014 [59]	Qualitative	2	2	1	…	…	…	…	…	…	2	…	…	…	2	2	2	2	0	0	15/20	0.75	Adequate
Dustin, 2011 [60]	Qualitative	2	2	1	…	…	…	…	…	…	1	…	…	…	2	2	2	1	0	2	15/20	0.75	Adequate
Fleischmann, 2011 [61]	Qualitative	2	2	1	…	…	…	…	…	…	1	…	…	…	2	2	2	0	0	0	12/20	0.60	Adequate
Lopes, 2015 [62]	Qualitative	2	1	0	…	…	…	…	…	…	1	…	…	…	1	2	2	1	0	1	11/20	0.55	Adequate
Maund, 2009a [63]	Qualitative	2	2	2	…	…	…	…	…	…	1	…	…	…	1	2	2	1	2	1	16/20	0.80	Adequate
Mowatt, 2011 [64]	Qualitative	2	2	2	…	…	…	…	…	…	2	…	…	…	2	2	2	1	0	2	17/20	0.85	Adequate
White, 2016 [65]	Qualitative	2	2	1	…	…	…	…	…	…	2	…	…	…	2	2	2	2	2	2	19/20	0.95	Adequate
Cavanaugh, 2014 [66]	Quantitative	1	1	1	1	NA	NA	NA	2	2	1	1	0	1	1	…	…	…	…	…	12/22	0.55	Adequate
de Matos, 2017 [67]	Quantitative	2	2	1	1	NA	NA	NA	NA	1	2	1	0	2	2	…	…	…	…	…	14/20	0.70	Adequate
Godfrey, 2015 [68]	Quantitative	2	2	1	2	NA	NA	NA	1	2	2	1	0	2	2	…	…	…	…	…	17/22	0.77	Good
Hignett, 2017 [69]	Quantitative	1	1	1	1	NA	NA	NA	1	1	1	1	0	1	2	…	…	…	…	…	11/22	0.50	Adequate
James, 2017 [70]	Quantitative	1	1	1	2	NA	NA	NA	2	2	2	1	0	2	2	…	…	…	…	.	16/22	0.73	Good
Maund, 2009b [63]	Quantitative	2	2	2	2	NA	NA	1	2	2	2	2	NA	2	2	…	…	…	…	…	21/22	0.95	Strong
Pereira, 2020 [71]	Quantitative	2	2	2	2	2	0	0	2	2	2	2	0	1	2	…	…	…	…	…	21/28	0.75	Good
Razani, 2018 [72]	Quantitative	2	2	2	2	2	1	NA	2	2	2	1	0	2	2	…	…	…	…	…	22/26	0.85	Strong
Rogers, 2014 [73]	Quantitative	2	2	2	2	NA	NA	NA	2	2	2	1	0	2	2	…	…	…	…	…	19/22	0.86	Strong
Vella, 2013 [74]	Quantitative	2	2	1	2	NA	NA	NA	2	2	2	2	2	2	2	…	…	…	…	…	21/22	0.95	Strong

NA, not applicable; a, qualitative component of a mixed-method study; b, quantitative component of a mixed-method study.

Table 3: Characteristics of blue prescription programmes.

			Inputs				Activities			
Authors, year, country	Service users	Health and wellbeing status	Facility providing prescription or referral	Prescriber or referrer	Frequency and duration	Timescale	Referral pathway	Programme format	Type of blue space activity	Health, wellbeing and other outcomes
Bennett et al., 2014, USA [59]	28 veterans, aged 22–50 years	PTSD, TBI, and hearing impairment	Veteran hospital	Recreational therapist	4 sessions, 4 hours each	4 days	Signposting	Structured fly-fishing, stretching, and breathing exercises, campfire, and games	Fly-fishing	Self-confidence, social and nature reconnection, overcoming fears
Cavanaugh and Rademacher, 2014, UK [66]	11 student campers, aged 10–16 years	ASD	Specialised school	Psychologist	7 sessions (estimated), unspecified duration	7 weeks (estimated)	Holistic link worker	Structured pre-post surf camp, family socials, group activities, two-day surf camp (i.e., arts and crafts, frame decoration, paddle relay, sandcastle building, and t-shirt signing)	Surfing	Social competence (assertion, responsibility, and engagement); social skills (ownership of behaviour)
de Matos et al., 2017, Portugal [67]	48 adolescents, aged 10–16 years	Psychosocial problem and vulnerability	Foster care homes	Social worker and adolescent educators	8 sessions, 4 hours each	3 months (estimated)	Direct referral	Structured group surfing and psychoeducational activities	Surfing	Perseverance, problem solving, time management, social competencies, interpersonal relationship, emotional regulation, improved peer interaction, surfing skills, and sea safety
Dustin et al., 2011, USA [60]	13 veterans, unspecified age	PTSD	Veteran hospital	Therapeutic recreation specialist, nurse, psychologist, social worker	Whole day camping for 4 days	4 days	Direct referral	Structured boating (floating), hiking, campfire, and socials	Combined river running, kayaking and paddling	Reduced PTSD symptomology, feeling present, self-efficacy, less dependence on medications
Fleischmann et al., 2011, USA [61]	One adult, aged 21 years	Polytrauma, TBI, and mild depression	Veteran hospital	Exercise physiologist	24 sessions, 3 hours each	6 months	Holistic link worker	Structured group surf therapy and yoga for strength training, balance rehabilitation, and hydrotherapy	Surfing	Improved mobility (walking, balancing, vestibular function, muscular strength, and aerobic endurance); relief from TBI; reduced narcotic intake

Table 3: Continued.

Authors, year, country	Service users	Inputs					Activities			Health, wellbeing and other outcomes
		Health and wellbeing status	Facility providing prescription or referral	Prescriber or referrer	Frequency and duration	Timescale	Referral pathway	Programme format	Type of blue space activity	
Godfrey et al., 2015, UK [68]	121 young people, aged 8–18 years	Depression, anxiety, social exclusion, obesity, and sensory problems	GP surgery, educational facility, and social care institution	GP, nurse, psychologist; and social and child support service specialist	6 sessions, unspecified duration	6 weeks	Direct referral	Structured group surfing	Surfing	Robust positive functioning, self-esteem, emotional wellbeing, vitality, friendship and social trust, fitness, and physical activity
Hignett et al., 2017, UK [69]	58 young people, aged 13–16 years	Aggressive behaviours, and social, emotional, and behavioural problems	Short stay schools or pupil referral units	Teachers trained in assessing social, emotional, and behavioural status of children using a tool developed by the local council	Unspecified	12 weeks	Direct referral	Structured surfing and environmental awareness activities (e.g., beach cleaning)	Surfing	Physical fitness (drop in resting heart rate); personal and interpersonal wellbeing; social connectedness; positive attitude; and environmental awareness and knowledge
James et al., 2017, USA [70]	Unspecified number of children, aged 2–13 years	Overweight and obesity	Community health clinic/ centre	Paediatrician	Weekly sessions, unspecified duration	Unspecified	Holistic link worker	Unstructured physical activities outdoors (e.g., nature walks, unstructured playtime at the beach)	Play activities	Physical activity and weight loss
Lopes, 2015, Portugal [62]	321 children and adults, aged 8–66 years	Mobility and visual impairment, cognitive disabilities	Rehabilitation centres and foster care homes	Therapist and social worker	10 surfing sessions, unspecified duration	1 year	Direct referral	Structured adapted surfing encompassing activities of daily living, education, work, play and leisure, and social participation	Surfing	Social skills and inclusion, mental wellbeing, physical activity, and health and environmental awareness
Maund et al., 2009, UK [63]	16 adults, aged 65–85 years	Anxiety and depression	Community wellbeing service	Mental health support worker	6 sessions, unspecified duration	6 weeks	Link worker	Structured guided nature walks, introduction to wetland reserve, feeding and identifying bird species, canoeing, and free time in nature	Combined nature and river walk, bird and otter watching, and canoeing	Improved mental and physical health; social inclusion; nature connection

Table 3: Continued.

			Inputs				Activities			
Authors, year, country	Service users	Health and wellbeing status	Facility providing prescription or referral	Prescriber or referrer	Frequency and duration	Timescale	Referral pathway	Programme format	Type of blue space activity	Health, wellbeing and other outcomes
Mowatt & Bennett, 2011, USA [64]	67 veterans, unspecified age	PTSD	Veteran hospital	Recreational therapist	Whole day for 2 days	2 days	Signposting	Unstructured fly-fishing	Fly-fishing	Being at the present state, relaxed, and retrospective reconciliation
Pereira et al., 2020 Portugal [71].	89 youth, aged 7–17 years	High risk of mental health conditions (e.g., anxiety, depression, low self-esteem, and social disconnection)	Residential childcare centre	Residential care worker	Weekly sessions, 3 hours each	1 school year	Direct referral	Structured surfing and psychoeducation composed of sharing and recapitulation (initial circle), theme-related group activity or reflection on socioemotional skills (group dynamic), surfing (surf dynamic), and another sharing and reflection (final circle)	Surfing	Significant reduction in total emotional and behavioural problems and significant increase in prosocial behaviour and quality of life (care worker reported outcomes). No significant effects on depression, anxiety, self-esteem, emotion regulation, social connectedness, sleep quality, and physical activity (child reported outcomes)
Razani et al., 2018, USA [72]	78 children, average age of 8 years	Poor mental health, loneliness, and psychological stress	Primary care clinic	Paediatrician	Unspecified	3 weeks	Signposting and link worker	Mix of independent and supported park prescription (e.g., group nature outings and play activities at the bayfront and lake)	Play activities	Decrease in stress, improvement in loneliness and physical activity, nature affinity, and frequent park visit
Rogers et al., 2014, USA [73]	14 veterans, aged 24–30 years	PTSD and depression	Primary care clinic	Physician	5 sessions, 4 hours each	5 weeks	Holistic link worker	Structured one-to-one surfing lesson and collaborative socialisation	Surfing	Lower PTSD symptom severity

Table 3: Continued.

Authors, year, country	Service users	Inputs					Activities			Health, wellbeing and other outcomes
		Health and wellbeing status	Facility providing prescription or referral	Prescriber or referrer	Frequency and duration	Timescale	Referral pathway	Programme format	Type of blue space activity	
Vella et al., 2013, USA [74]	74 veterans, unspecified age	PTSD, TBI, major depressive disorder, and anxiety	Veteran hospital	Recreational therapist	4 sessions, 4 hours each	2 days	Direct referral	Structured fly-fishing, socials, games, and entertainment	Fly-fishing	Sustained reduction in symptoms of depression, anxiety, and somatic stress; increased sleep quality and efficiency; improvement in mood profiles (e.g., attentiveness, serenity, self-assuredness, joviality, and positive affect); and decreased feelings of guilt, hostility, fear, sadness, and negative affect
White et al., 2016, UK [65]	11 adults, aged 26–61 years	Alcohol and drug use	Rehabilitation clinic	Medical professionals specialising in drug and alcohol dependency	Whole day for 5 days	5 days	Direct referral	Structured day-to-day sailing functions and group activities and socialisation (e.g., hosting sails, lifting anchors, cooking, cleaning, navigation, steering, keeping watch, and attending social meetings)	Sailing	Self-insight, perseverance, and inner strength; social skills; increased confidence; abstinence to substance abuse; and positive future framing

PTSD: post-traumatic stress disorder; TBI: traumatic brain injury; ASD: autism spectrum disorder; GP: general practitioner.

Table 4: Co-existence of contextual factors and initial programme theories in investigated studies.

Source study	Occurrences of initial social prescribing programme theories (PTs) in each study					Occurrence of contextual factors (CFs) associated with BPP implementation in each study																		
						Patient-related contextual factors												Programme-related contextual factors						
						CF1	CF2	CF3	CF4	CF5	CF6	CF7	CF8	CF9	CF10	CF11	CF12	CF13	CF14	CF15	CF16	CF17	CF18	CF19	CF20
						Information on prescription	Patient perceptions	Programme format	Accessibility	Compatibility of blue space activities	Social environment	Blue space environment	Skilled service providers	Values of service providers	Social support	Health and wellbeing improvements	Coordination between link workers and providers	Patient-link worker communication	Patient-healthcare provider communication	Patient-service provider communication	Patient-patient communication	Patient-carer communication	Organisational support	Stakeholder support	Funding and policy support
Bennett et al., 2014, USA [57]	1	2	3		5			CF3	CF4	CF5	CF6	CF7		CF9	CF10	CF11							CF18		
Cavanaugh and Rademacher, 2014, UK [64]	1	2	3		5			CF3					CF8			CF11							CF18		
De Matos et al., 2017, Portugal [65]	1	2	3	4	5			CF3			CF6		CF8		CF10	CF11	CF12						CF18		
Dustin et al., 2011, USA [58]	1	2	3	4	5			CF3			CF6	CF7			CF10	CF11				CF15				CF19	CF20
Fleischmann et al., 2011, USA [59]	1	2	3	4				CF3	CF4					CF9		CF11							CF18		CF20
Godfrey et al., 2015, UK [66]	1	2	3		5			CF3	CF4					CF9		CF11							CF18		CF20
Hignett et al., 2017, UK [67]	1	2	3		5			CF3	CF4			CF7				CF11							CF18	CF19	
James et al., 2017, USA [68]	1	2	3	4	5	CF1		CF3	CF4							CF11	CF12	CF13	CF14	CF15		CF17		CF19	
Lopes, 2015, Portugal [60]	1	2	3	4	5		CF2	CF3	CF4	CF5	CF6	CF7		CF9	CF10						CF16		CF18	CF19	
Maund et al., 2009, UK [61]	1	2	3		5			CF3	CF4		CF6	CF7		CF9	CF10	CF11							CF18		
Mowatt & Bennett, 2011, USA [62]		2	3	4							CF6	CF7		CF9	CF10	CF11		CF13	CF14	CF15	CF16	CF17			
Pereira et al., 2020, Portugal [71]		2	3	4				CF3	CF4		CF6			CF9	CF10					CF15	CF16				
Razani et al., 2018, USA [69]	1	2	3	4		CF1		CF3	CF4					CF9		CF11		CF13	CF14	CF15		CF17			
Rogers et al., 2014, USA [71]	1	2	3	4			CF2	CF3	CF4		CF6			CF9	CF10	CF11		CF13	CF14	CF15	CF16	CF17			
Vella et al., 2013, USA [72]	1	2	3		5			CF3	CF4		CF6	CF7			CF10	CF11							CF18		
White et al., 2016, UK [73]	1	2	3					CF3			CF6	CF7		CF9	CF10	CF11									

Initial PT1: if a referral is presented in an acceptable manner, it is compatible with the patient's needs and expectations, and the patient believes that it will improve their condition, then they may enrol (enrolment) [10]. Initial PT2: if transportation is provided making the socially prescribed activity accessible to the patient, then they will engage (engagement) [10]. Initial PT3: if the service providers are skilled and there are improvements on patient's condition, then they are more likely to keep attending (adherence) [10]. Initial PT4: if there are link workers facilitating the delivery of social prescriptions and liaising with health and social care facilities and third sector organisations, then the referral uptake will be successful (link worker coordination) [10, 13–15]. Initial PT5: if partnership between health and social care facilities and community-based organisations is financially supported, then the delivery of social prescribing programmes will be sustained (partnership with community-based organisations) [13–15].

Table 5: Final programme theories of BPP implementation.

Initial social prescribing programme theories (PTs) based on literature	Assumptions	Setting	Contextual factors (CF) associated with the initial and final programme theories	Final programme theories describing the mechanisms of implementing blue prescription programmes
Initial PT1: patient enrolment If a referral is presented in an acceptable manner, it is compatible with the patient's need and expectations, and the patient believes that it will improve their condition, then they may enrol [11]	People with physical and/or mental health conditions seek health and social care services	Health or social care facilities	CF1 prescription information CF2 service user's perceptions CF3 programme format (activities, timescale, frequency, and duration)	Final PT1: service user enrolment to blue prescription programme (service user enrolment) If service users' apprehensions and optimistic expectations are positively influenced by the information on BPPs provided by prescribers, then they may enrol
Initial PT2: patient engagement If transportation is provided making the socially prescribed activity accessible to the patient, then they will engage [11]	People with physical and/or mental health conditions enrolled in BPPs	Community-based organisation providing blue prescription programmes	CF3 programme format (activity, timescale, frequency, and duration) CF4 accessibility (provision of transportation, equipment, and other logistics) CF5 compatibility of blue space activities to patient needs CF6 social environment CF7 blue space environment	Final PT2: service user engagement with blue prescription programmes (service user engagement) If service users are provided with free logistics, equipment, and transportation to access a socially supportive and client-centred blue space activity and environment, then they may engage
Initial PT3: patient adherence If the service providers are skilled and there are improvements on patient's condition, then they are more likely to keep attending [11]	People with physical and/or mental health condition continuously engaging with BPPs	Community-based organisation providing blue prescription programmes	CF8 skilled service providers CF9 values of service providers CF10 social support CF11 health and wellbeing improvements	Final PT3: service user adherence to blue prescription programme (service user adherence) If service users experience social support and health improvement through blue space activities delivered by knowledgeable and skilled service providers, then they may adhere
Initial PT4: link worker coordination If there are link workers facilitating the delivery of social prescriptions and liaising with health and social care facilities and third sector organisations, then the referral uptake will be successful [11, 14–16]	People with physical and/or mental health conditions seek health and social care (some were accompanied by their carers)	Health or social care facilities and community-based organisations	CF12 coordination between link workers, service providers, and health and social care facilities CF13 service user-link worker communication CF14 service user-healthcare provider communication CF15 service user-service provider communication CF16 service user-service user communication CF17 service user-carer communication	Final PT4: visibility of blue prescription programmes in health and social care facilities and successful prescription supported by communication protocols (communication protocols) If communication protocols are in place between service users, prescribers, link workers, and service providers, then BPPs may be more visible and successfully implemented in health and social care facilities

Table 5: Continued.

Initial social prescribing programme theories (PTs) based on literature	Assumptions	Setting	Contextual factors (CF) associated with the initial and final programme theories	Final programme theories describing the mechanisms of implementing blue prescription programmes
Initial PT5: partnership with community-based organisations If the partnership between health and social care facilities and community-based organisations is financially supported, then the delivery of social prescribing programmes will be sustained [14–16]	People with physical and/or mental health conditions seek health and social care (some were accompanied by their carers)	Health or social care facilities and community-based organisations	CF18 organisational support (staff and volunteers) CF19 stakeholder support CF20 funding and policy support	Final PT5: long-term programme sustainability of blue prescription programmes (long-term programme sustainability) If BPPs receive organisational, stakeholder, funding, and policy support, then these are more likely to be sustainably implemented

provider to service user ratio [66], whilst others were in 1 : 1, 1 : 2, or 1 : 3 ratios [67, 68, 71].

The logic model explains the mechanisms of BPPs implementation in health, social care, and specialised educational facilities (Figure 2). This logic model is informed by data on inputs (e.g., natural resources, physical, human resources, intellectual, and financial); service user- (e.g., enrolment, engagement, and adherence) and programme-related (e.g., communications and sustainability) activities; outputs; intermediate health outcomes (e.g., physical, cognitive/mental, social, and environmental); and health and wellbeing impacts. We assumed that individuals with physical and/or mental health conditions seek health and social care in either health, social care, or specialised educational facilities.

4. Discussion

BPPs implemented in health and social care facilities had benefits on the general, physical, cognitive (mental), and social health and proenvironmental knowledge of service users. We present a synthesised logic model that demonstrates the holistic implementation of BPPs. The mechanisms of BPP implementation are explained by PTs on service user enrolment, engagement, adherence, communication protocols, and long-term programme sustainability and are associated with CFs on service user's needs and characteristics; accessibility; compatibility; social and blue space environments; skills and values of service providers; health improvement; communication; multistakeholder partnership; financing; and policy.

Our review is consistent with existing evidence demonstrating the health and wellbeing benefits of contact with blue spaces [1, 36, 76] and participation in NBSP [11, 37]. Our study is also consistent with the evidence that contact with nature (i.e., blue spaces) through NBSP could improve proenvironmental knowledge and prosocial behaviours [10, 22, 77–79]. Investigated BPPs were combinations of water-based and psychoeducational activities which could explain improvements in service users' proenvironmental knowledge about the value of blue spaces. These also provided venues for interpersonal opportunities characterised as safe spaces for social interactions highlighting that "sociability" in NBSP harnesses service user's social skills as they interact with places, social settings, and shared stories [80]. The existence of communication protocols might have also reinforced interactions between service users and providers.

Young people and veterans who were at high-risk or experienced mental health conditions (e.g., anxiety, depression, PTSD, etc.) were predominantly referred to or prescribed with blue space activities (e.g., therapeutic fly-fishing and surf therapy). In contrast to another study [44], we did not include research involving women with breast cancer who participated in dragon boating because there was no sufficient information that this was prescribed using SP referral pathways. The large number of young people referred to BPPs could be an opportunity for BPPs to be used as a tool to promote childhood nature experience and improve proenvironmental behaviours [81]. However, it is important to note that prescribing time in nature could be perceived as a medical order rather than a personal choice [82], which could compromise engagement and adherence, especially for younger participants. Extrinsic motivation (i.e., prescribing specific blue space environments and activities) could impact service users' intrinsic motivation to visit nature, compromising its health benefits [82]. Sockhill et al. [83] suggested that behavioural interventions should be tailor-fitted to the values and degree of an individual's connection with nature in order to maximise the generation of proenvironmental behaviours. The design and delivery of BPPs should be based on the needs, environment, and personal circumstances of the service users.

Written prescriptions could facilitate enrolment of service users because these were perceived as an alternative to pharmaceutical prescriptions [38, 84]. The provision of positive information using appropriate consultation and motivational techniques could reinforce service users' agency and motivation to enrol in and engage with BPPs. Service user-centred approaches could facilitate their autonomy since this is an opportunity to understand the compatibility of BPPs with the service users' health and personal needs [85–88]. Investigated blue space activities had a higher duration than the 120 minutes per week recommended dose of nature [89]. Time or duration is a personal effect modifier for blue space engagement [1]. Thus, programme duration should be matched with service users' gender, age, ethnicity, and health conditions [90–99] because different individuals may be in situations that could limit their engagement. Reducing session time might also promote engagement amongst the elderly population [100]. Increasing choices for blue space activities such as dragon boating [44], recreational diving [101], open water swimming [102, 103], and cycling near blue spaces [104–106] could also increase the compatibility to individuals with varying preferences. Providing service users with variable and fixed noncash incentives (e.g. transportation, food, accommodation, and health benefits) may improve enrolment and engagement and could improve proenvironmental behaviours [107].

Accessibility also influences service users' engagement and adherence to NBSP [11]. However, closer proximity to blue spaces is not always associated with better mental health [108], suggesting that proximity to blue spaces might not always translate to BPP adherence. Our review suggests that BPPs package the health-promoting benefits of blue spaces into structured interventions making blue spaces more accessible to those who could most benefit from these. Nevertheless, accessibility should be an important consideration for prescribers and service providers in designing and delivering BPPs. From a behaviour change perspective [109], improving the quality and accessibility of blue spaces could provide greater opportunities for exposure with these [1]. Equipment; adaptive infrastructure for people living with disability; accommodation; and meal requirements influence accessibility. Programme adaptation is important for service users who have fears or discomfort in blue spaces. A gentle, intuitive, and encouraging approach is

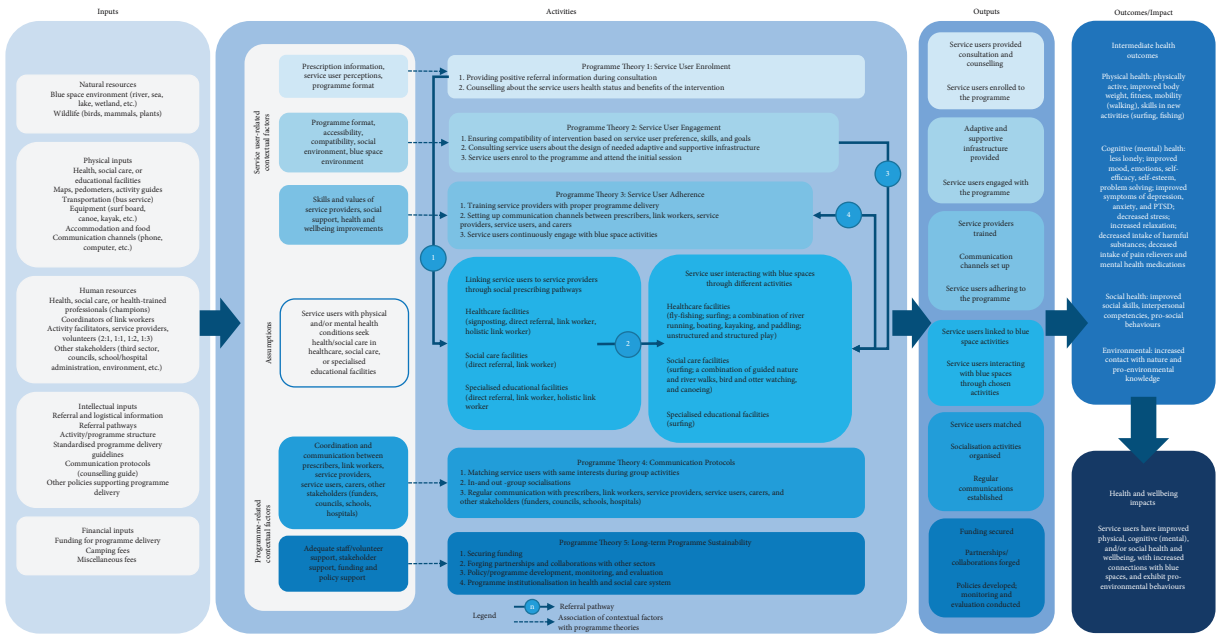

FIGURE 2: Synthesised logic model of blue prescription programme in health, social care, and specialised educational facilities based on included studies.

recommended to participants with serious mental health conditions to avoid retraumatisation [100]. Adaptation should be coupled with capability-building (e.g., knowledge sharing) and motivational strategies (e.g., social support), through referral, prescription, or motivational counselling, helping to promote and sustain contact with natural settings [110].

Reviews on SP and green prescription models highlighted the doctor-patient relationship, capacity of service providers, and supportive social environments as factors associated with participant uptake [11, 37, 38]. These were highlighted in our review in addition to communication protocols, stakeholder collaboration, and policy support. Engagement with and adherence to BPPs were facilitated by positive healthcare worker and service user interactions because it promotes self-confidence, motivation, and optimism amongst service users [111]. However, our review suggests that blue space activities are prescribed by either healthcare/social care workers/educators with different specialisations. This underscores the multistakeholder nature of NBSP where BPPs could be delivered by the broader health and allied professions [44]. Healthcare providers have a high interest in nature prescriptions, but many remain untapped due to limited awareness and time. Similar to Besenyi et al. [112], our review highlights the limited time of healthcare providers in prescribing BPPs. This could be resolved by integrating link workers responsible for virtual/in-person motivational interviews and coordination of BPP referrals with third sector providers [112, 113]. Link workers' roles are recognised in the UK's National Health Service [114] because they support healthcare delivery by helping service users find health solutions [11, 14–16]. However, standardised training on delivery protocols, especially in managing the social and environmental risks associated with blue space activities is needed [115].

Recent COVID-19 pandemic lockdowns magnified nature's health-promoting benefits [116]. NBSPs were provided virtually through telephone or video referrals and virtual health walks during lockdowns [117]. NBSPs such as BPPs could alleviate the social and economic pressures of the COVID-19 pandemic [118] if used as a complementary service for mental healthcare. However, a siloed approach in tackling the mental health epidemic compounded by limited resources could hinder effective implementation. Before the COVID-19 pandemic, some NBSPs were discontinued due to cost, capacity, limited information, lack of transportation, and communication [116, 117, 119]. A critical systems thinking approach could be used in designing, implementing, and evaluating BPPs to ensure that implementation models holistically consider issues on human resource, technology and logistical requirements, quality assurance, sustainability, and collaboration between stakeholders for resource and knowledge sharing and successful buy-in [40]. These collaborations and resources should address identified contextual factors influencing enrolment, engagement, and adherence of service users alongside effective communication and programme sustainability.

Many BPPs are formed through stakeholder partnerships which are funding dependent. Unstable funding impacts programme sustainability [14] compounded by concerns on the capacity and readiness of service providers due to the increasing demand to outdoor water-based activities [115]. Policies on institutionalising BPPs in government-funded health services to funnel resources and build stakeholder capacities are necessary. However, the cost benefit of health interventions is a concern for policymakers before investing. Living near blue spaces [120] and providing BPPs have associations with reduced antidepressant prescription, suggesting its potential

contribution to decreasing antidepressant spending. Moreover, initial insights into the economic returns of investing in NBSP suggest that the 10-year total benefit to cost ratio ranges between 7.61 and 27.1 [118]. However, there are questions on more appropriate social, economic, and environmental evaluations [115, 121] for BPPs due to their different spending requirements for equipment, programme delivery, and environmental setting. Lastly, even though BPPs could have positive impacts on the health and value of nature [100], medicalising the ecosystem services of blue spaces could go against some ecological paradigms [122]. Blue space activities could cause disturbances to wildlife, human-induced pollution, and other irreversible environmental degradation [123–126]. The ethical principles of beneficence and nonmaleficence [85] should be applied in designing, delivering, and evaluating human and planet-centred BPPs by involving health, environmental, and community-based stakeholders.

5. Strengths and Limitations

We offer robustly developed CFs, PTs, and a logic model for the development, implementation, and evaluation of BPPs. However, our review has some limitations. Our search included a broad range of keywords on blue spaces, but its combination with other keywords (i.e., "prescription") may have limited the hits for articles that did not use these keyword combinations. Some studies did not specify the presence of blue spaces in their interventions, especially those that referred to blue spaces as components of green spaces due to ambiguities on definitions in the literature. This made it difficult to identify studies that only used blue spaces. Thus, we did not include studies with unclear information on the use of blue spaces and referral pathways. We did not include grey literature, which could provide more information about CFs and mechanisms of BPP implementation. There were limitations on the quality of individual studies specifically for controlling confounders, reporting variance estimates, strategies for data collection, verification, and reflexivity. Realist review is also subjective [37], especially in interpreting how CFs inform PTs. We interrogated our results during consultative meetings with a set of transdisciplinary stakeholders to avoid potential interpretation bias. Geographical homogeneity was a limitation. Some studies had participants from different ethnicities and sociodemographic backgrounds, but all studies were conducted in Global North countries, which could mean missing out on contexts of programme implementation in the Global South.

6. Research Directions

We suggest employing intervention studies examining the impacts of BPPs on physical and mental health with appropriate and robust health, economic, and social evaluation techniques. Implementation research and pilot studies based on strongly developed logic models are needed to establish a "proof of concept" that is viable for real-world implementation, scaling up, and institutionalisation. The causation and long-term implications of BPPs on population health, healthcare service delivery, and the environment should also be investigated.

7. Conclusion

Our systematic realist review demonstrates that service users with physical and/or mental health conditions were referred to or prescribed with blue space activities by health, social care, and health-trained professionals. We offer a synthesised logic model demonstrating how service user- and programme-related CFs and PTs are associated with and explain the mechanisms of BPP implementation to help improve physical, cognitive (mental), social health, and proenvironmental knowledge of service users. If the implementation of accessible and service user-centred BPPs is sustainably supported by multistakeholder partnerships; funding support; policies; effective communication protocols; skilled health, social care workers; and service providers, then service users are more likely to enrol in, engage with, and adhere to BPPs and experience improvements on their health and wellbeing. With the inaccessibility, long waiting lists, adverse effects, incompatibility, cost, and environmental impacts of conventional healthcare, employing a well-designed BPP implementation model in a suite of healthcare services especially for people with mental health conditions has some benefits.

Data Availability

The data supporting this systematic review are from previously reported studies, which have been cited. Beginning three months after publication until September 2024, the processed data are available from the corresponding author upon request.

Additional Points

The following are known about this topic: (i) Blue spaces offer health benefits alternative to green spaces. (ii) Blue prescription programme (BPP) is an example of nature-based social prescribing characterised by connecting people with blue spaces. (iii) There is limited understanding on the contextual factors and programme theories that describe BPP implementation. This paper adds the following: (i) There are 20 service user- and programme-related contextual factors associated with BPP implementation. (ii) BPP implementation could be explained by programme theories on communication protocols and long-term programme sustainability, in addition to existing programme theories on enrolment, engagement, and adherence of service users. (iii) A holistic logic model (theory of change) demonstrating mechanisms of BPP implementation that could be used in designing, implementing, and evaluating nature-based social prescribing programmes.

Disclosure

This article was submitted as a preprint in https://www.medrxiv.org/content/10.1101/2021.10.15.21264908v1.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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