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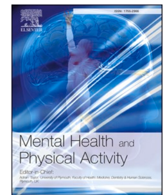

OUTSIDE: OUTdoor Swimming as a nature-based Intervention for DEpression: a feasibility randomised controlled trial

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ABSTRACT

Introduction: There is growing support for nature-based activities as potential effective interventions for depression. Randomized control trials (RCTs) to determine outdoor swimming benefits are needed. To inform the design of a full-scale trial, this feasibility study examines (1) participant recruitment, intervention and study engagement, (2) intervention and study safety, (3) participant experience and acceptability, (4) between-group mean difference estimates on measures of depression (primary clinical outcome), anxiety, wellbeing, mindfulness, self-compassion, health related quality of life and clinical resource use.
Methods: Participants with mild to moderate symptoms of depression were recruited and randomised to an 8-session outdoor swimming course plus usual care or usual care only. Swimming courses took place in three locations. Participants completed online or paper surveys at baseline (T0), immediately after the intervention (T1, 8 weeks post-randomisation) and follow up 8 weeks later (T2, 16 weeks post-randomisation). Serious adverse events were recorded. Qualitative data were collected to explore participant, coach and social prescriber experiences.
Results: 87 participants (99 % target) were recruited. 79 % (95 % CI: 61 %–88 %) of the outdoor swimming arm completed the intervention (4+ sessions out of 8). Two unrelated serious adverse events occurred during the trial. Participants' experience was positive and identified five themes for future study design: Accessibility, Belonging, Facing challenges with support, Benefiting and enjoyment and Clarity of information. Overall data completeness at all time points (including withdrawals and drop-outs) was high (85 %). There were between-group differences in favour of the intervention arm with medium to large effects across all measures.
Conclusions: It is feasible to conduct a large-scale RCT to determine if an outdoor swimming course (in addition to usual care) can reduce symptoms of depression and is good value for money when compared to usual care alone.

1. Introduction

Globally, depression has a lifetime prevalence of 10.8 % (Lim et al., 2018). The total annual cost of mental ill health in the UK is at least £117.9 billion (McDaid & Park, 2022). These costs continue to grow nationally and globally (Santomauro et al., 2021).

Treatment guidelines recommend a range of psychological therapies, medications and physical activities as evidence-based interventions for depression (Guideline Development Panel for the Treatment of Depressive Disorders, 2019; NICE, 2022). However, outcomes from

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these interventions are disappointing (Ormel et al., 2022). Psychological therapy and medications have modest recovery rates (45–50 %) (Gartlehner et al., 2017) potentially exacerbated by poor rates of engagement/adherence (Gartlehner et al., 2008; NHS Digital, 2024). The evidence for exercise as a treatment for depression is well established (Babyak et al., 2000). However, only 70 % of males and 59 % of females achieve UK recommended levels of physical activity (150 min of moderate activity or 75 min of vigorous activity per week, NHS (2023)).

There is growing evidence that access to the natural environment (green and blue spaces) is linked to improved mental health outcomes (Haywood et al., 2024; MIND, 2013). However, not all types of green and blue exercise equally engage all people, for instance, due to accessibility, injury or interest in the activity (Garside et al., 2020). Non-medical, community and social activities are being highlighted as an alternative way to help people improve their health and wellbeing (Husk et al., 2020; Loftus et al., 2017). Social prescribing, when healthcare workers link or signpost patients and service users to community-based services, is a key component of the NHS England Long Term Plan (NHS, 2025). Understanding which nature-based and exercise interventions works best for whom, however, will be key to the success of this approach (Garside et al., 2020).

The popularity of open water swimming, as a form of blue exercise, is growing (Sport England, 2024) with many reporting transformative experiences and a greater connection to nature (Denton & Aranda, 2020) as well as benefits to mental health (Burlingham et al., 2022; Denton & Aranda, 2020; Massey et al., 2020, 2022). However, a randomised controlled trial (RCT), considered the gold standard in health research (Jones & Podolsky, 2015), has yet to be undertaken in order to determine clinical and cost effectiveness and safety, as outdoor swimming can be hazardous (Tipton et al., 2017, 2022).

Before conducting a full-scale RCT several feasibility questions need addressing. In this study, an 8-session outdoor swimming course, offered in addition to usual care, was compared to usual care only in adults who have mild to moderate depression. The primary aim was to assess the feasibility of conducting an RCT by assessing recruitment rates and the avenues through which we could recruit, intervention attendance, retention, data completion, safety, participant acceptability and experience, and to evaluate clinical and economic measures in preparation for a full-scale trial. This study also aimed to explore the trial experience for participants, referrers and, swim coach teams with the aim of identifying potential improvements to the design of a full-scale trial.

2. Methods

2.1. Design

This was a parallel-group, pragmatic, feasibility RCT with 1:1 allocation to an 8-session outdoor swimming course at one of three different swim locations (North Devon [coastal], Worcestershire [lake], London [lido]) plus usual care or usual care only. Participants completed online or paper surveys at baseline (T0), immediately after the intervention (T1, 8 weeks post-randomisation) and follow up 8 weeks later (T2, 16 weeks post-randomisation).

2.2. Participants

Individuals were eligible for the study if they: i) were aged 18 years and above; ii) able to give informed consent; iii) had mild to moderate severity depression; as determined by the 9-question patient health questionnaire (Kroenke et al., 2001) ([PHQ-9] scores 5–19 inclusive); iv) had a self-reported ability to swim a minimum distance in a heated pool depending on the location as follows: sea (50 m); lake (25 m); and no swimming experience was required for the outdoor unheated swimming pool (lido).

Exclusion criteria were: i) Risk of suicide (as determined by screening questions and further interview by psychiatrists who were part of the research team (AB, RC), or recent suicidal intent or attempts, or self-harm requiring medical treatment; ii) Other mental health problems to a severe degree determined following interview with a psychiatrists from the trial team (AB, RC); iii) not able to speak English to a level that would enable participants to understand safety instructions; iv) History of significant cardiac abnormalities (e.g., ischaemic heart disease/angina and congestive heart failure); v) Immediate (first degree) relative history of cardiac events (GP consultation and/or echocardiogram was required for inclusion); vi) Respiratory conditions triggered by cold such as poorly controlled exercise-induced asthma; vii) Cold water urticaria (a skin reaction to cold that appears within minutes after cold exposure); viii) Non-freezing cold injuries/Raynaud's (unless able to control risk e.g. using neoprene gloves).

Participants who did not meet eligibility criteria at the baseline assessment were referred to social prescribers to be offered alternative activities.

2.3. Measures

All measures were completed using an online survey (Qualtrics, https://www.qualtrics.com), the link was e-mailed to participants by the blinded research assistant. Demographic information collected was age, gender, gender identity, sexual orientation, ethnicity (collected using the Office for National Statistics in the UK categorisation (Office for National Statistics, 2023)), first language, religion, education level, marital status, disability status, whether have dependents, carer status, household income, swimming ability and BMI.

2.3.1. Primary feasibility measures

Recruitment: The number of people recruited weekly was recorded.

Retention: Retention was reported as the number and percentage (with 95 % confidence intervals) of people who completed the surveys at T0, T1 and T2. Intervention completion was recorded as the number and percentage (with 95 % confidence Intervals) of participants attending at least 4 of the 8 swim sessions (using the same definition of intervention completion as group based interventions such as Mindfulness-Based Cognitive Therapy research (Kuyken et al., 2015; Kuyken et al., 2016). Data completeness (%) for the outcome measures was also established.

2.3.2. Safety

Serious adverse events were recorded in line with Health Research Authority (England) guidelines and judged by an independent clinical monitor as study related or study unrelated. Adverse events (events that caused physical discomfort, but not requiring additional health care) were also logged and described as being study related or unrelated.

2.3.3. Secondary feasibility measures

Experiences of participants, social prescribers and swim coach team: Qualitative data was collected using evaluation questionnaires for participants at T1 and T2 and focus groups with participants, social prescribers, researchers involved in screening appointments and swim coaching teams. The data was analysed thematically to better understand facilitators and barriers to participation.

Clinical measures: Standardised and validated measures of depression symptom severity (Patient Health Questionnaire-9, PHQ-9 (Kroenke et al., 2001)), anxiety severity (Generalised Anxiety Disorder-7, GAD-7 (Spitzer et al., 2006)) and wellbeing (Short Warwick Edinburgh Wellbeing Scale, SWEMWBS (Stewart-Brown et al., 2011)) were administered at T0, T1 and T2.

Potential mechanistic measures: In addition, validated scales that may support potential mechanisms were included at T0, T1 and T2. These include connectedness to nature (Mayer & Frantz, 2004), mindfulness (Five Facet Mindfulness Questionnaire, FFMQ-15 (Baer et al., 2022; Gu et al., 2016)) and self-compassion (Self-compassion Sussex-Oxford Compassion for Self-Scale, SOCS-S (Gu et al., 2020)) and loneliness (Hughes et al., 2004; Office for National Statistics, 2018).

Health economic measures: Health-related quality of life (HRQoL) was assessed at T0, T1 and T2 using the EuroQoL EQ-5D-5L (Herdman et al., 2011) and Recovering Quality of Life-10 (ReQoL-10)instruments (Keetharuth et al., 2021). From those, quality-adjusted life years (QALYs) were calculated. Resource use data on all health and social care services and medications were collected from participants using a modified version of the Clinical Service Receipt Inventory (CSRI). A modified version of the Institute of Medical Technology Assessment (i-MTA) Productivity Cost Questionnaire (iPCQ) (Bouwmans et al., 2015) was used to capture the impact of mental health on employment and unpaid work (e.g. household chores). Both questionnaires were completed at T0 (with reference to the prior three months), T1, and T2. Bespoke form/logs were completed by swim coaches and link workers to identify swimming course-related resource use (treatment arm only and for the duration of the course only), including session duration, travel time to the venue, time devoted to preparation for the sessions, and time spent in training/supervision. All resource use questionnaires were co-designed with Patient and Public Involvement (PPI) input.

Intervention evaluation measures and tools*:* The qualitative data were collected using evaluation questionnaires and online focus groups. Questions and topic areas were informed by discussions with the trial lived experience and PPI team to improve understanding of the experience of the trial from a participant perspective.

2.4. Procedure

This trial received ethical approval through the NHS Research Ethics Service (22/LO/0268, IRAS 309748) prior to starting recruitment. The trial was pre-registered (ISRCTN 90851983) on 19/05/2022 and the protocol submitted for peer review (01/09/2022) before the end of recruitment (04/09/2022) and subsequently published (Massey et al., 2023). One substantial amendment was made after this date to clarify the wording of the health economic questions (13/09/2022) that did not impact the feasibility questions.

In accordance with Mellor et al. (2021), progression of the feasibility to a full-scale RCT will be guided by the criteria for success stated in the protocol (Massey et al., 2023) and provided below:

- 80 % trial retention at post intervention (T1) for completion of the primary outcome (PHQ-9, Kroenke et al., 2001)
- 80 % intervention participants attending four or more swim sessions
- 80 % data completeness
- Collection of data on the experience of participation from at least 20 % of participants in the intervention arm
- Feedback indicates that taking part in this study was a positive experience for participants, referrers and swim coaching teams.

Participants with mild to moderate depression symptoms (PHQ 9 scores of between 5 and 19) were recruited through social prescribing services close to each location and self-referral (via social media, primary care center posters, or word-of-mouth). No payment was offered, but reasonable travel costs were reimbursed. Participants received study information via a leaflet, gave written informed consent, and completed a health history questionnaire. Eligibility was clarified through a telephone call with a research team member. If additional physical health investigations were needed, information was requested from participants' GP.

Eligible participants completed the baseline assessment survey online, on paper, or via telephone with a research assistant (RA) based on their preference. Participants were then randomised to either the swim and usual care or usual care only arm using the Sealed Envelope™ online service (Sealed Envelope Ltd). The trial statistician set up and tested the randomisation procedure which used block randomisation with randomly varying block sizes of 2 and 4, stratified by location and with 1:1 allocation ratio. The statistician was not involved in further aspects of the trial process. One of the Co-CIs (HM) used the online service to randomise participants. The automated service revealed assignment to either the swim course intervention plus usual care or usual care only arm. Intervention participants received swim course details and, where possible, support from social prescribers. They completed 8 outdoor swimming sessions before T2. All participants were advised to continue usual care and complete surveys at T1 and T2. Weekly follow-up for one month occurred for incomplete assessments.

Intervention group participants received an evaluation questionnaire at the end of the swim course (T1) for feedback. All participants received an evaluation form at the end of the follow-up period (T2) for trial experience feedback and were invited to focus groups for more in-depth understanding. Nine sessions were offered: two for intervention participants at each location and three for controls. Focus groups were also held with social prescribers, researchers, and swim coaching teams after recruitment and swim course completion.

2.4.1. Intervention

Intervention participants were contacted by swimming coaches for additional information and questions before the 8-session outdoor swimming course. Courses were held at three locations in England: coastal (North Devon), lake (Worcestershire), and lido (London). The course included 8 1-h sessions, during which participants continued with usual care. Groups were exclusively for research study participants and not open to the public. Two locations (North Devon and Worcestershire) each delivered one session per week over eight weeks. A third location, London, delivered two sessions per week over four weeks. This allowed acceptability of different session frequencies to be evaluated through participant feedback in preparation for a definitive trial.

2.4.1.1. Course structure. The courses focused on the safe enjoyment of the water rather than expert swimming. Participants were supported by trained outdoor swimming coaches and lifeguards and gave consent for the research team to share medical conditions, swim experience, and emergency contact details with coaches. Coaches contacted participants before each session, met them at the facilities, and walked them through procedures.

Course staff, qualified in basic life support, lifeguarding, and mental health first aid, supervised all swimmers during the sessions and closely monitored participants for adverse responses. Each location performed and reviewed risk assessments before each session. Sessions were postponed if conditions were unsafe. Swim coaches kept attendance registers at each session and supported participants to find or form groups for safe swimming after course completion.

Each location ran two intervention courses with a maximum capacity of 8 participants per course. Swim coaches were given the following course structure to follow (i): welcome and introductions; (ii) information on what participants should bring with them, hazard identification and mitigation, weather and water conditions, entry into water, cold shock, floating and self rescue; (iii) a short safety briefing with a risk assessment, warm-up activities and an introduction to the weekly activity; (iv) gradual immersion in the water; (v) a group activity such as synchronised swimming moves; (vi) an optional period for individual exploration in the water.

In water duration was between 10 and 30 min and water temperatures varied between 13 and 22 °C. Participants were free to wear wetsuits if they chose and to exit the water at any point. After the water-based activities, participants dressed and rewarmed, with swim coaches checking in.

2.4.2. Usual care

The usual care arm served as the control. Usual care was unrestricted and could include, for example antidepressant medication, talking therapies or socially prescribed activities. Participants in the usual care arm were offered the outdoor swimming course after the trial to reduce disappointment, attrition, and reporting bias, and was recommended by

the PPI representatives.

2.5. Lived experience involvement

PPI was central to the initial design of the study. This included consulting a PPI group comprised of members who had previously participated in introductory swim courses, set up introductory swim courses for people with mental health difficulties, or have lived experience of depression. Two PPI co-applicants (SC and SR) were invited to be members of the core study team. Once funded, a lived experience advisory panel (LEAP) group was established during the study period. These processes highlighted the participants' journey through the study, particularly the importance of a swim course for the control group after the trial completion, developing the participant information sheets, and informing the recruitment strategy.

2.6. Data and statistical analysis

2.6.1. Sampling and monitoring

The sample size was based on Teare et al.'s (2014) recommendation for pilot studies, where a total of 35 completer participants were required per arm. To account for 20 % study drop-out, a total of 88 participants was estimated, based on a previous single arm trial (Burlingham et al., 2022). In line with guidelines for feasibility studies, the study was not powered to detect between-group differences for any outcomes. A Trial Steering Committee provided oversight.

2.6.2. Recruitment and retention analysis

Recruitment and retention data were reported descriptively and means and confidence intervals of outcome measures at T0, T1 and T2 were reported. Summary statistics (means, standard deviations, median, Interquartile range, counts or percentages) were provided for all demographics, quantitative outcomes and feasibility measures. Intervention adherence data recorded by swim coaches was analysed by an unblinded team member (HM).

2.6.3. Clinical outcomes

The statistician analysing the quantitative data (AMBJ) remained blinded until the quantitative data analysis was complete. Data were analysed using Stata version (16.1). Intervention adherence, acceptability and completion was assessed based on attendance of participants at the swim sessions. Clinical outcomes were summarised for each trial arm at each time point. Effect sizes and 95 % confidence intervals were calculated for between-group mean differences (usual care vs usual care + outdoor swimming intervention) at each follow-up time point (T1 and T2) using Cohen's D. Cohen's D can be interpreted as 0.2 = small, 0.5 = medium and 0.8 = large effect sizes.

Clinical outcomes were modelled with linear mixed models (to allow for covariate adjustment), with random effects for individuals and fixed effects for treatment group, time and the group x time interaction with the baseline score and site entered as covariates. Parameter estimates with 95 % confidence intervals were calculated. There was no hypothesis testing.

2.6.4. Health economic analysis

Data completeness and summary statistics (means, standard deviations, median, range, counts or percentages, 95 % Confidence Intervals for mean differences, as applicable) were provided for all economic outcomes and summarised for each trial arm at each time point. For the two economic measures of HRQoL, i.e. the EQ-5D-5L and ReQoL-10 utility scores were calculated using validated algorithms (Herdman et al., 2011; Keetharuth et al., 2021; Clinical Service Receipt Inventory (CSRI); Bouwmans et al., 2015) for the intervention and the control groups, and QALYs derived. Resource use was reported by trial arm, stratified by resource type, with the mean, standard deviation, range and percentage of the sample reported for each arm that had at least one contact.

2.6.5. Qualitative analysis

Qualitative data from focus groups and evaluation forms were transcribed and analysed using thematic analysis (Braun & Clarke, 2006) informed by a (critical) realist perspective to understand facilitators and barriers of participation for each trial arm. Insights were gathered from participants, social prescribers, screening researchers, and swim coaching teams. Analysis was conducted by a researcher (HD) and an assistant (AJ) using NVivo, with critical feedback from research team members (HM, AB, RC, SR, SC, CS) to encourage reflection. Interview extracts were anonymized by numbering.

2.6.6. Primary outcome selection

Measurement completeness, participant feedback from evaluation forms, focus groups and interviews were used to inform the selection of the primary outcome measure for a full-scale trial, additional clinical measures and the health economic questionnaires.

3. Results

3.1. Recruitment

Participants were recruited between 20/05/2022 and 04/09/2022. We received 252 expressions of interest, and 87 (35 %) participants were recruited and randomised. Participants were recruited through social media adverts (65; 75 %); social prescribing teams or GP practice posters (12; 14 %); word-of-mouth (7; 8 %); news articles (2; 2 %); and the trial website (1; 1 %). Recruitment was open for a total of 8.3 weeks and an average of 10.5 participants were recruited each week. Fig. 1 represents the flow of participants through the study. Of the randomized participants, the majority were female (73; 84 %), with 13 (15 %) identifying as male and 1 (1 %) non-binary. The mean age was 42.6 years. A full demographic profile, including breakdown by study arm, can be found in Table 1. There was good balance between the two groups.

Participants were randomised to either the intervention (n = 43) or control arm (n = 44). In North Devon, 13 participants were assigned to each arm. In Worcestershire, 15 were allocated to the intervention and 14 to the control. In London, 15 participants received the intervention and 17 were assigned to the control arm.

3.2. Retention

Table 2 shows trial retention at T1 and T2 with 95 % CIs. Overall, 73 (84 %; 95 % CI 74,91) participants were retained at T1 and 68 (78 %; 95 % CI 68,86) at T2.

3.2.1. Data completeness for clinical and mechanistic measures

Tables A2.2 to A2.5 Supplementary document 3, summarises overall data completeness percentages, categorised by trial arm (intention-to-treat perspective), for site and clinical measures, at T0, T1 and T2. Among those still in the study at T1 and/or T2 (conditional percentage) there was 97 % data completeness conditional on recruitment and retention in the study. Participants' response rates on all measures were generally very good ranging from 92 % to 100 % for clinical and mechanistic measures completed in full. Overall, there was 85 % data completeness which includes study drop-outs (this was above the 80 % target).

3.2.2. Data completeness for health economic measures

Tables A3.1 to A3.7 supplementary document 3 summarises data completeness percentages, categorised by trial arm (intention-to-treat perspective), for key health economics measures at T0, T1 and T2. Overall, trial participants' response rates on key health economic measures was good. Data completeness for the sample of recruited participants over the whole duration of the study (unconditional percentage)

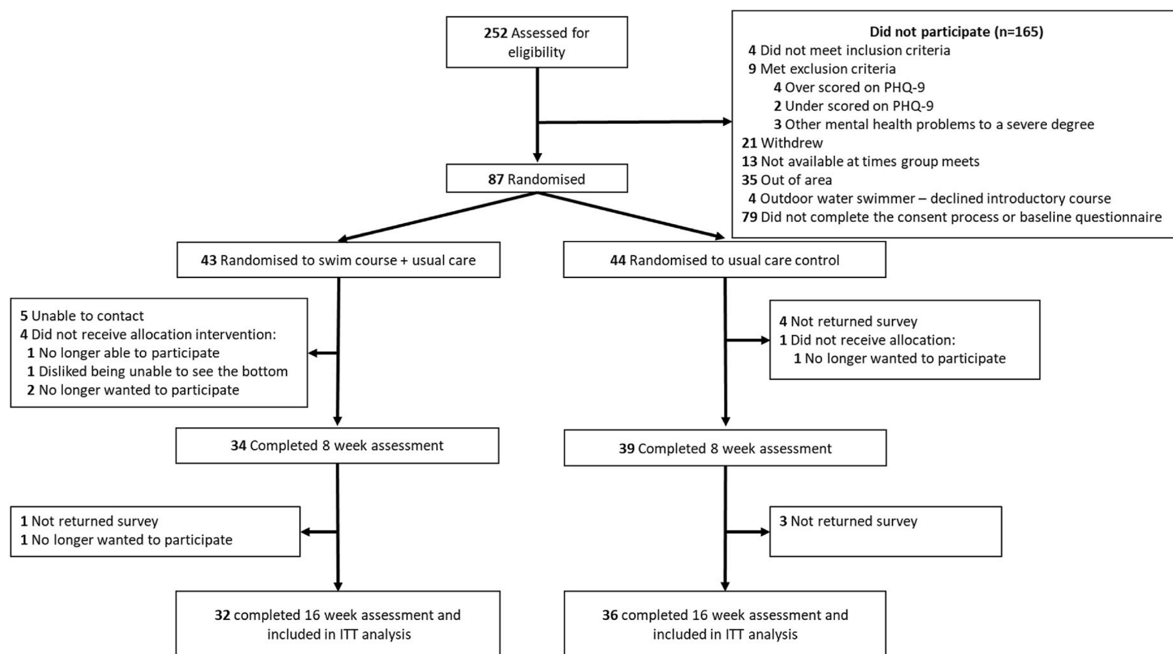

Fig. 1. CONSORT trial profile.

was about 84 % (exception being the 71 % response rate on the swim course-specific questions at post-treatment in the treatment arm). When restricting to participants who engaged with the trial questionnaires at each specific assessment (conditional percentage), data completeness ranged from 96 % to 98 % across all questions, with the only exception being 89 % on the swim course-specific questions at post-treatment in the treatment arm). This means that almost all participants who engaged with the trial questionnaires also answered the health economics questions in full.

3.2.3. Retention

Swim coaches attendance records indicated that participants attended a mean of 4.9 outdoor swimming sessions with 33/43 (79 %; 95 % CI 61 %,88 %) participants attending at least 4 sessions. At the London location 11 of the 15 participants completed the sessions 73 % (95 % CI: 45 %,92 %), in Devon 12 of 13 participants completed the sessions 92 % (64 %,100 %) and in Worcestershire 10 of 15 participants completed the sessions 67 % (38 %,88 %).

3.3. Safety

Two serious adverse events (SAE) and four adverse events (AE) in the swimming intervention arm were recorded and no SAE or AEs were reported in the control arm.

All SAEs (pulmonary embolism resulting from a known medication side effect and found during a routine CT scan and back pain resulting from a bone spur that required surgery) were deemed unrelated to the intervention or study by the independent clinical monitor.

AEs included one participant feeling panicked when swimming out of their depth, another felt very anxious when they could not see the bottom. Another participant found immersion in the water resulted in painful and tingling fingers, the participant wore neoprene gloves thereafter and had no further reoccurrence of symptoms. The final AE related to an off-putting smell at one of the swim locations that the participant could smell for some time after leaving the location. No other swimmers or staff reported the smell as off putting.

3.4. Experiences of the trial

18 participants (20.6 %) joined focus groups providing information about their experiences of the trial and swim courses, meeting our criteria of at least 20 % participating in focus groups (Massey et al., 2023).

Five themes were identified that described key aspects of participant experience: accessibility, belonging, facing challenges with support, benefiting and enjoyment, clarity of information. These are described in more detail in Denton et al. (2024). These findings suggest that participants did have positive experiences on the trial. Participants also indicated a preference for the eight sessions to be delivered on a weekly basis rather than twice per week. This allowed the intervention to become part of their routine and increased the likelihood of attending more sessions, even if they were away for a week.

3.5. Preliminary indicators of effectiveness

A descriptive summary of the measures, intention-to-treat effect estimates and effect sizes at each follow-up time point.

3.5.1. Depression, anxiety and wellbeing and proposed mechanisms

Estimated effects (95 % CI) were used to indicate any signals of potential effect (Table 3 and supplementary document 3 Table A2.15). Between-group mean difference estimates for depression severity (PHQ-9), anxiety severity (GAD-7) and wellbeing (SWEMWEBS) all showed medium to large effects at T1 and T2 accompanied by Cohen's d values in the range of 0.58–0.97 in favour of the intervention arm.

Between-group mean difference estimates for mindfulness (FFMQ-15), self-compassion (SCS-SF), connectedness to nature, and loneliness at T1 and T2 findings indicate moderate effects for mindfulness and a small effect for connectedness to nature in favour of the intervention arm. For self-compassion, a small effect at T1 and no effect at T2 was indicated in favour of the intervention arm. The loneliness scale indicated no effect at T1 or T2. Across the mechanisms and timepoints, Cohen's d values ranged from 0.04 to 0.66 in favour of the intervention arm.

Table 1
Demographic profile of participants.

	Outdoor Swimming		Usual Care		Total	
	Count	%	Count	%	Count	%
Age:						
Mean	46.3		46.2		46.2	
Minimum	22		23		22	
Maximum	74		73		74	
Gender:						
Male	6	14	7	16	13	15
Female	37	86	36	82	73	84
Non-binary	0	0	1	2	1	1
Transgender[a]:	0	0	1	2	1	1
Yes	43	100	42	98	86	100
No						
Sexual orientation:						
Bisexual	1	2	5	11	6	7
Heterosexual	38	88	35	80	73	84
Lesbian/Gay	1	2	2	5	3	3
Prefer not to say	3	7	2	5	5	6
Ethnicity:						
African	2	5	0	0	2	2
Black British	1	2	0	0	1	1
Caribbean	1	2	0	0	1	1
Another Black Background	0	0	1	2	1	1
Asian British	1	2	0	0	1	1
Chinese	0	0	2	5	2	2
Indian	2	5	0	0	2	2
Another Asian Background	1	2	0	0	1	1
White British	31	72	34	77	65	75
White & Black African	0	0	1	2	1	1
White & Asian	1	2	0	0	1	1
White & Black Caribbean	1	2	0	0	1	1
Another White Background	2	5	5	11	7	8
Another Ethnic Group	0	0	1	2	1	1
First Language:						
Arabic	1	2	0	0	1	1
Chinese	0	0	1	2	1	1
English	39	91	41	93	80	92
French	1	2	0	0	1	1
Italian	0	0	1	2	1	1
Portuguese	0	0	1	2	1	1
Punjabi	1	2	0	0	1	1
Religion:						
Atheist/Agnostic	3	7	6	14	9	10
Buddhist	1	2	0	0	1	1
Christian	18	42	16	36	34	39
Hindu	1	2	0	0	1	1
Muslim	2	5	1	2	3	3
Sikh	1	2	0	0	1	1
Spiritual/Humanistic	2	5	3	7	5	6
No Religion	6	14	10	23	16	18
Other	0	0	3	7	3	3
Prefer not to say	8	19	5	11	13	15
Missing data	1	2	0	0	1	1
Marital status:						
Cohabiting	5	12	4	9	9	10
Long term relationship	5	12	1	2	6	7
Married/Civil Partnership	16	37	18	41	34	39
Separated/divorced	2	5	1	2	3	3
Single	13	30	18	41	31	36
Windowed	1	2	1	2	2	2
Prefer not to say	1	2	1	2	2	2
Education level:						
None	3	7	0	0	3	3
GCSE/O'levels	3	7	5	11	8	9
College/6th Form	10	23	11	25	21	24
University Degree	14	33	15	34	29	33
Masters/PhD	12	28	12	27	24	28
Prefer not to say	1	2	1	2	2	2
Disability status:						
No	34	79	32	73	66	76
Yes	9	21	11	25	20	23
Prefer not to say	0	0	1	2	1	1
Dependents[b]:						
Yes, 11 and under years old	7	58	12	80	19	70
Yes, 12–17 years old	4	33	5	33	9	33
Prefer not to say	1	8	0	0	1	4
Carer status:						
Yes, Child/children u18	2	17	2	13	4	15
Yes, Child/Children 18+	1	8	0	0	1	4
Yes, Other relative or partner	0	0	4	27	4	15
Yes, Combination children/ relative/partner	0	0	1	7	1	4
No	9	75	8	53	17	63
Household income:1						
£16,000	7	16	9	20	16	8
£16,001-£30,000	2	5	13	30	15	17
£30,001-£40,000	7	16	5	11	12	14
£40,001-£50,000	5	12	3	7	8	9
£50,001-£60,000	2	5	2	5	4	5
£60,001-£70,000	4	9	2	5	6	7
£70,001-£80,000	3	7	1	2	4	5
£80,001-£90,000	2	5	1	2	3	3
£90,001-£120,000	0	0	3	7	3	3
£120,000+	1	2	0	0	1	1
Prefer not to say	10	23	5	11	15	17
Swimming competence:						
No experience	0	0	1	2	1	1
Some experience	4	9	1	2	5	6
Able to swim	39	91	42	95	81	93
Body Mass Index:						
Mean	28.6		28.6		28.6	
Minimum	17.1		20.9		17.1	
Maximum	48.1		42.9		48.1	

[a] $n = 86$.
[b] $n = 29$.

3.5.2. Health economic outcomes

Table 4 presents descriptive statistics on HRQoL derived from the EQ-5D-5L and the ReQOL instruments, and the associated quality adjusted life years (QALYs).

3.5.2.1. Health-related quality of life and QALYs derived from the EQ-5D-5L. At baseline, there was a slight imbalance in average HRQoL between the two trial arms, with participants in the Swim group reporting higher mean quality of life (mean difference: 0.023; 95 % CI: [−0.041; 0.088]). At post-treatment, perceived HRQoL in the intervention arm improved, on average, and remained stable at this higher level until follow-up. On the contrary, perceived mean HRQoL in the control group continued to deteriorate throughout the study, with mean differences between intervention and control arms of 0.103 (95 % CI: [−0.006; 0.213]). Over the duration of the trial, the mean difference in QALYs accrued was 0.045 (95 % CI: [0.008; 0.082]) in favour of the intervention arm.

3.5.2.2. Health-related quality of life and QALYs derived from the Re-QOL. Imbalance in baseline HRQoL was also captured by the Re-QOL instrument, with a baseline mean difference of 0.011 (95 % CI: [−0.033, 0.055]) in favour of participants in the Swim group. At post-treatment, perceived HRQoL in the swim group slightly improved, on average, and then decreased again at a level slightly lower than baseline at the end of the study. However, overall fluctuations were quite small. HRQoL for the control group decreased throughout the study with the largest mean deterioration (mean difference: −0.47; 95 % CI: [−0.124, 0.030]) occurring between 8 and 16 weeks follow up. Over the duration

Table 2
Clinical outcomes retention: number of participants, percentage of sample in the trial with 95 % confidence intervals.

Timepoint	Outdoor Swimming		Usual Care		Total	
	Count	% (95 % CI)	Count	% (95 % CI)>	Count	% (95 % CI)
Baseline	43	100	44	100	87	100
Post intervention	34	79 (64,90)	39	89 (75,96)	73	84 (74,91)
8 Weeks Follow-up	32	74 (59,86)	36	82 (67,92)	68	78 (68,86)

Table 3
Means and standard deviations (SD) for Baseline (T0), post intervention (T1) and at 8 weeks follow up (T2). Group difference effect sizes (Cohen's *d*) show for post intervention (T1) and follow up (T2) timepoints.

Variable		Baseline M (SD)	Post intervention (T1) M (SD)	Follow-up M (SD)	Between-group difference post intervention (T1) Cohen's *d* (95 % CI)	Between-group difference follow-up (T2) *d* (95 % CI)
PHQ-9	Intervention	11.0 (5.3)	6.4 (4.8)	7.1 (4.5)	0.71 (1.88, 5.52)	0.58 (1.15, 4.91)
	Control	10 (5.2)	9.7 (4.7)	9.9 (5.0)		
GAD-7	Intervention	8.4 (4.6)	4.5 (3.4)	4.7 (3.8)	0.74 (1.93, 5.57)	0.80 (2.20, 5.93)
	Control	9.1 (5.6)	8.5 (5.5)	9.0 (5.7)		
SWEMWEBS	Intervention	19.5 (4.1)	22.8 (4.7)	23.2 (4.8)	−0.86 (−5.12, 1.38)	−0.97 (−5.59, 1.73)
	Control	19.7 (3.5)	19.9 (4.6)	19.6 (4.6)		
FFMQ-15 [a]	Intervention	33.8 (5.80	37.9 (6.7)	39.2 (5.8)	−0.60 (−6.81, −1.62)	−0.66 (−7.31, −1.98)
	Control	35.6 (8.1)	34.7 (8.1)	35.5 (6.3)		
SOCS-S	Intervention	61.2 (10.3)	65.7 (11.7)	66.5 (12.2)	−0.33 (−8.57, 0.85)	−0.15 (−6.52, 3.04)
	Control	64.0 (12.8)	61.8 (15.6)	66.8 (13.3)		
Connectedness to nature	Intervention	50.6 (8.9)	53.9 (9.2)	54.1 (11.7)	−0.44 (−7.60, 1.13)	−0.28 (−6.13, 0.58)
	Control	49.9 (10.8)	48.6 (11.6)	49.7 (12.3)		
Loneliness	Intervention	2.0 (0.9)	2.4 (1.1)	2.3 (1.1)	0.07 (−0.61, 0.87)	0.11 (−0.56, 0.96)
	Control	2.1 (1.0)	2.5 (1.2)	2.5 (1.2)		

PHQ-9: Patient Health Questionnaire - 9, GAD-7: Generalised Anxiety disorder - 7, SWEMWEBS: Short Warwick - Edinburgh Mental Wellbeing Scale, FFMQ-15: Five facets of Mindfulness Questionnaire - 15, SOCS-S: Sussex-Oxford Compassion for Self-Scale.
[a] Five facets of Mindfulness Questionnaire – 15 (total value – observing subscale).

Table 4
Health-related quality of life and QALYs.

	Swim						Control						Unadjusted difference			
	N	Mean	SD	Median	Min	Max	N	Mean	SD	Median	Min	Max	Mean	CI lower[1]	CI upper[2]	p-value[3]
EQ-5D-5L: Baseline	43	0.725	0.143	0.738	0.255	0.988	43	0.701	0.157	0.732	0.169	0.985	0.023	−0.041	0.088	0.475
EQ-5D-5L: 8 weeks	34	0.739	0.237	0.755	−0.310	0.988	38	0.647	0.210	0.688	0.008	0.985	0.092	−0.012	0.197	0.083
EQ-5D-5L: 16 weeks	32	0.738	0.197	0.791	0.123	0.988	34	0.635	0.244	0.690	−0.111	0.987	0.103	−0.006	0.213	0.065
EQ-5D-5L: QALYs	31	0.275	0.074	0.279	0.050	0.402	32	0.230	0.075	0.240	0.049	0.348	0.045	0.008	0.082	0.019
ReQOL-10: Baseline	42	0.823	0.075	0.832	0.556	0.991	44	0.812	0.124	0.818	0.164	0.972	0.011	−0.033	0.055	0.609
ReQOL-10: 8 weeks	34	0.826	0.201	0.891	−0.038	0.995	38	0.810	0.102	0.835	0.469	0.939	0.016	−0.057	0.090	0.660
ReQOL-10: 16 weeks	31	0.820	0.206	0.878	−0.046	0.975	35	0.763	0.213	0.811	−0.129	0.968	0.057	−0.047	0.161	0.276
ReQOL-10: QALY	29	0.307	0.066	0.313	0.099	0.406	32	0.285	0.051	0.283	0.166	0.367	0.022	−0.008	0.052	0.151

[1 & 2]These columns report the lower and upper limits, respectively, of the 95 % Confidence Intervals around the mean difference values; [3]p-values are reported for completeness, as no statistical testing was undertaken.

of the trial, the mean difference in QALYs accrued was 0.022 (95 % CI: [−0.008; 0.052]) in favour of the intervention arm.

3.5.2.3. Health, swim course, and other resource use. Descriptive statistics for health and other resources used by trial participants, as well as resources linked to the provision of the intervention, are reported in Supplementary document 3 (Tables A3.8 to A3.15). Results indicate that the percentage of participants reporting use of depression-specific therapy was lower in the treatment than in the control arm post-treatment and follow-up, with the treatment group reporting, on average, almost one therapy session less than the control group between post-treatment and follow-up (Table A3.8). The use of antidepressants

and sleeping tablets, on average, reduced more in the intervention than in the control arm for the trial duration (Table A3.10). Participants allocated to the treatment arm reported attending, on average, six swim sessions each (Table A3.11) (slightly higher than reported the mean of 4.9 reported by the swim coaches). Each swim session lasted 40 min on average, with another 15 min taken, on average, to change before and after each session. Participants spent on average more than 40 min per session, at a mean cost of almost £5 to travel to and from the swim course location. As part of the health economic questionnaires, participants were asked about activities they engaged with to support their mental health, recorded under "other community health and social service resource use". Engagement in these activities was low, and no responses mentioned any outdoor swimming. This points towards a low risk of potential contamination in the usual care group.

Further details on resources related to the swim course (Tables A3.12 - A3.13), other health and social care use (Table A3.14) and time off paid and unpaid work (Table A3.15) for the participants are outlined in supplementary document 3.

3.6. Assessment against criteria for success

All a-priori success criteria were met, with the exception of intervention completion (79 %) falling just below the success threshold of 80 %. See Table 5 for further details.

4. Discussion

Findings from this feasibility RCT suggest that a full-scale RCT of the same design is feasible in terms of ability to recruit, intervention engagement, intervention acceptability and a signal of efficacy in favour of the intervention versus control arm. Given the feasibility nature of this study, definitive comparisons between the treatment and the control arms were not undertaken, and all mean differences between trial arms, where presented, must be interpreted with caution, as they are only explorative. As such it is too early to recommend use of the introductory outdoor swimming course as an intervention for depression based on our findings. Whilst the study was not powered to detect statistically significant between group differences, the data are encouraging and should be tested with an adequately powered trial. However, the PHQ-9 was sensitive to change, with additional efficacy signals from the GAD-7, EQ-5D-5L, ReQoL, and FFMQ15. EQ-5D-5L and ReQoL were suitable and acceptable for capturing general and depression-specific health-related quality of life, and QALYs were derived from both aligning with NICE recommendations (NICE, 2025). A future full-scale trial should also include a full economic evaluation comparing 'swim course plus treatment as usual' to 'treatment as usual' alone. Resource use questionnaires were appropriate, though swim coach logs had lower completion rates, this should be addressed through improved communication and co-design with coaches.

With 87 participants recruited, it is feasible to recruit to target in a short time frame. While some participants were referred by social prescribers, most interest came from social media and media outlets, including many outside the intervention area. Additional locations would be needed to accommodate a larger sample for a full-scale RCT.

Intervention completion was very close to meeting our success criteria of 80 % (Massey et al., 2023). This rate is comparable to a yoga intervention (80 % completion (Kinser et al., 2013)) and exceeds recent figures from NHS Talking Therapy services (57.7 % completion (NHS, 2025)). However, there was a discrepancy in the average number of sessions attended when recorded based upon the swim coach registers and the data provided by participants in the post intervention survey. The swim coach registers are likely to be most accurate as swim coaches are required to keep contemporaneous registers for safety reasons. These registers will include attendance information on participants who did not complete post-intervention assessments and therefore their self-reported attendance was not captured. Our data also indicate that those who attended the first sessions were more likely to attend frequently, this has also been found by Schauman et al. (2013). The challenge for future research is to support engagement and attendance to early sessions by offering strategies to promote engagement and reduce logistical barriers as suggested by Sweetman et al. (2021).

The trial design posed challenges for some participants especially those in the control group, some of whom were disappointed at being randomised to the usual care only arm. This is not unusual for RCTs (Naidoo et al., 2020) and clear communication with participants about being part of the control group were highlighted. However, the study retention rates at the post intervention and follow survey were high. Control participants had the opportunity to attend a swim intervention course after the study, which is considered RCT best practice (Brueton et al., 2017) and was highly recommended by our lived experience panel. This was included to attempt to minimise attrition within the control group. Control participants also emphasised the importance of study team contact and feeling part of the study for their continued retention. Based on feedback, several recommendations were made for the full-scale RCT. These included offering support during randomisation and questionnaire completion, maintaining engagement with control participants, and providing additional assistance ahead of their end-of-study swim course, all aligned with best practice standards (Brueton et al., 2017).

Overall, trial participants, social prescribers, and coaches interviewed reported positive experiences of the study and intervention, meeting success criteria. Key themes describing the participant's

Table 5
Criteria for success, outcomes and recommendations towards a full scale trial.

Criteria	Evidence	Recommendations
1. 80% trial retention at T1 for the PHQ-9	84% across both arms of the study	Qualitative analysis and PPI activity provided suggestions to support overall retention within a full RCT.
2. 80% attending four or more swim sessions	79% attended 4 or more swim sessions (33/44 participants).	Lots of positive feedback from swimmers and coaches for improvements for a full RCT. Very close to our criteria for success.
3. 80% data completeness	83% provide full data sets	Find ways to encourage data completeness, reduce survey burden, improve the look of the surveys, reimburse time.
4. Collection of data on the experience of participation from at least 20% of participants	18 attended focus groups (20.6% of participants) 68 completed written evaluations (78%)	Recommendations will be instigated to improve the participants' journey. The recommendations include clearer information at an earlier stage, improve accessibility and support offered to participants, promote a sense of belonging and support participants facing challenges. See supplemental material 3 and Denton et al (47).
5. Taking part in this study was a positive experience for participants, link workers and coaches.	Qualitative evidence provides support	

Green: criteria for success met, Amber: close to meeting criteria for success.

experience were identified and are explored in detail elsewhere (Denton et al., 2024). The analysis also highlighted areas that could be improved and which led to recommendations for a full-scale RCT. These recommendations included offering the course as eight weekly sessions rather than to increase session frequency, and offer bespoke courses for participants with protected characteristics, in this study men were underrepresented. Men are frequently underserved within health care, particularly mental health services (Shepherd et al., 2023). A further challenge to future mental health research is to provide support to underserved communities.

Social Prescribers supporting the study were eager to offer 'something different' to the community they support. However, their limited availability made it challenging to support the referral process. Nationally, social prescribers face difficulties due to organisational and locality differences, making it hard to identify the key stakeholders (Chng et al., 2021), social prescribers having to prioritise referrals related to the cost-of-living crisis, including food and fuel poverty (Westlake et al., 2023). While social prescribers can initially support participants in joining the trial, their current workload limits further involvement. Therefore, a large RCT will engage social prescribers to advertise the trial and allow people to self-refer into the study where possible, but will mainly rely on other recruitment methods, such as NIHR Be Part of Research advertising, local advertising, social media, and GP text messaging.

The swim coaching team's expertise and the environment they create are crucial to creating a positive experience, as was frequently noted by the participants (Denton et al., 2024). However not all swim coaches are trained mental health professionals (Juster-Horsfield & Bell, 2022). Additional training for coaches to promote understanding and supporting people with mental health issues will be provided for the full-scale RCT and additional clarification that the courses will not focus on participants' mental health difficulties. This suggests that should the intervention be subsequently found to reduce symptoms of depression, part of the scaling up process should include standardised mental health training for swim coaches and a manual providing guidance to support the delivery of the sessions.

4.1. Strengths and limitations

This study represents the first randomised controlled trial (RCT) aimed at evaluating the feasibility of conducting a trial to assess both the clinical and cost-effectiveness of an outdoor swimming intervention for depression. It provided an ecologically valid example of implementing an introductory outdoor swimming program across diverse water-based locations. The incorporation of qualitative and health economics components demonstrated the feasibility of conducting a larger-scale RCT, which would be sufficiently powered to detect between-group differences. Furthermore, the study offered recommendations to enhance participant experiences for a future RCT. However, as this is a feasibility study, no conclusions can be drawn about the impact of the intervention.

Participants in this study either self-referred or were signposted by healthcare professionals and social prescribers. A formal diagnosis of depression was not required for participation. However, to be eligible for inclusion in the trial, participants were required to have PHQ-9 scores between 5 and 19 (inclusive), indicating mild to moderate symptoms of depression. The PHQ-9 is a brief self-report tool used to assess depressive symptoms. While it is useful for screening, if we aim to evaluate the effectiveness of outdoor swimming as an intervention for depression in a larger-scale randomised controlled trial (RCT), an established diagnostic interview should be used to determine inclusion.

The activity of cold water swimming is not without risk and as such participant's answers to a medical screening questionnaire were reviewed by the study medical team for any potential contraindications to cold water immersion (Tipton et al., 2022) or met any of the medical exclusion criteria for the study. Further assessments were ordered from GPs if required by the medical team. Therefore, it is important to indicate that this intervention may not be suitable for all people with symptoms of depression and medical assessment for contraindications to cold water immersion maybe required prior to participation. Given this screening process and support of the experienced open water coaches and lifeguards who supported the group sessions, no serious adverse events attributed to the intervention or study were reported.

Some participants described physical discomfort that put them off swimming. Understanding why individuals who initially expressed interest and later disengaged deserves further exploration, especially given that existing literature has primarily focused on the pleasurable and restorative aspects of immersion in natural water environments (Denton & Aranda, 2020; Denton et al., 2024). Despite attempts to contact participants who withdrew from the intervention, limited engagement was possible and should be a consideration for future trials. To better understand for whom the intervention may help, it is necessary to highlight the aspects that were off putting for individuals who decided to withdraw from the intervention. This allows a better and more balanced description of the activity for individuals who may like to try outdoor swimming than currently exists.

5. Conclusion

The present trial indicates that it is feasible to conduct a full-scale RCT to assess the clinical- and cost-effectiveness of the eight-session outdoor swimming intervention (plus usual care) compared to usual care alone for adults experiencing depression. We recruited close to target, retained participants within the intervention and trial, gained valuable information about the acceptability of the trial and intervention and demonstrated a signal of efficacy on all outcomes in favour of the intervention arm.

CRediT authorship contribution statement

Heather Massey: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization. **Hannah Denton:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Amy Burlingham:** Writing – review & editing, Resources, Methodology, Funding acquisition, Data curation, Conceptualization. **Mara Violato:** Writing – review & editing, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Anna-Marie Bibby-Jones:** Writing – review & editing, Software, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Rebecca Cunningham:** Writing – review & editing, Resources, Project administration, Methodology. **Sandy Ciccognani:** Writing – review & editing, Methodology, Investigation, Funding acquisition, Conceptualization. **Sam Robertson:** Writing – review & editing, Resources, Methodology, Investigation, Funding acquisition. **Anmol Jhans:** Writing – review & editing, Resources, Project administration. **Jack Pollard:** Writing – review & editing, Methodology, Formal analysis. **Shuye Yu:** Writing – review & editing, Formal analysis. **Clara Strauss:** Writing – review & editing, Writing – original draft, Resources, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization.

Key points

In this feasibility randomised control trial (RCT) of 87 people living with depression, we found:

- Favourable study recruitment, retention and intervention completeness
- High level of data completeness

- Many participants reported positive experiences of trial participation and swim courses

With the feedback provided by participants to improve the design, it is recommended to progress to a full-scale RCT.

Trial registration

Current controlled trial registration number is ISRCTN 90851983 registered on 19/05/2022. https://www.isrctn.com/ISRCTN90851983.

Trial protocol

The trial protocol is published (Massey et al., 2023) and is available as supplementary document 1.

Dissemination

A short film and podcast have been co-produced with the members of the LEAP team to describe the study, these will be used to help recruit for a full-scale randomised control trial and show cased at local and national events.

The film can be found at (https://www.youtube.com/watch?v=CD-Xq-ZBsck [12.20] or https://player.vimeo.com/video/915180233?share=copy [4.21])

The podcasts can be found at (https://open.spotify.com/show/7jeVzXMG8G1HeaMgR1wUWi)

Author's contributions

Study concept and design: Massey, Strauss, Denton, Bibby-Jones, Violato, Robertson, Cigcognani, Burlingham and Cunningham.

Acquisition, analysis, or interpretation of data: Massey, Strauss, Denton, Jhans, Bibby-Jones, Violato, Robertson, Cigcognani, Burlingham and Cunningham, Pollard, Yu.

Drafting of the manuscript: Massey, Strauss, Denton, Bibby-Jones, Violato, Robertson, Cigcognani, Burlingham and Cunningham.

Critical revision of the manuscript for important intellectual content:

Statistical analysis: Bibby-Jones, Violato, Pollard, Yu.

Obtained funding: Strauss, Massey, Denton, Bibby-Jones, Violato, Robertson, Cigcognani, Burlingham and Cunningham.

Administrative, technical, or material support: Strauss, Massey, Denton, Jhans, Pollard, Yu,

Study supervision: Strauss, Massey, Denton.

Availability of data and materials

The datasets created for the current study will be available from the corresponding author on reasonable request.

A video of the study including some participants views is available at https://www.youtube.com/watch?v=CD-Xq-ZBsck.

Ethics approval and consent to participate

This study has received full ethical approval from the Health Research Authority (HRA) in the UK (Research Ethics Committee reference: 22/LO/0268). Informed consent was obtained from all participants through completion of a consent form. Important modifications to the trial protocol were submitted for approval from the trial sponsor and HRA.

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Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: All Authors report financial support was provided by National Institute for Health and Care Research. Heather Massey reports a relationship with CHILL CIC that includes: consulting or advisory. Amy Burlingham reports a relationship with CHILL CIC that includes: non-financial support. Hanah Denton reports a relationship with Seasure CIC that includes: non-financial support. Heather reports a relationship with Swim the Wight that includes: non-financial support. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Abbreviations

CSRI Clinical Service Receipt Inventory
DEFRA Department of Environment, Food and Rural Affairs
DSMB Data Safety Monitoring Board;
EQ-5D-5L EuroQol – 5-Dimension – 5-level instrument
FFMQ-15 Five facets of Mindfullness Questionnaiure 15
GAD-7 Generalised Anxiety Disorder 7
IAPT Improving access to psychological therapies
iPCQ i-Productivity Cost Questionnaire
NICE National Institute of Health and Care Excellence
PHQ-9 Patient Health Questionnaire 9
PPI Public and patient involvement
RA Research assistant
RCT Randomised Control Trial
ReQoL-10 Recovering Quality of Life-10 instrument
SOCS-S Sussex-Oxford Compassion for Self-Scale
sWEMWBS short version of the Warwick Edinburgh Mental Well-being Scale

TSC Trial Steering Committee

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.mhpa.2025.100723.

Data availability

Data will be made available on request.

References

Babyak, M., Blumenthal, J. A., Herman, S., Khatri, P., Doraiswamy, M., Moore, K., et al. (2000). Exercise treatment for major depression: Maintenance of therapeutic benefit at 10 months. *Psychosomatic Medicine, 62*(5), 633–638.

Baer, R., Gu, J., & Strauss, C. (2022). Five facet mindfulness questionnaire (FFMQ). In O. N. Medvedev, C. U. Krägeloh, R. J. Siegert, & N. N. Singh (Eds.), *Handbook of assessment in mindfulness research [internet]* (pp. 1–23). Cham: Springer International Publishing [cited 2024 Aug 24] https://link.springer.com/10.1007/978-3-030-77644-2_15-1.

Bouwmans, C., Krol, M., Severens, H., Koopmanschap, M., Brouwer, W., & Roijen, LH van (2015). The iMTA productivity cost questionnaire. *Value in Health, 18*(6), 753–758.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101.

Brueton, V., Stenning, S. P., Stevenson, F., Tierney, J., & Rait, G. (2017). Best practice guidance for the use of strategies to improve retention in randomized trials developed from two consensus workshops. *Journal of Clinical Epidemiology, 88*, 122–132.

Burlingham, A., Denton, H., Massey, H., Vides, N., & Harper, C. M. (2022). Sea swimming as a novel intervention for depression and anxiety - A feasibility study exploring engagement and acceptability. *Ment Health Phys Act, 23*, Article 100472.

Chng, N. R., Hawkins, K., Fitzpatrick, B., O'Donnell, C. A., Mackenzie, M., Wyke, S., et al. (2021). Implementing social prescribing in primary care in areas of high socioeconomic deprivation: Process evaluation of the 'Deep End' community links worker programme. *British Journal of General Practice, 71*(713), e912–e920.

Clinical Service Receipt Inventory (CSRI). Database of instruments for resource use measurement (DIRUM) [Internet]. Available from: https://www.dirum.org/instruments/details/44.

Denton, H., & Aranda, K. (2020). The wellbeing benefits of sea swimming. Is it time to revisit the sea cure? *Qual. Res. Sport Exerc. Health, 12*(5), 647–663.

Denton, H., Robertson, S., Ciccognani, S., Meddings, S., White, P., Elsby-Pearson, C., et al. (2024). Challenging perspectives; understanding the barriers to engaging in an outdoor swimming feasibility randomised controlled trial. *Health & Place, 90*, Article 103312.

Garside, R, Orr, N, Short, R, Lovell, B, McEachan, R, Rashid, R, & Dickie, I (2020). *Therapeutic nature: Nature-based social prescribing for diagnosed mental health conditions in the UK*. Report to DEFRA https://arc-swp.nihr.ac.uk/wp/wp-content/uploads/2021/06/15138_TherapeuticNature-Finalreport.pdf.

Gartlehner, G., Thieda, P., Hansen, R. A., Gaynes, B. N., DeVeaugh-Geiss, A., Krebs, E. E., et al. (2008). Comparative risk for harms of second-generation antidepressants: A systematic review and meta-analysis. *Drug Safety, 31*(10), 851–865.

Gartlehner, G., Wagner, G., Matyas, N., Titscher, V., Greimel, J., Lux, L., et al. (2017). Pharmacological and non-pharmacological treatments for major depressive disorder: Review of systematic reviews. *BMJ Open, 7*(6), Article e014912.

Gu, J., Baer, R., Cavanagh, K., Kuyken, W., & Strauss, C. (2020). Development and psychometric properties of the sussex-oxford compassion scales (SOCS). *Assessment, 27*(1), 3–20.

Gu, J., Strauss, C., Crane, C., Barnhofer, T., Karl, A., Cavanagh, K., et al. (2016). Examining the factor structure of the 39-item and 15-item versions of the five facet mindfulness questionnaire before and after mindfulness-based cognitive therapy for people with recurrent depression. *Psychological Assessment, 28*(7), 791–802.

Guideline Development Panel for the Treatment of Depressive Disorders. (2019). APA clinical practice guideline for the treatment of depression across three age cohorts: (505892019-001) [internet] [cited 2024 Aug 22] https://doi.org/10.1037/e505892019-001.

Haywood, A., Thompson, J., Foster, A., Dayson, C., Holding, E., Garside, R., et al. (2024). OP118 preventing and tackling mental ill health through green social prescribing: Findings from a realist-informed, mixed methods evaluation. *Journal of Epidemiology & Community Health, 78*(Suppl 1). A43–A43.

Herdman, M., Gudex, C., Lloyd, A., Janssen, M., Kind, P., Parkin, D., et al. (2011). Development and preliminary testing of the new five-level version of EQ-5D (EQ-5D-5L). *Quality of Life Research, 20*(10), 1727–1736.

Hughes, M. E., Waite, L. J., Hawkley, L. C., & Cacioppo, J. T. (2004). A short scale for measuring loneliness in large surveys: Results from two population-based studies. *Research on Aging, 26*(6), 655–672.

Husk, K., Blockley, K., Lovell, R., Bethel, A., Lang, I., Byng, R., et al. (2020). What approaches to social prescribing work, for whom, and in what circumstances? A realist review. *Health Soc. Care Commun., 28*(2) [cited 2025 Mar 2] https://pubmed.ncbi.nlm.nih.gov/31502314/.

Jones, D. S., & Podolsky, S. H. (2015). The history and fate of The Gold standard. *The Lancet, 385*(9977), 1502–1503.

Juster-Horsfield, H. H., & Bell, S. L. (2022). Supporting 'blue care' through outdoor water-based activities: Practitioner perspectives. *Qual. Res. Sport Exerc. Health, 14*(1), 137–150.

Keetharuth, A. D., Bjorner, J. B., Barkham, M., Browne, J., Croudace, T., & Brazier, J. (2021). An item response theory analysis of an item pool for the recovering quality of life (ReQoL) measure. *Quality of Life Research, 30*(1), 267–276.

Kinser, P. A., Bourguignon, C., Whaley, D., Hauenstein, E., & Taylor, A. G. (2013). Feasibility, acceptability, and effects of gentle hatha yoga for women with major depression: Findings from a randomized controlled mixed-methods study. *Archives of Psychiatric Nursing, 27*(3), 137–147.

Kroenke, K., Spitzer, R. L., & Williams, J. B. W. (2001). The PHQ-9: Validity of a brief depression severity measure. *Journal of General Internal Medicine, 16*(9), 606–613.

Kuyken, W., Hayes, R., Barrett, B., Byng, R., Dalgleish, T., Kessler, D., et al. (2015). Effectiveness and cost-effectiveness of mindfulness-based cognitive therapy compared with maintenance antidepressant treatment in the prevention of depressive relapse or recurrence (PREVENT): A randomised controlled trial. *The Lancet, 386*(9988), 63–73.

Kuyken, W., Warren, F. C., Taylor, R. S., Whalley, B., Crane, C., Bondolfi, G., et al. (2016). Efficacy of mindfulness-based cognitive therapy in prevention of depressive relapse: An individual patient data meta-analysis from randomized trials. *JAMA Psychiatry, 73*(6), 565–574.

Lim, G. Y., Tam, W. W., Lu, Y., Ho, C. S., Zhang, M. W., & Ho, R. C. (2018). Prevalence of depression in the community from 30 countries between 1994 and 2014. *Scientific Reports, 8*(1), 2861.

Loftus, A. M., McCauley, F., & McCarron, M. O. (2017). Impact of social prescribing on general practice workload and polypharmacy. *Public Health, 148*, 96–101.

Massey, H., Denton, H., Burlingham, A., Violato, M., Bibby-Jones, A. M., Cunningham, R., et al. (2023). OUTdoor swimming as a nature-based intervention for DEpression (OUTSIDE): Study protocol for a feasibility randomised control trial comparing an outdoor swimming intervention to usual care for adults experiencing mild to moderate symptoms of depression. *Pilot Feasibility Stud., 9*(1), 122.

Massey, H., Gorczynski, P., Harper, C. M., Sansom, L., McEwan, K., Yankouskaya, A., et al. (2022). Perceived impact of outdoor swimming on health: Web-based survey. *Interact J. Med. Res., 11*(1), Article e25589.

Massey, H., Kandala, N., Davis, C., Harper, M., Gorczynski, P., & Denton, H. (2020). Mood and well-being of novice open water swimmers and controls during an introductory outdoor swimming programme: A feasibility study. *Lifestyle Med., 1*(2), e12.

Mayer, F. S., & Frantz, C. M. (2004). The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of Environmental Psychology, 24*(4), 503–515.

McDaid, D, & Park, AL (2022). *The economic case for investing in the prevention of mental health conditions in the UK*. Mental Health Foundation. Available from https://www.mentalhealth.org.uk/explore-mental-health/publications/economic-case-investing-prevention-mental-health-conditions-UK.

Mellor, K., Eddy, S., Peckham, N., Bond, C. M., Campbell, M. J., Lancaster, G. A., et al. (2021). Progression from external pilot to definitive randomised controlled trial: A methodological review of progression criteria reporting. *BMJ Open, 11*(6), Article e048178.

MIND. Feel better outside, feel better inside: Ecotherapy for mental wellbeing, resilience and recovery [internet] [cited 2022 July 7]. Available from: https://www.basw.co.uk/resources/feel-better-outside-feel-better-inside-ecotherapy-mental-wellbeing-resilience-and-recovery, (2013).

Naidoo, N., Nguyen, V. T., Ravaud, P., Young, B., Amiel, P., Schanté, D., et al. (2020). The research burden of randomized controlled trial participation: A systematic thematic synthesis of qualitative evidence. *BMC Medicine, 18*(1), 6.

NHS. (2025) Fit for future: 10 year Health plan for England [Internet]. Available from: https://www.gov.uk/government/publications/10-year-health-plan-for-england-fit-for-the-future/fit-for-the-future-10-year-health-plan-for-england-executive-summary.

NHS Digital. (2024). NHS talking therapies monthly statistics including employment advisors. *Performance January 2024 Official statistics [Internet]*. Available from: https://digital.nhs.uk/data-and-information/publications/statistical/nhs-talking-therapies-monthly-statistics-including-employment-advisors/performance-january-2024.

NHS Digital. (2025). NHS talking therapies monthly statistics including employment advisors. Performance December 2024 and Quarter 3 2024/25 data [Internet] https://digital.nhs.uk/data-and-information/publications/statistical/nhs-talking-therapies-monthly-statistics-including-employment-advisors/performance-december-2024-and-quarter-3-2024-25-data.

NHS England. (2023). Health survey for England, 2021 part 2 [internet]. Available from: https://digital.nhs.uk/data-and-information/publications/statistical/health-survey-for-england/2021-part-2/physical-activity.

NICE. (2022). *Depression in adults: Treatment and management [internet]*. Report No.: NG222. Available from: https://www.nice.org.uk/guidance/ng222.

NICE. (2025). *National Institute for Health and Care Excellence health technology evaluation: The manual. NICE process and methods*. Last updated: 14 July 2025 [Internet] www.nice.org.uk/process/pmg36.

Office for National Statistics. (2018). *Measuring loneliness: Guidance for use of the national indicators on surveys [Internet]*. Available from: https://www.ons.gov.uk/peoplepopulationandcommunity/wellbeing/methodologies/measuringlonelinessguidanceforuseofthenationalindicatorsonsurveys.

Office for National Statistics. (2023). *Ethnic group, national identity and religion [Internet]*. Available from: https://www.ons.gov.uk/methodology/classificationsandstandards/measuringequality/ethnicgroupnationalidentityandreligion.

Ormel, J., Hollon, S. D., Kessler, R. C., Cuijpers, P., & Monroe, S. M. (2022). More treatment but no less depression: The treatment-prevalence paradox. *Clinical Psychology Review, 91*, Article 102111.
Santomauro, D. F., Mantilla Herrera, A. M., Shadid, J., Zheng, P., Ashbaugh, C., Pigott, D. M., et al. (2021). Global prevalence and burden of depressive and anxiety disorders in 204 countries and territories in 2020 due to the COVID-19 pandemic. *The Lancet, 398*(10312), 1700–1712.
Schauman, O., Aschan, L. E., Arias, N., Beards, S., & Clement, S. (2013). Interventions to increase initial appointment attendance in mental health services: A systematic review. *Psychiatric Services, 64*(12), 1249–1258.
Sealed Envelope Ltd. Sealed envelope: Randomisation and online databases for clinical trials. www.sealedenvelope.com.
Shepherd, G., Astbury, E., Cooper, A., Dobrzynska, W., Goddard, E., Murphy, H., et al. (2023). The challenges preventing men from seeking counselling or psychotherapy. *Ment. Health Prev., 31*, Article 200287.
Spitzer, R. L., Kroenke, K., Williams, J. B. W., & Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: The GAD-7. *Archives of Internal Medicine, 166*(10), 1092.
Sport England. (2024). *Active lives Surve*. Available from: https://www.sportengland.org/research-and-data/data/active-lives?section=measures.
Stewart-Brown, S., Platt, S., Tennant, A., Maheswaran, H., Parkinson, J., Weich, S., et al. (2011). The warwick-edinburgh Mental Well-being Scale (WEMWBS): A valid and reliable tool for measuring mental well-being in diverse populations and projects. *Journal of Epidemiology & Community Health, 65*(Suppl 2), A38–A39.
Sweetman, J., Knapp, P., Varley, D., Woodhouse, R., McMillan, D., & Coventry, P. (2021). Barriers to attending initial psychological therapy service appointments for common mental health problems: A mixed-methods systematic review. *Journal of Affective Disorders, 284*, 44–63.
Teare, M. D., Dimairo, M., Shephard, N., Hayman, A., Whitehead, A., & Walters, S. J. (2014). Sample size requirements to estimate key design parameters from external pilot randomised controlled trials: A simulation study. *Trials, 15*(1), 264.
Tipton, M. J., Collier, N., Massey, H., Corbett, J., & Harper, M. (2017). Cold water immersion: Kill or cure? *Experimental Physiology, 102*(11), 1335–1355.
Tipton, M., Massey, H., Mayhew, A., & Morgan, P. (2022). Cold water therapies: Minimising risks. *British Journal of Sports Medicine, 56*(23), 1332–1334.
Westlake, D., Tierney, S., Wong, G., & Mahtani, K. R. (2023). Social prescribing in the NHS—Is it too soon to judge its value? *BMJ*, Article p699.