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Bridging the evidence gap: A review and research protocol for outdoor mental health therapies for young Australians

Emily J. Flies · Anita Pryor · Claire Henderson-Wilson · Megan Turner · Jessica Roydhouse · Rebecca Patrick, et al. ***[full author details at the end of the article]***

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Abstract

Internationally, over 60% of all lifetime cases of mental health disorders are identified as emerging by 25 years of age. In Australia, young people (aged 16–24 years) report the highest prevalence of mental health problems. Acceptability of mainstream services for young people is a concern, particularly for clients 18–25 years, heterosexual males and certain marginalised communities. With unaddressed distress in young people a precursor to poor, potentially lifelong mental ill-health trajectories, the provision of acceptable, and accessible mental health services remains a critical system imperative.

Outdoor therapies, such as outdoor talking therapies, present an option for increasing the breadth of mental health interventions available to young people. Reported benefits of outdoor therapies include improved self-esteem and confidence, positive and negative affect, stress reduction and restoration, social benefits, and resilience. As outdoor therapies draw on multidisciplinary skillsets, this modality has the potential to expand services beyond existing workforce capacities. However, there are evidence gaps that must be addressed before mainstreaming of this treatment modality can occur.

Here we overview the existing evidence base for *outdoor talking therapies,* as a form of outdoor mental healthcare, to determine their appropriateness as an effective and efficient treatment modality for young people with psychological distress in Australia and elsewhere. We then propose a research protocol designed to determine the acceptability, efficacy and efficiency of 'outdoor talking therapies'. Our aim is to help address identified youth mental healthcare service shortages in Australia, and potentially support the health of our mental healthcare workforce.

Keywords Nature · Wellbeing · Distress · Therapy · Ecotherapy · Youth

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Introduction

In Australia, 43.7% of the adult population report having experienced a mental health disorder in their lifetime, and one-in five (21.4%) experienced symptoms in the 12-months prior to the National Survey of Mental Health and Wellbeing (ABS, 2022). Internationally, over 60% of all lifetime cases of mental health disorders are identified as emerging by 25 years of age (Solmi et al., 2022), and consistent with this finding, young Australians aged 16–24 years report the highest prevalence of 12-month mental health disorder (39.6%) (ABS, 2022). Regrettably, less than half (47.7%) of these young people saw a health professional for their mental health during that time (ABS, 2022).

Providers of mental healthcare for young people in Australia include general practitioners; counsellors or psychologists in schools or the community including phone and online services such as the Kids Helpline, ReachOut Australia and Head-to-Health; the national youth mental health service, headspace; children and adult Head to Health hubs, private and public specialists e.g., psychiatrists, psychologists and paediatricians; and for those with complex and specialised needs specialised public mental health services. For people in crisis, emergency departments and public and private hospitals may also be accessed, as may Safe Haven Cafes where available. Services are thus available across the spectrum of community to tertiary care, through a system that is not always easily navigable or accessible.

For Australians with recent symptoms, existing data suggests that general practitioners (GPs) were the most commonly accessed provider (38%), followed by psychologists (22%) and psychiatrists (8%) (ABS, 2022). Telehealth options also provide many people with anonymous support; a key crisis support line in Australia, Lifeline, for example, receives over 1 million calls per year (Lifeline, 2023). The provision of mental health care by general practitioners (including those employed at the national youth mental health service, headspace), psychiatrists, paediatricians, psychologists, social workers, may potentially be subsidised through Australia's national health insurance scheme Medicare.

One in nine Australians accessed mental health-specific services through Medicare in 2020–21, and the fraction of Australians seeking Medicare-subsidised mental health services has been steadily climbing for the last decade (AIHW, 2022). Trends in provider access demonstrate a demand for alternatives to the standard mental health care options with the greatest increase in service demand is for 'other allied health professionals' such as occupational therapists, social workers, Aboriginal health workers and mental health nurses (AIHW, 2022). This trend demonstrates demand for alternatives to the standard mental health care options.

Access to and acceptability of mental health services can be an issue. People with lower income, education, mobility limitations, and poor self-reported health often have trouble accessing care (Corscadden et al., 2019). And for many people, cost is a major barrier to accessing care (Corscadden et al., 2019; Fennell et al., 2018). Costs of care were a reason for 12.0% of all persons needing mental

health care postponing or not pursuing care on at least one occasion in Australia in 2020–21, with younger people less likely to access care (Neil, 2023). Additional barriers include a desire for privacy, and a lack of trust in mental health practitioners (Corscadden et al., 2019; Fennell et al., 2018). Some clients report that the traditional (indoor) therapy makes them feel ill, constrained, bored, sad or disengaged and that the (indoor) setting feels too formal (Cooley et al., 2020; Fernee et al., 2019). Data from headspace suggests that low acceptability of services is a particular issue for clients who are male, heterosexual, Aboriginal or Torres Strait Islander, living in a rural location or socioeconomically disadvantaged (Seidler et al., 2020). The need for new models of mental health care is widely acknowledged, particularly for young people, with unaddressed psychological distress in this age-group a precursor to poor, potentially lifetime trajectories of mental and physical ill-health (Colizzi et al., 2020).

Meanwhile, mental health professionals face increased risk of psychological distress, mental ill-health and suicide (Dattilio, 2015). High-demands, low-control and limited support are factors that contribute to job strain and burnout in this workforce (Nahrgang et al., 2011). Workforce capacity in mental health services is understood to be particularly susceptible to strain and burnout, with lower productivity, high levels of absenteeism and increasing workers' compensation claims exacerbating service delivery challenges (Morse et al., 2012). Further, since the COVID-19 pandemic, increasing demand for services (Bower et al., 2021; McGorry, 2022) has compounded existing workforce and capacity pressures (headspace, 2021) resulting in long waitlists for distressed young people (Seidler et al., 2020). Waitlists of 3-months and longer are common and demand management strategies, including single visits, have been implemented in some locations. Thus, not only are young people in distress, our workforce and mental health system is too. This situation points to an urgent need to develop new models of care that address these significant risks to a sustainable workforce.

Within this high-demand context, the provision of acceptable, accessible and sustainable multidisciplinary mental health services is a critical imperative. This need is confirmed by a collection of recent national inquiries and policy directives. For example, the 2020 Productivity Commission Inquiry into Mental Health, spoke to the need for the creation of a "person-centred" mental health system focussed on the wellbeing of young people, particularly early intervention and prevention (Productivity Commission, 2020). The National Suicide Prevention Adviser recommended the need for early access to programs, treatment and support for children and young people (National Suicide Prevention Adviser 2020). In the National Mental Health and Suicide Prevention Plan (Department of Health, 2021), funding was announced to support the expansion of headspace, to improve access to culturally safe and accessible services through child mental health and wellbeing hubs, and support for family members and/or carers of people dealing with mental ill health. To increase the range of mental health interventions available to young people, the need for collaborative integrated multidisciplinary services has also been highlighted in the academic literature (Colizzi et al., 2020); outdoor talking therapies are one such option.

The outdoor therapy option

Outdoor therapies, sometimes called 'nature-based' therapies or eco-therapies, are widely used and potentially scalable, but not yet -mainstreamed. These approaches offer health promoting and targeted mental health interventions for people with a therapeutic need (Colizzi et al., 2020) and usually comprise semi-structured activities in natural environments led by accredited practitioners (Cooley et al., 2020). Across their diversity, outdoor therapies tend to embody four key components: BIO (physical and experiential), PSYCHO (mental and emotional care, and intentional conversations), SOCIO (equalised social relationships) and ECO (nature contact/time in nature; Fig. 1)(Neil et al., 2023). Culture (culturally appropriate facilitation, including but not limited to First Nations approaches such as 'on country' programs for Aboriginal young people) is increasingly being embodied in these activities as a fifth element. These therapy components relate to some of the mechanisms connecting nature to wellbeing benefits (Hartig et al., 2014) including that; nature can benefit physical and social health by providing a place for physical activity and social

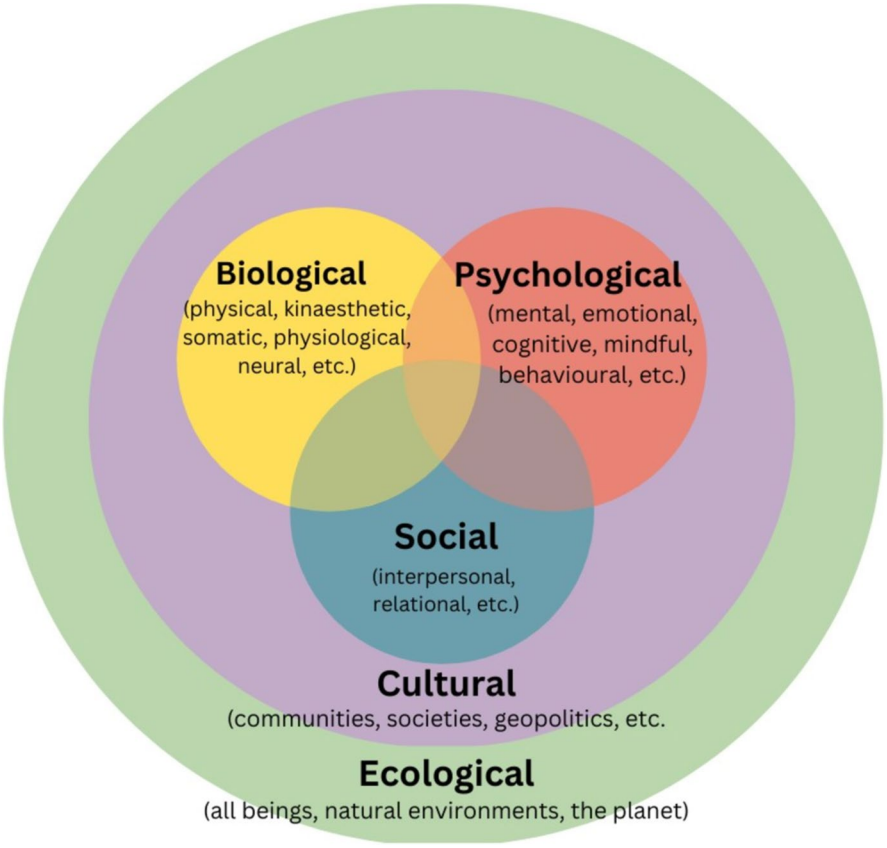

Fig. 1 Key common practice elements of outdoor therapies

interaction, and it can help us recover from stress (Hartig et al., 2014). In outdoor health practice, 'nature' can mean anything from urban parks and gardens, to coastlines, forests and wilderness areas (Cooley et al., 2020); 'nature' is often used to describe anywhere outdoors, with ample opportunity for humans to interact with non-human living beings though elements of nature (e.g. plants, animals) can be brought indoors for therapeutic benefits. Experiences in or with nature can also support greater connection with nature, and the eudaimonic wellbeing benefits (e.g. personal growth, autonomy, purpose in life, self-acceptance, positive relations to others and vitality), such nature connection can bring (Pritchard et al., 2019). Meanwhile, reported benefits of outdoor therapies include improved self-esteem and confidence, positive and negative affect, stress reduction and restoration, social benefits, and resilience (Roberts et al., 2020). Nature exposure and outdoor activities have also been associated with lower burnout (Hyvönen et al., 2018), a major risk factor in our mental health workforce.

Outdoor therapies are employable across the continuum of care, from prevention to intervention (see Fig. 1 in Neil et al., 2023). For example, public health messaging suggests everyday contact with nature through outdoor recreation, gardening, conservation volunteering etc. can support wellbeing maintenance and disease prevention. At the other end of the continuum of care, nature-based health interventions, such as integrated outdoor therapy, can support people with specific physical, psychological or social needs. Outdoor therapies can be offered in primary care navigation delivery models (Carter et al., 2018) and are sometimes the preferred choice for social or nature/green prescriptions. Nature prescription, where a health professional 'prescribes' time outdoors/in nature to a client, is an area in which trials are currently being funded, such as the investigation of physical activity in nature for people with cardiometabolic disease (Nguyen et al., 2023). Outdoor therapies may be more accessible and acceptable than usual care for young people who find the traditional care options to be boring, formal, oppressive or constrained (Cooley et al., 2020; Fernee et al., 2019). Use of a non-mainstream workforce in this field has the potential to create additional system capacity and improve efficiency and sustainability in part by the possible flow-on effects to practitioner well-being (Cooley et al., 2020).

Nature prescriptions have the potential to greatly benefit individuals with a diverse spectrum of health and social care needs. However, it is important that all interest, investment and innovation in these areas is supported and informed by high-quality research (Husk et al., 2019).

The current evidence base

Since 2020, rigorous scientific evidence of the benefits of outdoor therapies in young people has increasingly appeared, and been the subject of evidence reviews including: a mixed-methods meta-synthesis ($n = 38$) of the experiences of practitioners and clients who have practiced outdoor therapies in natural, outdoor spaces to establish a framework for best practice (Cooley et al., 2020); a systematic review ($n = 14$) of nature activities and wellbeing in children and young people (Roberts

et al., 2020); and a systematic review ($n = 84$) of the wellbeing benefits of immersive nature-experiences for young people (Mygind et al., 2019). Here we summarise the findings of these key reviews of relevance to outdoor therapy for young people, and the single randomised clinical trial in this field.

Cooley et al. (2020) meta-synthesis on outdoor-based therapies examined 38 articles, representing data from 322 practitioners and 163 clients. The articles came largely from the US, UK and Israel (n = 1 from AU), and 11 focussed on child/adolescent clients (Cooley et al., 2020). The resulting outdoor talking therapy framework included potential challenges and solutions and client suitability characteristics, including discomfort with conventional therapy. Several therapeutic enrichments were noted by clients and/or practitioners, including interconnectedness and improved practitioner wellbeing through more holistic practices, which may lead to reduced staff burnout. Future research was considered essential to "shape the implementation of therapy outdoors in practitioner training programmes and mainstream services." (Cooley et al., 2020, p12).

Roberts et al. (2020) reviewed the wellbeing benefits of nature-based activities for young people up to 21 years of age, including talking therapies ranging from outdoor education to wilderness therapy programs. Their systematic review examined 14 studies; most were conducted in the UK, and only one (Rose et al., 2018) from Australia. They found positive outcomes for wellbeing across all ages, including self-esteem (although self-esteem was inconsistent for adolescents) and confidence, positive affect, stress reduction and restoration, social benefits, and resilience. However, all quantitative studies undertaken with adolescents were considered of weak quality, with sample size and/or lack of power calculations ubiquitous concerns and the relative importance of including a therapeutic aspect could not be determined. Reviewers considered the use of objective physiological assessments, in addition to subjective measures, to be a positive feature of some included studies. Only two studies considered negative outcomes from nature-based activities including feelings of anxiety and claustrophobia (Milligan & Bingley, 2007) and fear of attack or harassment by other humans in the natural environment (Burgess, 1996). Adequate follow-up, assessment of connectedness to nature as a potential mediating effect, and the use of objective measures, such as physiological stress as well as subjective measures were considered important in future research.

A systematic review from 2019 by Mygind and others, summarised and evaluated the evidence from 84 articles for benefits of immersive nature-experience on children and adolescents' mental, physical and social health (Mygind et al., 2019). The review found conditional support for benefits for self-esteem, self-efficacy, resilience and academic and cognitive performance, consistent with Roberts et al (2020). However, similar to other reviews, Mygind et al. (2019) found the quality of evidence to be low due to risk of bias, insufficient sampling methods and unsuited comparison groups, although the difficulties of blinding in behavioural, psychosocial intervention research was noted. To maximise trial quality the blinding of participants and personnel to specific research aims was raised. No reporting of harms was noted in the included trials.

There was one RCT identified in the Mygind and Roberts reviews (Greenwood & Gatersleben, 2016) which tested restoration of stress and mental fatigue in an outdoor or indoor environments in the UK – alone, with a friend or while playing a game on a mobile phone – amongst 120, 16–18-year-olds over 20 min. Teenagers were found to recover more quickly from stress and mental fatigue in an outdoor natural setting than an indoor one, and that being with a friend increased positive affect. Selection bias, the treatment of confounding and withdrawals as well as uncertainty about whether power was achieved were identified in the review as key concerns.

There are major challenges in undertaking a randomised-controlled study with vulnerable populations such as youth seeking mental health treatment. At least one RCT in this field was terminated due to the ethical, practical, and methodological challenges presented by this study design (Gabrielsen et al., 2015). In this study, the randomisation process left already distressed adolescents being treated through specialist services feeling disappointment and rejection if they were allocated into the control group despite the offer of being in the outdoor option at a later date. notwithstanding the specifics of the therapy and the population, the potential for negative impacts is a major challenge of any RCT in this field.

Other studies have instead opted for quasi-experimental designs; one study in America used an exploratory, non-equivalent groups pre-post design and found that community-based adventure therapy significantly reduced problem severity for youth with emotional and behavioural disorders, with the largest improvements for females and African American participants (Tucker et al., 2012). Other studies have opted for mixed methods approaches using surveys and focus groups to demonstrate the benefits of outdoor (adventure) therapy for youth with Adjustment Disorder on trauma symptomology and family functioning (Norton et al., 2019).

Further notable studies have examined the longitudinal impacts of different outdoor therapies for functioning (DeMille et al., 2018), behavioural and emotional outcomes (Behrens et al., 2010) and substance abuse (Lewis, 2013), finding improvements can last for at least a year after treatment. Parent-perceived functioning of adolescents post-outdoor behavioural therapy treatment has been shown to persist for at least 18 months (Combs et al., 2016). Further research on the persistence of these (and other) therapies is warranted.

Despite the challenges, an effective and ethical RCT could help to remove existing barriers to greater integration of outdoor therapies across the continuum of mental healthcare in Australia.

The evidence gap

While the evidence of effectiveness of outdoor therapies is building, there are clearly some remaining questions about outcomes, active mechanisms, cost-effectiveness, and risks. In therapy outcomes, there are important influences from client and practitioner characteristics, the type of natural setting and how it is incorporated into practice (e.g. from active to passive incorporation, with low to high nature-interaction) which can make it hard to unpick the mechanistic drivers of clinical outcomes (Cooley et al., 2020).

Regarding mechanisms connecting nature-based interventions and depression, Owens and Bunce developed the nature-depression nexus model where stress, rumination, mindfulness, sleep and exercise were identified as five putative, candidate mechanisms underlying observed beneficial effects (Owens & Bunce, 2022). These mechanisms are consistent with Green Mind Theory which links the mind with the body and the brain through reciprocal relationships, and draws on evidence from neuroscience and brain plasticity, spiritual and wisdom traditions, mindfulness-related and talking therapies, green exercise in nature, the lifeways of original cultures, and material consumption behaviours (Pretty et al., 2017).

However, the mechanisms identified by Owen and Bunce for nature-based interventions were specific for depression and mechanisms may differ depending on the disorder experienced by participants (Owens & Bunce, 2022). An umbrella review by Harper and colleagues examined 14 systematic reviews or meta-analyses to identify the theories and mechanisms of change in outdoor therapies. The therapy types represented in the reviews included nature-based, forest, horticultural, wilderness and adventure therapies. They found that while studies on outdoor therapies often demonstrate positive outcomes for participants, they rarely identify underlying theories and causal mechanisms and observed outcomes were weakened by study design and biases (Harper et al., 2021).

There are likely complex and multiple pathways connecting nature-based therapies to good mental health and wellbeing, with important and interacting contributions from client and practitioner characteristics, the natural setting, and therapeutic program. To unravel these pathways, Harper et al. (2021) have advocated that future research include larger randomised controlled trials (RCTs), longitudinal studies and cohorts, qualitative analyses and advanced multivariate modelling. These features were also recommended by Owens and Bunce (2022) for nature and depression. For such studies to effectively close the gaps in the current evidence base, Harper et al. (2021) further recommend that future outdoor therapy studies:

(1) Use validated psychometric assessment tools and physiological measures, in addition to self-reported questionnaires and observational measures, to capture a fuller picture of the therapeutic effects of outdoor therapies;
(2) Identify and measure process factors;
(3) Provide matched sample results, as well as means, standard deviations and sample sizes for each outcome at each measured time point;
(4) Include follow-up and longitudinal assessments to test longer term effects;
(5) Involve more studies with clinical samples;
(6) Increase involvement of participants' perspectives in the design and delivery of interventions;
(7) Increase attention to participants' perceived experience of and attitudes toward particular outdoor environments and activities, as well as their previous engagement, or lack of engagement, with nature;
(8) Describe any side-effects, adverse events or harmful phenomena, including reasons for withdrawal and non-participation, in outdoor therapy studies;
(9) Include cost-effectiveness information; and,
(10) Utilise randomised control designs when possible and appropriate.

In terms of risks, unlike in drug trials, the monitoring of harm is not compulsory in psychological trials although it remains of integral importance (Berk & Parker, 2009). A review of the assessment of harms in talking therapy trials in children and young people (Hayes & Za'ba, 2022) has identified just over half (51%) of relevant trials registered in the International Standard Randomised Controlled Trial Number (ISRCTN) database mentioned harm or adverse events during the trial or its follow-up in at least one piece of documentation. Inclusion of an explicit, clear and transparent process for monitoring and recording adverse events as per CONSORT-SPI (Grant et al., 2018) was recommended, as was a need to develop a comprehensive understanding of the types of harm and side effects of therapy.

As highlighted earlier, mental health professionals are at risk of psychological distress, mental ill-health and suicide (Dattilio, 2015) with high work pressures and poor working conditions common (Cetrano et al., 2017; Teles et al., 2014). Advice to psychologists for protecting their own mental health includes early engagement with clinically therapeutic programs, positive psychology approaches and self-care strategies (Dattilio, 2015). Work engagement, however, is *protective* for mental health, as represented by three psychosocial markers: *Vigour* (high levels of energy and mental resilience while working), *dedication* (feelings of a sense of significance, enthusiasm, inspiration, pride, and challenge) and *absorption* (being fully concentrated and deeply engrossed in one's work) (Salanova & Llorens, 2008). It is not yet known whether engagement in the *provision* of regular outdoor therapy may help boost work engagement among therapists, by providing a buffering effect in relation to negative mental health impacts.

A randomised controlled trial proposal

To establish the most rigorous, quantitative evidence-base to understand the benefits of outdoor talking therapy in clinical practice, we propose a design for an unblinded RCT that compares outdoor talking therapies with conventional indoor talking therapies (usual care) in young people with moderate psychological/emotional distress. A RCT study design allows for holistic data to be collected about clients *and* practitioners, and pairing with advanced multivariate modelling to progress understanding of causal pathways between nature interventions and good mental health and wellbeing (Owens & Bunce, 2022). Our proposed design is informed by the aforementioned framework for outdoor talking therapy (Cooley et al., 2020), putative mechanisms of outdoor therapy in depression (Owens & Bunce, 2022), and prior research and publications by the leading national organisation for outdoor therapies in Australia, Outdoor Health Australia (previously the Australian Association for Bush Adventure Therapy) (Rakar-Szabo et al., 2019). The trial's design will address known limitations and provide information for implementation to guide scalability.

There are many different models and methods for outdoor therapy, as exemplified by the umbrella review by Harper et al. (2021), and the RCT would need to standardise one therapy model. With this in mind, a basic five-session therapy approach (Box 1), was developed by experienced accredited practitioners and clinical supervisors from Outdoor Health Australia. In Australia, outdoor therapy practitioners are

from wide-ranging cross-disciplinary backgrounds and professions. The advisory OHA professionals are from training and experience pathways that include psychotherapy, counselling, psychology, social work, family therapy, outdoor education, adventure education, outdoor activity specialists and Aboriginal mentors. This model, endorsed by Outdoor Health Australia, integrates best practice principles and is a cost-effective starting point, comparable with 'treatment as usual' for generating beneficial effects, is considered a minimum 'dose' of individually-tailored group-based outdoor therapy. Because indoor and outdoor therapies can be conducted in individual or group settings, and both location and setting may influence client outcome, the proposed study has four arms:

Treatment Arm 1: Individual indoor therapy, in accordance with usual care, would comprise provision of up to 10 × 1-h sessions provided by 1 headspace counsellor to 1 young person on a negotiated frequency within a 6-month timeframe, or up to 20 sessions in 1-year.
Treatment Arm 2: Group indoor therapy, in accordance with usual care, would comprise the provision of up to 6 × 1.25 -hour weekly cognitive behavioural therapy (CBT) based sessions provided by one headspace counsellor to 6–8 young people.
Treatment Arm 3: Individual outdoor talking therapy would comprise therapy sessions in a park or other easily accessible greenspace and provided in alignment with best practice outdoor therapy. Consistent with person-centred care, location, intensity (low to medium) and timing of sessions will be negotiated between the client and their accredited outdoor therapy practitioner.
Treatment Arm 4: Group-based outdoor talking therapy: We propose to use the 5-session Model (Box 1; see also Neil et al., 2023) endorsed by Outdoor Health Australia. The group-based outdoor therapy would be provided by accredited counsellors who have been specifically trained in outdoor therapy modalities within a 3- to 6-month period, and co-designed with participants.

Box 1 Proposed five session outdoor group therapy model

Meeting each other: a 60-90min session provided by one outdoor therapy practitioner to one young person*. Location options: A. outreach in the home or a setting familiar to the participant, B. online, C. onsite at headspace, or D. outdoors at a mutually agreed public park or natural environment.

Joining up: 3h (180min) group-based session provided by two outdoor therapy practitioners to a closed group of 4–8 young people. Location: outdoors at a negotiated park or natural environment. This session will involve introductory processes that include safety, social agreement, purpose and intent, and gentle physical activity in nature.

Challenging ourselves: 3h (180min) group-based session provided by 2 outdoor therapy practitioners to the same group of 4–8 young people. Location: outdoors at a negotiated park or natural environment. This session will involve processes that include tailored and gradated physical, social and mindful activities in nature.

Reflecting together: 3h (180min) group-based session provided by two outdoor therapy practitioners to the same group of 4–8 young people. Location: outdoors at a negotiated park or natural environment. This session will involve review, future-oriented and closure processes that include reflective physical, social and mindful activities in nature.

What now: a 60-90min session provided by one outdoor therapy practitioner to one young person*. Location options: outreach in the home or a setting familiar to the participant, online, onsite at headspace or outdoors at a mutually agreed park or natural environment.

*Participants are invited to bring a trusted adult friend, family member or mentor of their choice to the first and fifth sessions.

The proposed study would require genuine collaboration between industry and research with practitioners, researchers and clients at the heart of the planning process. The study would also include an investigation of the types of harm and side effects of outdoor therapy and the relationship between therapy and practitioner well-being. The study would result in a holistic understanding of the impact of this therapy type for all participants. To promote the systematic uptake of research findings, qualitative research would be included to identify enablers and barriers to implementation from the perspective of therapists, providers and clients. Co-production of training outputs for practitioners would increase sector capacity for outdoor therapies for young people experiencing psychological distress. To date, outdoor therapy is not formally recognised nor accredited by Australian tertiary institutions. While training programs are offered in various settings under various terms, consolidation of training pathways and standardised criteria are a 'work in progress' for the field. Findings from this study could be used to inform decisions regarding implementation of outdoor talking therapy, transforming health system practice, and widening community-based prevention and early intervention efforts.

Participants

Using an RCT design in mental health settings presents difficulties in balancing scientific rigour alongside client preferences (Gabrielsen et al., 2015). We propose including young adults who are 18–25 years old, assessed as having moderate psychological distress (Kessler 10 scores in the 25–29 range) at intake and considered as suitable for the study by their clinician during initial screening and triaging stages. In addition to the high demand for mental health care, this age group is more independently mobile to access outdoor health options, are able to provide consent to participate, and may be more resilient to potential disappointment of randomisation than younger youth. Potential participants would be advised about the study by their clinician and referred to study staff.

Any client with severe or low levels of distress, or with language or cognitive barriers that make them unable to provide consent or to complete surveys with or without the assistance of study staff would be ineligible to participate.

Mixed methods data collection

As has been called for by others, we propose a study design that focusses on multifaceted wellbeing as measured by subjective and objective data (Table 1). Baseline measures would include validated tools of health and social behaviours that represent different aspects of holistic wellbeing and cover the mechanism through which outdoor therapy may be supporting wellbeing. To minimise burden and enable long-term follow-up, we would seek consent for linkage to routine data assessments for example Medicare Benefits Schedule (MBS) and Pharmaceutical Benefits Schedule (PBS) data. A questionnaire could be developed to collect resources not captured through MBS/PBS linkage including presentations to the emergency department, admissions to hospital, costs associated with attending therapy, and other wellbeing-maintenance measures used outside of the study. Clinicians involved in the study could also keep a time log of their study-related activities to facilitate an economic analysis.

A potential sampling timeline is proposed in Fig. 2; the final sampling protocol should be codesigned with a youth reference group to ensure minimal burden for participants and an acceptable sampling procedure.

Randomisation

Eligible people who agree to participate in the study would be randomly allocated into one of the four treatment arms. Consenting individuals could be randomised using the using a computerised protocol with a 1:1:1:1 ratio across four treatment arms: group outdoor therapy, individual outdoor therapy, group indoor therapy and individual indoor therapy. Randomisation should be stratified according to clinic site and sex, given males are more likely to withdraw from mental health care treatment (according to headspace data (Rickwood et al., 2015).

Table 1 Data collection types to monitoring changes to holistic wellbeing of participants

	Subjective	Objective
Measures	X	
Psychological distress	X	
Physiological stress		X
Life satisfaction	X	
Social and occupational functioning	X	
Affect	X	
Sleep (amount and quality)	X	X
Physical Activity levels	X	X
Mindfulness	X	
Rumination	X	
Nature connectedness	X	
Outdoor activities/nature engagement	X	
Social connectedness/loneliness	X	
Resource Use & Socio-demographics	X	X

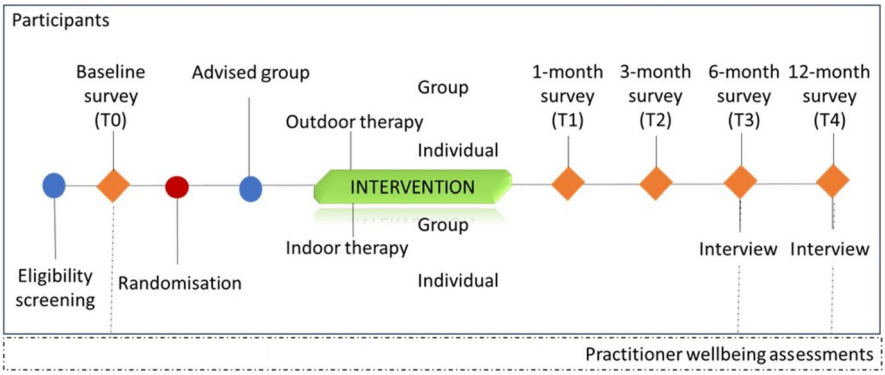

Fig. 2 A timeline for the proposed RCT study

The comparative cost-effectiveness of outdoor group-based counselling could be assessed with reference to accepted Australian thresholds for incremental cost-effectiveness ratios. Several supplementary analyses could be included, such as individual versus group outdoor treatment, and the longevity of treatment impacts. Thematic analyses of lunchtime focus groups, walk-along interview data and observation field notes would be used to deepen understandings of the nuances of the intervention, from participant and practitioner perspectives, and identify any social or structural barriers and/or enablers to the outdoor healthcare treatments.

Safety/Harms

The focus of this study component would be: 1) understanding the adverse events (AEs) and serious adverse events (SAEs) that are likely to arise in the study population (Dunleavy et al., 2021); and 2) developing procedures for effectively monitoring these events throughout the trial (Dunleavy et al., 2021). First informed by recommendations from the literature (Dunleavy et al., 2021; Hayes & Za'ba, 2022), we would develop an indicative list of AEs and SAEs, with all AEs plausibly related to the interventions proposed (Horigian et al., 2010). Second, we propose the development of a safety assessment protocol, including active (regular, systematic and standardised assessments) and passive surveillance for harms (open-ended questions) and a process for AE attribution, and a training protocol to optimise standardisation across trial sites.

Practitioner wellbeing

Whilst there is some evidence (Hyvönen et al., 2018) that nature exposure and outdoor activities during leisure time is associated with lower burnout in a

general sample of Finnish employees, nature exposure *during the working day* is seen as an important future research direction in the field of occupational wellbeing. Hence, in addition to demographic characteristics, occupation/employment conditions (Cetrano et al., 2017), and tenure as a therapist, we propose the use of validated instruments to monitor practitioner wellbeing.

Conclusions

There is strong evidence that outdoor therapies can contribute to the wellbeing of participants, including young people with moderate psychological distress (Cooley et al., 2020; Harper et al., 2021; Roberts et al., 2020). However, existing evidence suffers from a lack of multifaceted measures of wellbeing, small sample sizes, no or limited follow-up to determine the longevity of treatment effects, no assessment of treatment side-effects or adverse events, no participant involvement in study delivery and design, and cost-effectiveness of treatment models. The RCT proposed here would build on other outdoor health RCT efforts, longitudinal and quasi-experimental work to be the first clinical trial of outdoor therapy for young people with moderate psychological distress in Australia. Our proposed method aims to balance scientific rigor with realistic delivery by adopting the treatment as usual (indoor) care models, and pair them with standardized individual and 'minimum dose' group outdoor therapy models. If this program leads to greater uptake of outdoor therapy, the group models could adopt different lengths, intensities and levels of flexibility to meet the needs of local clients and services. The RCT would generate the robust evidence required to determine the comparative benefits, harms, cost-effectiveness, mechanisms and overall potential of outdoor talking therapy as an effective mainstream mental health treatment option. This holistic study could actively and efficiently translate findings to improve care pathways, population health outcomes and system sustainability in resource-constrained environments and help ensure young people in Australia and elsewhere are provided with the care they need.

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Declarations

Competing interests EJF and PM are unpaid members of Outdoor Health Australia (OHA) and received funding from the Australian Government's National Environmental Science Program to examine the wellbeing benefits of connecting with nature. AP is an unpaid member of OHA, her organisation Adventure Works was contracted to help develop the OHA Service Directory in 2022–2023. RP is an unpaid board member of the Climate and Health Alliance. All other authors have no competing interests to report.

References

ABS (2022) Summary statistics on key mental health issues including the prevalence of mental disorders and the use of services. *Australian Bureau of Statistics*. Retrieved 6 April, 2023 from https://www.abs.gov.au/statistics/health/mental-health/national-study-mental-health-and-wellbeing/latest-release. Accessed 6 Apr 2023.

AIHW (2022) Medicare-subsidised mental health-specific services. *Australian Institute of Health and Welfare*. Retrieved 6 April, 2023 from https://www.aihw.gov.au/mental-health/topic-areas/medicare-subsisded-services. Accessed 6 Apr 2023.

Behrens, E., Santa, J., & Gass, M. (2010). The evidence base for private therapeutic schools, residential programs, and wilderness therapy programs. *Journal of Therapeutic Schools and Programs, 4*(1), 106–117.

Berk, M., & Parker, G. (2009). The elephant on the couch: Side-effects of psychotherapy. *Australian and New Zealand Journal of Psychiatry, 43*(9), 787–794. https://doi.org/10.1080/00048670903107559

Bower, M., Smout, S., Ellsmore, S., Donohoe-Bales, A., Sivaprakash, P., Lim, C., Gray, M., Francis, A., Grager, A., Riches, J., & Australia's Mental Health Think Tank. (2021). *COVID-19 and Australia's mental health: An overview of academic literature, policy documents, lived experience accounts, media and community reports.*

Burgess, J. (1996). Focusing on Fear: The Use of Focus Groups in a Project for the Community Forest Unit, Countryside Commission. *Area*, 28(2), 130–135.

Carter, N., Valaitis, R. K., Lam, A., Feather, J., Nicholl, J., & Cleghorn, L. (2018). Navigation delivery models and roles of navigators in primary care: A scoping literature review. *BMC Health Services Research, 18*(1), 96. https://doi.org/10.1186/s12913-018-2889-0

Cetrano, G., Tedeschi, F., Rabbi, L., Gosetti, G., Lora, A., Lamonaca, D., Manthorpe, J., & Amaddeo, F. (2017). How are compassion fatigue, burnout, and compassion satisfaction affected by quality of working life? Findings from a survey of mental health staff in Italy. *BMC Health Services Research, 17*(1), 755. https://doi.org/10.1186/s12913-017-2726-x

Colizzi, M., Lasalvia, A., & Ruggeri, M. (2020). Prevention and early intervention in youth mental health: Is it time for a multidisciplinary and trans-diagnostic model for care? *International Journal of Mental Health Systems, 14*(1), 23. https://doi.org/10.1186/s13033-020-00356-9

Combs, K. M., Hoag, M. J., Roberts, S. D., & Javorski, S. (2016). A multilevel model to examine adolescent outcomes in outdoor behavioral healthcare: The parent perspective. Child & Youth Care Forum,

Cooley, S. J., Jones, C. R., Kurtz, A., & Robertson, N. (2020). 'Into the Wild': A meta-synthesis of talking therapy in natural outdoor spaces. *Clinical Psychology Review, 77*, 101841. https://doi.org/10.1016/j.cpr.2020.101841

Corscadden, L., Callander, E. J., & Topp, S. M. (2019). Who experiences unmet need for mental health services and what other barriers to accessing health care do they face? Findings from Australia and Canada. *The International Journal of Health Planning and Management, 34*(2), 761–772. https://doi.org/10.1002/hpm.2733

Dattilio, F. M. (2015). The Self-Care of Psychologists and Mental Health Professionals: A Review and Practitioner Guide. *Australian Psychologist, 50*(6), 393–399. https://doi.org/10.1111/ap.12157

DeMille, S., Tucker, A. R., Gass, M. A., Javorski, S., VanKanegan, C., Talbot, B., & Karoff, M. (2018). The effectiveness of outdoor behavioral healthcare with struggling adolescents: A comparison group study a contribution for the special issue: Social innovation in child and youth services. *Children and Youth Services Review, 88*, 241–248. https://doi.org/10.1016/j.childyouth.2018.03.015

Department of Health. (2021). *National Mental Health and Suicide Prevention Plan.* Commonwealth of Australia. https://www.health.gov.au/resources/publications/the-australian-governments-national-mental-health-and-suicide-prevention-plan. . Accessed 6 Apr 2023.

Dunleavy, L., Collingridge Moore, D., Korfage, I., Payne, S., Walshe, C., & Preston, N. (2021). What should we report? Lessons learnt from the development and implementation of serious adverse event reporting procedures in non-pharmacological trials in palliative care. *BMC Palliative Care, 20*(1), 19. https://doi.org/10.1186/s12904-021-00714-5

Fennell, K., Hull, M., Jones, M., & Dollman, J. (2018). A comparison of barriers to accessing services for mental and physical health conditions in a sample of rural Australian adults. *Rural Remote Health, 18*(1), 4155. https://doi.org/10.22605/RRH4155

Fernee, C. R., Mesel, T., Andersen, A. J. W., & Gabrielsen, L. E. (2019). Therapy the Natural Way: A Realist Exploration of the Wilderness Therapy Treatment Process in Adolescent Mental Health Care in Norway. *Qualitative Health Research, 29*(9), 1358–1377. https://doi.org/10.1177/1049732318816301

Gabrielsen, L. E., Fernee, C. R., Aasen, G. O., & Eskedal, L. T. (2015). Why Randomized Trials Are Challenging Within Adventure Therapy Research. *Journal of Experiential Education, 39*(1), 5–14. https://doi.org/10.1177/1053825915607535

Grant, S., Mayo-Wilson, E., Montgomery, P., Macdonald, G., Michie, S., Hopewell, S., & Moher, D. (2018). CONSORT-SPI 2018 Explanation and Elaboration: Guidance for reporting social and psychological intervention trials. *Trials, 19*(1), 406. https://doi.org/10.1186/s13063-018-2735-z

Greenwood, A., & Gatersleben, B. (2016). Let's go outside! Environmental restoration amongst adolescents and the impact of friends and phones. *Journal of Environmental Psychology, 48*, 131–139. https://doi.org/10.1016/j.jenvp.2016.09.007

Harper, N. J., Fernee, C. R., & Gabrielsen, L. E. (2021). Nature's role in outdoor Therapies: an umbrella review. *International Journal of Environmental Research and Public Health, 18*(10), 5117.

Hartig, T., Mitchell, R., De Vries, S., & Frumkin, H. (2014). Nature and Health. *Annual Review of Public Health, 35*(1), 207–228. https://doi.org/10.1146/annurev-publhealth-032013-182443

Hayes, D., & Za'ba, N. (2022). What metrics of harm are being captured in clinical trials involving talking treatments for young people? A systematic review of registered studies on the ISRCTN. *Counselling and Psychotherapy Research, 22*(1), 108–129. https://doi.org/10.1002/capr.12407

Headspace. (2021). *helping young people get through challenging times: headspace year in review 2020–2021*. https://headspace.org.au/assets/Headspace-Year-in-Review-2022_RGB.pdf. Accessed 6 Apr 2023.

Horigian, V. E., Robbins, M. S., Dominguez, R., Ucha, J., & Rosa, C. L. (2010). Principles for defining adverse events in behavioral intervention research: Lessons from a family-focused adolescent drug abuse trial. *Clinical Trials, 7*(1), 58–68. https://doi.org/10.1177/1740774509356575

Husk, K., Elston, J., Gradinger, F., Callaghan, L., & Asthana, S. (2019). Social prescribing: Where is the evidence? *British Journal of General Practice, 69*(678), 6–7.

Hyvönen, K., Törnroos, K., Salonen, K., Korpela, K., Feldt, T., & Kinnunen, U. (2018). Profiles of Nature Exposure and Outdoor Activities Associated With Occupational Well-Being Among Employees [Original Research]. *Frontiers in Psychology*, *9*. https://doi.org/10.3389/fpsyg.2018.00754

Lewis, S. F. (2013). Examining changes in substance use and conduct problems among treatment-seeking adolescents. *Child and Adolescent Mental Health, 18*(1), 33–38. https://doi.org/10.1111/j.1475-3588.2012.00657.x

Lifeline. (2023). *Data and statistics*. Retrieved 27 April, 2023 from https://www.lifeline.org.au/resources/data-and-statistics/. Accessed 27 Apr 2023.

McGorry, P. D. (2022). The reality of mental health care for young people, and the urgent need for solutions. *Medical Journal of Australia, 216*(2), 78–79. https://doi.org/10.5694/mja2.51327

Milligan, C., & Bingley, A. (2007). Restorative places or scary spaces? The impact of woodland on the mental well-being of young adults. *Health & Place, 13*(4), 799–811. https://doi.org/10.1016/j.healthplace.2007.01.005

Morse, G., Salyers, M. P., Rollins, A. L., Monroe-DeVita, M., & Pfahler, C. (2012). Burnout in mental health services: A review of the problem and its remediation. *Administration and Policy in Mental Health, 39*(5), 341–352. https://doi.org/10.1007/s10488-011-0352-1

Mygind, L., Kjeldsted, E., Hartmeyer, R., Mygind, E., Bølling, M., & Bentsen, P. (2019). Mental, physical and social health benefits of immersive nature-experience for children and adolescents: A systematic review and quality assessment of the evidence. *Health & Place, 58*, 102136. https://doi.org/10.1016/j.healthplace.2019.05.014

Nahrgang, J. D., Morgeson, F. P., & Hofmann, D. A. (2011). Safety at work: A meta-analytic investigation of the link between job demands, job resources, burnout, engagement, and safety outcomes. *Journal of Applied Psychology, 96*(1), 71–94. https://doi.org/10.1037/a0021484

National Suicide Prevention Adviser. (2020). *Connected and Compassionate: Implementing a national whole of governments approach to suicide prevention (Final Advice).* https://www.mentalhealthcommission.gov.au/national-suicide-prevention-office/national-suicide-prevention-adviser-final-advice. Accessed 27 Apr 2023.

Neil, A. (2023). Out-of-pocket payments: Impacts on healthcare decision-making and system and individual level measures to minimise the burden. *Australian Health Review, 47*(4), 401–409. https://doi.org/10.1071/AH22244

Neil, A. L., Pryor, A., Kneebone, J., & Flies, E. J. (2023). A perspective on outdoor mental health therapy: what, who, why, where to? *Australasian Psychiatry*.

Nguyen, P. Y., Astell-Burt, T., Rahimi-Ardabili, H., & Feng, X. (2023). Effect of nature prescriptions on cardiometabolic and mental health, and physical activity: A systematic review. *The Lancet Planetary Health, 7*(4), e313–e328. https://www.thelancet.com/journals/lanplh/article/piis2542-5196(23)00025-6/fulltext

Norton, C. L., Tucker, A., Farnham-Stratton, M., Borroel, F., & Pelletier, A. (2019). Family Enrichment Adventure Therapy: A Mixed Methods Study Examining the Impact of Trauma-Informed Adventure Therapy on Children and Families Affected by Abuse. *Journal of Child & Adolescent Trauma, 12*(1), 85–95. https://doi.org/10.1007/s40653-017-0133-4

Owens, M., & Bunce, H. L. I. (2022). The Potential for Outdoor Nature-Based Interventions in the Treatment and Prevention of Depression. *Frontiers in Psychology, 13*, 740210. https://doi.org/10.3389/fpsyg.2022.740210

Pretty, J., Rogerson, M., & Barton, J. (2017). Green Mind Theory: How Brain-Body-Behaviour Links into Natural and Social Environments for Healthy Habits. *International Journal of Environmental Research and Public Health, 14*(7), 706. https://doi.org/10.3390/ijerph14070706

Pritchard, A., Richardson, M., Sheffield, D., & McEwan, K. (2019). The Relationship Between Nature Connectedness and Eudaimonic Well-Being: A Meta-analysis. *Journal of Happiness Studies, 21*(3), 1145–1167. https://doi.org/10.1007/s10902-019-00118-6

Productivity Commission. (2020). *Mental Health, Report no. 95*. Commonwealth of Australia. https://www.pc.gov.au/inquiries/completed/mental-health/report. Accessed 27 Apr 2023.

Rakar-Szabo, N., Steele, E. J., Smith, A., & Pryor, A. (2019). *Regenerate Evaluation: Executive Summary*. Adventure Works Australia Inc.

Rickwood, D. J., Mazzer, K. R., Telford, N. R., Parker, A. G., Tanti, C. J., & McGorry, P. D. (2015). Changes in psychological distress and psychosocial functioning in young people visiting headspace centres for mental health problems. *Medical Journal of Australia, 202*(10), 537–542. https://doi.org/10.5694/mja14.01696

Roberts, A., Hinds, J., & Camic, P. M. (2020). Nature activities and wellbeing in children and young people: A systematic literature review. *Journal of Adventure Education and Outdoor Learning, 20*(4), 298–318. https://doi.org/10.1080/14729679.2019.1660195

Rose, L., Williams, I. R., Olsson, C. A., & Allen, N. B. (2018). Promoting Adolescent Health and Well-Being Through Outdoor Youth Programs: Results From a Multisite Australian Study. *Journal of Outdoor Recreation, Education, and Leadership, 10*(1), 33–51. https://doi.org/10.18666/jorel-2018-v10-i1-8087

Salanova, M., & Llorens, S. (2008). Current state of research on burnout and future challenges. *Papeles Del Psicólogo, 29*(1), 59–67.

Seidler, Z. E., Rice, S. M., Dhillon, H. M., Cotton, S. M., Telford, N. R., McEachran, J., & Rickwood, D. J. (2020). Patterns of Youth Mental Health Service Use and Discontinuation: Population Data From Australia's Headspace Model of Care. *Psychiatric Services, 71*(11), 1104–1113. https://doi.org/10.1176/appi.ps.201900491

Solmi, M., Radua, J., Olivola, M., Croce, E., Soardo, L., Salazar de Pablo, G., Il Shin, J., Kirkbride, J. B., Jones, P., Kim, J. H., Kim, J. Y., Carvalho, A. F., Seeman, M. V., Correll, C. U., & Fusar-Poli, P. (2022). Age at onset of mental disorders worldwide: Large-scale meta-analysis of 192 epidemiological studies. *Molecular Psychiatry, 27*(1), 281–295. https://doi.org/10.1038/s41380-021-01161-7

Teles, M. A., Barbosa, M. R., Vargas, A. M., Gomes, V. E., Ferreira, E. F., Martins, A. M., & Ferreira, R. C. (2014). Psychosocial work conditions and quality of life among primary health care employees: A cross sectional study. *Health and Quality of Life Outcomes, 12*, 72. https://doi.org/10.1186/1477-7525-12-72

Tucker, A. R., Javorski, S., Tracy, J., & Beale, B. (2012). The Use of Adventure Therapy in Community-Based Mental Health: Decreases in Problem Severity Among Youth Clients. *Child & Youth Care Forum, 42*(2), 155–179. https://doi.org/10.1007/s10566-012-9190-x

Emily J. Flies grew up in upstate New York. She completed a Bachelor of Arts in anthropology and psychology, taught outdoor education, and complete a master's and PhD in disease ecology and epidemiology. Now, as a lecturer at the University of Tasmania (UTAS), Emily studies how connecting with nature can benefit both human wellbeing and sustainability. She co-leads the 'sustainable people-environment interactions' research theme of the National Environmental Science Program's 'Sustainable Communities and Waste Hub'. Emily teaches about sustainability at UTAS, and has founded two not-for-profit science communication organisations, and Tasmania's Inspiring Women in STEMM Fellowship Program.

Anita Pryor is one of three Directors of not-for-profit Adventure Works Australia. She is a keen practitioner, trainer and researcher in bush adventure therapy. Adventure Works Australia allows her to apply her personal and professional experiences to support the wellbeing of others. She wants to help increase access to bush adventures for therapy and wellbeing in Australia. Her personal approach comes from the belief that humans benefit from contact with nature, and that good therapy is not something 'done' to another person, but co-created through mutual exploration. She loves living in Tasmania, and also enjoy partnerships that take her to other places.

Claire Henderson-Wilson is an Associate Professor in planetary health within the School of Health and Social Development at Deakin University. She leads the Health, Nature, Sustainability Research Group within the Sustainable Health Network. Claire provides oversight and leadership on a number of research projects on how people-environment relationships influence health and wellbeing. Specifically, her research focuses on the relationships between people, health and the natural environment and the impacts of environmental change (i.e. climate change) on people's health and wellbeing. She has a track record of multidisciplinary collaboration within the university sector and with industry and local governments.

Megan Turner is a clinical psychologist who specialises in child and youth mental health. She also holds qualifications in community development. Megan teaches into the postgraduate clinical psychology training program at Deakin University. She holds expertise in clinical assessment and diagnosis, and psychological interventions. Megan has a keen interest in sustainable health. Her research interests include lifestyle-based interventions in mental health.

Jessica Roydhouse is a health services researcher at the Menzies Institute for Medical Research. Her research interests include patient-reported outcomes (questionnaires), clinical trials and oncology.

Dr Rebecca Patricks' research expertise is climate change, nature, mental wellbeing, and young people. She specialises in community-based participatory and action research methodologies. Patrick is the Academic Convener of The University of Melbourne's Climate CATCH (Collaborative Action for Transformative Change in Health and Healthcare) Lab, Co-lead of Planetary Health Alliance (Oceania Hub) and Immediate Past President, Climate and Health Alliance.

Melissa O'Shea is a clinical psychologist and leads postgraduate clinical psychology training at Deakin University. She also holds qualifications in clinical leadership and is passionate about developing work ready clinical psychology graduates. Her research interests include integrative psychology and innovation in teaching and learning in professional psychology. She has a particular interest in the integration of complementary and alternative approaches with current psychology practice, including yoga and nature-based interventions.

Kimberly Norris is a psychological scientist and clinical psychologist who works across academic, research and clinical practice settings. Her overarching research and academic interests are focused on

maximising human health, wellbeing and performance in both typical (e.g. academic, work, life events) and extreme environments (e.g. Antarctica, space and FIFO). Through her work, she develops new and innovative ways to provide psychological support for individuals in remote, rural, maritime and extreme environments at an individual, organisational and relationship level.

Angela Martin is a Professorial Research fellow with the Menzies Institute for Medical Research, University of Tasmania. Her research is focussed on occupational health psychology and workplace mental health, particularly the translation of evidence to practice. She also works directly with organisations on strategies and interventions to protect, promote and support people's mental health at work via her company Pracademia.

Pauline Marsh is a Health Geographer with the Wicking Dementia Research and Education Centre, at the University of Tasmania. Pauline is interested in how being outdoors supports our brain health, particularly when we have cognitive, emotional or physical health challenges. She is an experienced social researcher, and likes to use story-gathering, filmmaking and other creative methods in her work. She is co-lead of the Venture Out Research Group and Chief Investigator on the Nature Connection Storytelling Project. She is a keen gardener, beekeeper, cycle-tourer and mother of two spectacular grown-ups.

Larissa Bartlett has a background in sociology and social policy, and a medical sciences PhD that focused on the effects of stress on health and the potential for mindfulness-based interventions to alleviate stress-related health problems. She is experienced in psychometric assessment, data synthesis, public health and behaviour change research. She has led and published the results of two randomised controlled field trials of mindfulness interventions. As a post-doc, she established the Island Study Linking Ageing and Neurodegenerative Disease (ISLAND), a large, prospective cohort study investigating the long-term effects of reducing behavioural risk factors on brain health and future dementia risk. Larissa is deeply interested in behavioural medicine and the influence of positive psychosocial resources on health behaviours, health and wellbeing.

Mostafa Rahimi Azghadi is an Engineering Associate Professor At James Cook University with strong interdisciplinary research interests. He develops tools for various problems from agriculture to medicine. The common theme in all his projects is developing high-performance tools for automation and decision making, and to help interpret complex systems and extract insights. He has led several Machine Learning international and multi-institutional teams to deliver impactful tools and techniques for healthcare applications ranging from wearable device data analysis to EEG signal processing systems for seizure detection and prediction. A/Prof Rahimi has co-raised over $11M in research funding from various sources.

Amanda Neil is an experienced health economist who commenced in the field in 1991, and who has worked in academia, government and as a consultant for industry. Since commencing at the Menzies Institute for Medical Research in 2013, A/Prof Neil has established a translational research program addressing the efficient and equitable provision of resources and service delivery in chronic illness and disorders from a broad societal perspective, with mental health a primary focus. In 2019 she established the Menzies' Mental Health and Wellbeing Research Group, engaging with researchers across the University and the Tasmanian mental health sector. She is the Health Economics Lead for the ALIVE National Centre for Mental Health Research Translation.

Authors and Affiliations

Emily J. Flies[1,2] · Anita Pryor[3,4,5] · Claire Henderson-Wilson[6] · Megan Turner[6] · Jessica Roydhouse[7] · Rebecca Patrick[6,8] · Melissa O'Shea[9] · Kimberly Norris[10] · Angela Martin[7] · Pauline Marsh[11] · Larissa Bartlett[7] · Mostafa Rahimi Azghadi[12] · Amanda Neil[7,13]

✉ Emily J. Flies
Emily.Flies@utas.edu.au

1 School of Geography, Planning and Spatial Sciences, University of Tasmania, Private Bag 51, Hobart, TAS 7001, Australia

2 Biological Sciences, University of Tasmania, Hobart, TAS, Australia

3 Adventure Works Australia, Hobart, TAS, Australia

4 Outdoor Health Policy Unit, Australian Association for Bush Adventure Therapy, Templestowe, VIC, Australia

5 Australian Association of Family Therapy Inc, Tasmanian Branch, Hobart, TAS, Australia

6 Sustainable Health Network, Deakin University, Geelong, VIC, Australia

7 Menzies Institute for Medical Research, University of Tasmania, Hobart, Australia

8 School of Population and Global Health, University of Melbourne, Melbourne, VIC, Australia

9 School of Psychology, Deakin University, Geelong, VIC, Australia

10 School of Psychological Sciences, University of Tasmania, Hobart, TAS, Australia

11 Wicking Dementia Research and Education Centre, University of Tasmania, Hobart, TAS, Australia

12 College of Science and Engineering, James Cook University, Townsville, QLD, Australia

13 The ALIVE National Centre for Mental Health Research Translation, University of Tasmania, Hobart, TAS, Australia