Wellbeing and Societal Transformation: A Mixed Methods Study of Wellbeing-Focused Interventions Spanning the Individual, Community and Healthcare

A Thesis Submitted in fulfilment of the requirements
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by
Lowri Sian Wilkie

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Summary

Prioritising wellbeing is fundamental for individual flourishing, fostering healthier, happier communities, and promoting positive social change. Across disciplines, scholars grapple with the definition of wellbeing, recognising its multifaceted and nuanced nature. This thesis embarks on a journey to explore wellbeing within the context of the GENIAL model—a transdisciplinary, biopsychosocial framework that integrates theories and empirical evidence from wellbeing science. The chapters highlight how the GENIAL framework can inform approaches to improve wellbeing across diverse societal contexts, supporting individual wellbeing, community wellbeing and more holistic approaches to wellbeing with the healthcare system. The thesis begins with an exploration of the conceptual foundations of wellbeing, its measurement, and presents the methodologies used in the research. It then delves into innovative findings from a network meta-analysis, comparing the efficacy of wellbeing interventions from across psychological, physical health behaviour and nature-based approaches. Moreover, the thesis examines the potential of a community-based approach - Local Area Coordination - in enhancing collective wellbeing. By harnessing community assets and empowering individuals, such approaches offer promising avenues to address health inequalities and bolster wellbeing, particularly among marginalised populations. Furthermore, the thesis investigates the restructuring of healthcare models to prioritise 'whole' health and wellbeing determinants. Through service evaluations of a community neurorehabilitation service in the UK, innovative interventions designed using the GENIAL model of wellbeing are evaluated, emphasising collaborative partnerships between healthcare providers, community organisations, and academic institutions. In the concluding chapter, key findings are synthesised and discussed, with a focus on addressing wellbeing inequalities by creating opportunities and empowering individuals. The thesis concludes with a call to prioritise holistic wellbeing across society using interventions which foster individual, collective and planetary wellbeing.

Keywords: Wellbeing, Positive Psychology, Wellbeing-Interventions, Community-Based Approaches, Healthcare Models, Societal Change, Sustainable Development

Declarations

DECLARIATION

This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

Signed [redacted] date)

Date 26.11.2024.

STATEMENT 1

This thesis is the result of my own investigations, except where otherwise stated. Where correction services have been used, the extent and nature of the correction is clearly marked in a footnote(s). Other sources are acknowledged by footnotes giving explicit references. A bibliography is appended.

Signed [redacted] ndidate)

Date 26.11.2024.

STATEMENT 2

I hereby give consent for my thesis, if accepted, to be available for photocopying and for inter-library loan, and for the title and summary to be made available to outside organisations.

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Authorship Declaration

1.1.Preamble and context in which the research presented in this thesis was conducted:

GENIAL Science is a collaborative research group between Swansea Bay University Health Board (SBUHB) and Swansea University School of Psychology, founded by Professor Andrew Kemp and Dr. Zoe Fisher in 2016. Together with a team of academics, clinicians, and students, the aim of the group is to advance the theory and practice of wellbeing science. Central to their efforts has been the development of the GENIAL framework, a novel approach that identifies key factors contributing to positive health and wellbeing, rooted in scientific evidence. Since my introduction to the GENIAL science group in 2019, I have continually contributed to research projects and further developments of the GENIAL framework, demonstrated in co-authorship on additional publications (see section on publications, conferences, and awards). While I hold the position of first author on all research presented in this thesis, the presence of collaborations have enriched this work. Through these collaborations, I have been able to draw upon diverse skill sets and research supervision, enhancing the rigor of the research findings. As the first author, I have led the coordination of these efforts and have driven all aspects of study design including conception of study designs to the execution of data collection and analysis. While I sought input and collaboration from colleagues to refine ideas and methodologies, I took the lead in all planning and implementation phases, supported by my two supervisors, Professor Andrew Kemp and Dr Zoe Fisher (authors 1 and 2). My contributions included personally undertaking all data collection activities, including adopting a co-supervisory role of MSc students who supported me with data collection. Thus, while my thesis features collaborations, it is underscored by my complete dedication and involvement in every stage of the research process.

1.2.Author Details and their Roles:

The following people and institutions contributed to the of work undertaken as part of this thesis:

Candidate	Lowri Wilkie Swansea University

Author 1	Dr Zoe Fisher Consultant Clinical Psychologist and Associate Professor Swansea University and Swansea Bay University Health Board
Author 2	Dr Andrew Kemp Professor of Psychology Swansea University
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Chapter Four: A Systematic Review and Network Meta-Analysis Comparing Wellbeing-Focused Interventions

The candidate led the design of the study, database searching, screening of papers, data analysis, and paper writing. Author 1 and Author 2 provided supervisory support, contributed to study design and reviewed the paper. MSc students Author 3, Author 4, and Author 5 assisted by screening papers under the candidate's supervision. Author 6, a librarian, collaborated on the study design and provided expertise in developing the search strategy.

Chapter Five: Improving Wellbeing Through Local Communities: A Mixed Methods Study on the Role of Relationship Building.

The candidate led the design of the study, conducted the study and data collection, analysed the data, and authored the paper. Author 1 and Author 2 provided supervisory support, contributed to the study design, supported on data collection and reviewed the paper. Author 7 also supported data collection and provided networking and participant recruitment support due to her close collaboration with LAC stakeholders. Author 8, an MSC student, provided support with data collection and qualitative data analysis under the candidate's supervision. Author 9, an expert in HRV synchrony data collection, offered technical guidance despite not directly undertaking data analysis.

Chapter Six: The Impact of Psycho-Social Interventions on the Wellbeing of Individuals with Acquired Brain Injury During the COVID-19 Pandemic.

Candidate led data collection and analysis in the Community Neurorehabilitation Service. Authors 10 and 11 (honorary assistant psychologists) aided in qualitative data interviews and data transcriptions. Candidate authored the manuscript, with input from supervisors (Authors 1 and 2), who provided supervisory support throughout the project.

Chapter Seven: The 'Rippling' Waves of Wellbeing: A Mixed Methods Evaluation of a Surf-Therapy Intervention on Patients with Acquired Brain Injury

The candidate designed the study, conducted data collection, analysed data and wrote the paper. Author 1 and Author 2 provided supervisory support, contributed to design of study and reviewed and supported the development of iterations of the paper.

We the undersigned agree with the above stated "proportion of work undertaken" for each piece of research contributing to this thesis:

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Journal Publications

Arroyo, P., **Wilkie**, L., Davies, E., Fisher, Z., & Kemp, A. H. Thriving in the wake of a storm: A qualitative review & meta-synthesis on facilitating post-traumatic growth in patients living with acquired brain injury. [Manuscript submitted for publication]. School of Psychology, Swansea University

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Conference Presentations

Wilkie, L. (2023, June). Hearts and Minds: The Science of Local Area Coordination. Presentation at the Local Area Coordination Network National Gathering, Sheffield, UK.

Wilkie, L. (2022, July). The 'Rippling' Waves of Wellbeing: A Mixed Methods Evaluation of a Surf-Therapy Intervention on Patients with Acquired Brain Injury. Presentation at the European Conference on Positive Psychology, Reykjavik, Iceland.

Wilkie, L. (2021, July). Collaborative Partnerships in Wellbeing Research. Presentation at the Summer of Hope: Multidisciplinary Wellbeing Symposia, Swansea University, UK.

Wilkie, L., & Gibbs, K. (2022, October). Riding the Wave into Wellbeing: The Impact of Surf-Therapy for People Living with ABI. Presentation at the South West Wales Brain Injury Conference, Swansea, UK.

Wilkie, L. (2023, October). A Community Based Approach to Wellbeing: The Role of Relationship Rapport. Presentation at the South West Wales Brain Injury Conference, Swansea, UK.

Awards

Wilkie, L. (2021). Runner-up, The Big Pitch Award (£1000 prize). Award ceremony held in March 2021 at Swansea University.

Wilkie, L. (2022, May). Finalist, 3 Minute Thesis Competition. Swansea University.

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Chapter One

1. Introduction: What is Wellbeing? A United Perspective Integrating Individual, Collective and Planetary Wellbeing

Abstract

Prioritising wellbeing is essential for individual flourishing, building happier and healthier communities and promoting positive societal change (Kemp & Fisher, 2022). Scholars from various disciplines have explored the definition wellbeing, offering complimentary perspectives on this multifaceted concept ranging from hedonism and eudaimonism in philosophy to theories of subjective wellbeing and positive psychology. However, defining and measuring wellbeing presents challenges due to its complexity, subjectivity, and cultural variability. To develop a comprehensive framework for promoting wellbeing, it is essential to integrate insights from across disciplines including philosophy, psychology, sociology, public health, and neuroscience (Mead et al., 2021). In this review, an exploration of these diverse perspectives will be undertaken, leading to the presentation of the GENIAL model, a biopsychosocial, interpretative framework of wellbeing which integrates previous definitions, theories and evidence relating to wellbeing. It is argued that when defined holistically, wellbeing becomes essential for driving progress towards The Sustainable Development Goals.

1.1. Philosophical Theories and Definitions of Wellbeing

Hedonism is a concept that posits that pleasure, particularly sensual gratification, is the highest good and the primary motivation for human actions (Moore, 2019). Psychological hedonism claims that wellbeing is achieved by maximising pleasure and minimising pain in one's life. Critics, however, have argued that hedonism can lead to short-term gratification at the expense of long-term fulfilment and morality (Aristotle, 2009; Kant, 1964; Plato, 1871). An alternative explanation of wellbeing is through desire theories of wellbeing, which argue that a person's life goes well to the extent that their subjective desires are satisfied, regardless of whether those desires lead to pleasure (Hume, 1751). In contrast to hedonism, desire theories suggest that we desire to earn pleasures and achievements through moral action rather that purely pleasurable brain chemistry (Nozick, 1974). One objection to desire theories of wellbeing is that some objects such as friendships or success may be desired, not because of subjective individual desires, but because they possess intrinsic value (Aristotle, 1984; Nussbaum, 1986). The practical distinctions between hedonism and desire theory can be observed through established wellbeing measures: positive affect measures focus on immediate emotional experiences (Watson et al., 1988) and align more with hedonism, while life satisfaction is a measure of overall life quality and corresponds more to the desire theory e.g. “Overall, how satisfied are you with your life as a whole?” (Diener et al., 1984).

An alternative theory of wellbeing comes from eudaimonia. In philosophical contexts, particularly in Aristotle's ethics, eudaimonia refers to a state of living in accordance with one's true nature and realising one's full potential (Aristotle, 2014). Eudaimonia suggests that wellbeing requires more than pleasure or satisfaction, and instead emphasises the importance of living a purposeful and virtuous life, which is intrinsically rewarding and thus contributes to flourishing (Nussbaum, 1986). The eudemonic theory of wellbeing is also considered a subjective theory because it focuses on individual experiences, perceptions, and interpretations of meaning and purpose.

On the other hand, pluralism, or objective list theories of wellbeing propose that there are specific elements or goods that objectively contribute to a person's wellbeing, regardless of individual preferences or desires. Unlike subjective theories, which prioritise personal satisfaction or fulfilment, objective list theories suggest that certain things which are inherently valuable for human flourishing (Griffin, 1986). For example, those who defend the capability approach propose that there is an objective list of capabilities that contribute to human wellbeing, including health, education, political participation, social relationships, and personal autonomy and that wellbeing should be assessed based on individuals' capabilities to achieve these objectively valuable capabilities (Nussbaum, 2000). Supporters of objective list theories criticise monistic views like hedonism and desire theories for reducing wellbeing to a single element and thus neglecting the broader context of human experience (Sen, 1999). One criticism however of objective list theories is their perceived elitism, as they suggest certain elements are inherently good for individuals, even if those individuals neither value nor desire them and thus they may reflect or impose cultural or social biases (Nussbaum, 2000; Sen, 1992). A balanced view acknowledges that some objective factors have intrinsic value regardless of subjective experiences, but they are also valued because they bring pleasure or satisfy desires.

1.2.Positive Psychology

Positive psychology is a branch of psychology that focuses on understanding and promoting the factors that contribute to human flourishing and wellbeing. In 2011, Martin Seligman introduced the PERMA model, a framework which integrates both hedonic and eudemonic dimensions of wellbeing (Seligman, 2011). This model identifies five core elements of wellbeing: positive emotions, engagement, relationships, meaning, and accomplishments. Seligman argues that true flourishing occurs when a person excels across all five pillars, highlighting the importance of a holistic approach to wellbeing that encompasses both hedonic pleasure and eudemonic fulfilment. PERMA may also however be considered an objective list theory of wellbeing since it identifies specific elements or components that are believed to inherently contribute to wellbeing. Early positive psychology theories such as PERMA have been criticised for over emphasising the role of positive emotions and pursuing hedonistic pleasures to enhance overall wellbeing (Wong, 2019). Paul Wong's wave of existential positive psychology (PP 2.0) highlighted that it is not always possible to maintain positive emotion, especially during periods of hardship, and that negative emotions and experiences also play a functional role. According to existential positive psychology, a meaning-focused perspective which involves positives while simultaneously regulating difficult emotion, is needed to experience wellbeing, especially during times of suffering (Wong, 2011, 2020; Wong, 2019).

Positive psychology has also faced criticism for focusing its emphasis on the individual or self, with little consideration for the cultural, social, or environmental context in which the individual is embedded (Yakushko & Blodgett, 2021). In response to this criticism, scholars in the field have called for a more holistic and systems informed approach (Donaldson et al, 2022; Lomas et al., 2020). It has been argued that the focus on content-focused positive interventions need to be broadened to context-focused interventions which prioritise understanding and addressing the specific environmental and situational factors influencing individuals' wellbeing, tailoring interventions to the unique needs and circumstances of individuals and communities (Ciarrochi et al., 2016).

1.3.The Mind-Body Problem and Wellbeing Science

Wellbeing science has also faced criticism for its narrow focus on psychological factors whilst neglecting the interconnectedness of physical and mental health. Traditionally, within the medical context, wellbeing has been defined as the absence of illness or disease. This reflects a dualism, Cartesian view of the mind and body as separate entities, where the focus is primarily on diagnosing and treating physical ailments without considering the interconnectedness of mental and physical health. By contrast, the World Health Organisation refers to health as ‘complete mental, physical and social wellbeing’, this definition aligns with materialistic monism, suggesting that mental and physical phenomena are two aspects of the same reality. Whilst this definition goes beyond defining health as an absence of disease, as per the medical model, striving for “complete” health as a goal for health pathologises suboptimal health states. This implies that people with chronic physical or mental health conditions, which make up a significant proportion of the population, are not capable of experiencing or improving their wellbeing because they must live with some degree of illness. An alternative approach to reconcile these contrasting definitions, is the concept of interactive dualism, which acknowledges the separation of mind and body while also emphasising their interaction (Switankowsky, 2000). It neither sees body and mind at entirely separate (dualism) nor considers them the same entity (monism), instead, it suggests that while the mind and body are distinct entities, they interact with each other in a dynamic and reciprocal manner.

Physical health is intricately linked to wellbeing yet is typically studied in isolation from scholarly work on psychological approaches to wellbeing. Positive psychology has placed little emphasis on physiological underpinnings of wellbeing or on the role of positive health behaviours, despite evidence that factors such as exercise, nutrition, sleep are influential to mental health (Kaneita et al., 2007; Moreno-Agostino et al., 2019; Wiese et al., 2018). The recently proposed PERMA+4 adds an additional four elements to Seligman's original model, one of which is positive health (Donaldson et al, 2022). However, whilst PERMA+4 acknowledges the role of physical health behaviours on wellbeing, it does not address the mind-body problem, clarify the relationship between mental and physical health nor propose the physiological underpinnings/mechanisms of wellbeing.

Given the criticisms and challenges facing wellbeing science, a comprehensive wellbeing framework is required to consolidate existing scholarly literature, multidisciplinary research, and various theories into a unified model, whilst considering the interaction of mind-body and potential physiological underpinnings of wellbeing. The GENIAL theoretical framework aims to fulfil this need working towards a shared understanding of wellbeing across disciplines and levels of scale.

1.4.The GENIAL Theoretical Framework of Wellbeing

The GENIAL model is a biopsychosocial, interpretative framework on the published literature on wellbeing (Kemp et al., 2017; Kemp & Fisher, 2022; Mead et al., 2019, 2021). The GENIAL acronym refers to relationships between **G**enomics-**E**nvironment-vagus **N**erve-social **I**nteraction-**A**llostatic regulation-**L**ongevity. The model focuses on five core domains spanning: the individual (including a balanced mind and a healthy body), collective (social connectedness), the planetary (connection with nature), in addition to positive societal change and socio-structural factors. GENIAL defines wellbeing itself as a sense of connectedness to ourselves (the individual domain), others (the collective domain), and nature (the planetary domain). The framework posits that wellbeing is mechanistically supported by the vagus nerve – the tenth cranial nerve which connects the brain to various organs in the body and plays a key role in the parasympathetic nervous system (Wilkie et al., 2022).

1.4.1. GENIAL: Individual Domain

Within the individual domain, the GENIAL framework highlights the role of emotional balance' and a 'healthy body' on wellbeing.

Emotional Balance: The notion of 'emotional balance' within this framework appreciates the hedonic need for positive emotions for wellbeing while also embracing the eudemonic and existential perspectives that highlight the importance of leading a purposeful life and the functional utility of negative emotions or suffering. This approach aligns with Lomas' (2024) emphasis on the importance of balance, proposing that true well-being involves balance and harmony across various dimensions of life. Mindfulness (being present and fully aware in the moment without judgment) is related to attaining emotional balance. Mindfulness encourages awareness of the full spectrum of emotions, recognising their presence without clinging to the positive or avoiding the negative. By doing so, it supports the development of a balanced emotional life where one does not pursue positive emotions at the expense of long-term well-being, nor avoid negative emotions that may provide important information or growth opportunities. For example, prioritising hedonic positive emotions in the moment, such as indulging in luxury purchases or the use of recreational drugs, should be avoided if it results in increased negative emotion and suffering or harms others and contradicts moral values (Lomas, 2024). Therefore, mindfulness is a trait and skill that can support the development and maintenance of emotional balance.

'Emotional Balance' is characterised in GENIAL by a triad that encompasses:

1. Experiencing Positive Emotions: This aspect emphasises the hedonic component of wellbeing, which is the capacity to experience joy, happiness, contentment, and other pleasurable emotions. This reflects earlier psychological theories of wellbeing such as The Tripartite Model of Subjective Well-being (Diener, 1984) which suggests the route to wellbeing is through increased positive affect, reduced negative affect and overall subjective life satisfaction. It also supports the broaden and build theory which proposes that positive emotions enhance wellbeing through a positive spiral of increased social connectedness and enhanced vagal function (Fredrickson, 2004).
2. Regulating Difficult Emotions: The ability to accept, manage and respond to negative emotions in a constructive manner is crucial for emotional balance. It involves awareness, coping, acceptance, and the ability for individuals to navigate through difficult emotions without being overwhelmed by them. This supports Paul Wong's concept of 'Tragic Optimism' (P. Wong, 2020; P. T. Wong, 2019) and the body of work on Post Traumatic Growth (L. G. Calhoun & Tedeschi, 2012; L. Calhoun & Tedeschi, 1999; Tedeschi et al., 1998), which claim suffering should not be viewed as negative, but as an opportunity to build meaning in life. This is also a key principle underpinning

wellbeing interventions such as mindfulness (Kabat-Zinn, 1990) and acceptance and commitment therapy (Hayes et al, 1999).

3. Meaning and Purpose in Life: This element draws from eudemonic theories and existential positive psychology, recognising that wellbeing extends beyond momentary pleasures to include a deeper sense of fulfilment. Meaning and purpose provide individuals with a sense of direction and the feeling that their life is worthwhile, which is essential for a sustained sense of wellbeing. This supports Ryff's six factor Psychological Wellbeing theory (self-acceptance, personal growth, purpose in life, positive relations with others, environmental mastery, and autonomy) (Ryff & Keyes, 1995) and is in line with existential positive psychology (P. Wong, 2020) and earlier influences of existentialism (Frankl, 2006).

Healthy Body: The term 'healthy body' highlights the role of positive health behaviours and acknowledges the crucial interplay between the body and mind within the individual domain of wellbeing (Wilkie et al., 2022). "Self-connection" has been defined as awareness of oneself, and the acceptance and alignment of behaviour based on that awareness (Klussman et al., 2022). GENIAL expands this definition by highlighting that self-connection extends beyond purely psychological experiences to encompass mind-body integration. One example of this integration is the functioning of the vagus nerve, which serves as a mechanism for self-regulation through communication between the brain and various bodily systems (Breit et al., 2018; Kemp et al., 2017; Kemp et al., 2017; Wilkie et al., 2022). This supports evidence from across disciplines indicating that health behaviours such as sleep, nutrition and physical activity are linked to both wellbeing outcomes and vagal function. For example, heart rate variability (HRV), which is a measure of vagal function, has been linked to sleep efficacy (Vanoli et al., 1995) and thus a healthy vagus may be considered protective against mental disorders, given that sleep disturbance is a causal factor in the occurrence of mental disorders (Freeman et al., 2017; C. Liu et al., 2021; R. T. Liu et al., 2020). Moreover, physical activity is associated with improved mood, increased positive affect, and higher life satisfaction (Wiese et al., 2018; Zhang & Chen, 2019), whilst sedentary behaviour is linked to poorer wellbeing, particularly in adolescents (Ussher et al., 2007). Regular exercise has also been shown to enhance vagal modulation and decrease sympathetic activity over time in people living with chronic conditions (Routledge et al., 2010).

GENIAL emphasises that true self-connection involves the harmonious interaction of both mental and physical aspects, facilitated by the workings of the vagus nerve.

1.4.2. GENIAL: Collective Domain

The GENIAL model offers a valuable framework for considering wellbeing across various levels encompassing not only the individual domain but also extending into what Bronfenbrenner termed the 'exosystem' (Bronfenbrenner, 1979). This refers to settings or structures that operate independently of the individual but still influence the environments in which the individual resides, and in the context of GENIAL, refers to the ‘collective’ and ‘planetary’ domains.

The GENIAL ‘collective’ domain emphasises the role of social ties and relationships as a pathway to health and wellbeing (Kemp et al., 2017). This encompasses both close personal relationships, supported through healthy vagal functioning (Porges, 2001), in addition to the importance of wider concepts such as social capital: the networks, norms, and trust that enable people to act together (Putman, 2000), social cohesion: developing shared values, challenges and equal opportunity in a society (Jenson, 1998) and social identity: individual's self-concept derived from their membership in social groups (Haslam, 2004). Evidence suggests that community is weakening due to interconnected societal changes such as increasing technology use, individualism, and social inequalities (Kushlev et al., 2017; Sampson, 2012; Twenge, 2013). Yet, positive social ties have a significant impact on individual wellbeing (C. Haslam et al., 2018; Jetten et al., 2009; Kemp et al., 2017). A meta-analysis of over 300,000 participants found that stronger social relationships were associated with a 50% increased likelihood of survival over a 7.5 year follow up; an effect on par with physical activity and smoking cessation (Holt-Lunstad et al., 2010). Social identity theory provides a useful framework to understand the influence of community on individual wellbeing (Tajfel et al, 1979). Individuals derive a sense of identity and belonging from their social groups, which provide them with meaning and purpose and facilitate a sense of belonging (Brown, 2000). Interventions specifically targeting social isolation such as “Groups 4 Health” have been found to improve wellbeing, and social connectedness up to 6-months post intervention (C. Haslam et al., 2016).

The GENIAL framework integrates this previous research within the ‘collective domain' of wellbeing, whilst additionally highlighting a role for the vagus nerve in underpinning collective wellbeing. According to Polyvagal Theory, when the vagus nerve is functioning optimally, it promotes a state of calm and connection, facilitating positive social interactions and emotional experiences (Porges, 2007, 2011). Evidence suggests that positive emotions, social connections, and vagal tone are interlinked in a reciprocal relationship, leading to enhanced wellbeing (Kok et al., 2012; Kok & Fredrickson, 2010). According to this work, positive emotions broaden individuals' cognitive and behavioural repertoires, making them more open to new experiences and social connection. These connections in turn strengthen vagal function which facilitates further emotional balance and deeper connections, creating a cycle of wellbeing.

1.4.3. GENIAL: Planetary Domain

In the GENIAL framework, the planetary domain emphasises the importance of humans connecting with the natural world. Humanity faces catastrophic climate change without committed action, posing significant threats to human health and wellbeing (IPCC, 2007, 2014). Climate change will impact mental health by exposing people to trauma, damaging physical health through heat exposure and extreme weather events, and destroying social environments (Berry et al., 2010). Low-income countries and vulnerable populations are disproportionately impacted, it has been estimated that climate change has increase global inequality by 25% over the last 50 years (Diffenbaugh & Burke, 2019). The diminishing availability of green spaces also impacts daily wellbeing. According to the 'biophilia hypothesis', humans have an innate affiliation with the natural world (Kellert & Wilson, 1995), this is supported by evidence of a positive correlation between green space and both mental health and all-cause mortality (Berg et al., 2015). Spending at least two hours per week in nature is associated with better health and wellbeing compared to those with no nature exposure (White et al., 2019). Nature connectedness may also be a strong predictor of pro-environmental behaviour (Capaldi et al., 2014). The GENIAL framework highlights that nature-connection promoting interventions and physical infrastructure are a commonly neglected strategy to improve psychological wellbeing. Moreover, GENIAL supports the potential for nature connectedness in fostering pro-environmental behaviour, highlighting its potential to contribute to achieving 'planetary wellbeing,' which is considered the highest standard of wellbeing for the Earth's ecosystems (Antó et al., 2021).

1.4.4. Positive Change and Socio-structural Factors

The GENIAL framework recognises the importance of both sustainable behaviour change and socio-structural factors in promoting or inhibiting the promotion of wellbeing. Knowledge and education are essential initial steps in positive behaviour change (Rosenstock, 1974), but mere information dissemination often fails to translate into transformational outcomes. Self-determination theory proposes that satisfying individuals' psychological needs for autonomy, competence, and relatedness is essential for motivating positive behaviours and wellbeing (Deci & Ryan, 2008). Other evidence-based strategies for successful behaviour change include goal setting (Locke & Latham, 1990), incentives (Skinner, 1953), social support (Bandura, 1986), environment restructuring cues (Ajzen, 1991), self-monitoring and role modelling (Bandura, 1977). The GENIAL model therefore recognises the utility of wellbeing interventions which also support individuals using evidence-based behaviour change strategies. However, in the absence of resources, access, or opportunities to promote wellbeing, individual psychology and motivation is of limited value. The GENIAL framework also recognises that wellbeing is also influenced by a multitude of socio-structural factors, including social, political, and economic circumstances, as well as cultural and historical contexts, which can lie beyond individual control.

Social determinants, such as income, education, and social support, significantly influence health and wellbeing outcomes (Marmot, 2005). Income inequality has broad-ranging effects on societal wellbeing, influencing rates of mortality, homicide, violent crime, work disability, health care expenditures and lifestyle factors such as smoking, and sedentary activity (Kaplan et al., 1996). Cross-country comparisons consistently reveal that poorer nations exhibit lower quality of life scores in comparison to wealthier counterparts (World Bank, 2022). Moreover, within countries, individuals facing social disadvantages stemming from economic, cultural, or social factors often experience diminished levels of wellbeing (Marmot, 2005). This disparity is exemplified by those grappling with chronic conditions and disabilities such as people living with mental health conditions or acquired brain injury for example, who typically report lower levels of wellbeing and reduced opportunities for experiencing it (Dijkers, 2004; Teasdale & Engberg, 2010). The capability approach argues that to promote wellbeing, it is essential to identify and nurture capabilities across domains such as health, education, social relationships, and political participation. This involves removing barriers, addressing inequalities, and promoting social justice to ensure that all individuals have the freedom to flourish. Additionally, promoting agency, participation, and human dignity is crucial for empowering individuals to pursue their goals and aspirations. In line with capabilities approach, GENIAL advocates for collaborative, systemic efforts to address socio-structural barriers to wellbeing promotion, ensuring equitable access and capacity for all individuals to pursue and maintain wellbeing.

Overall, GENIAL stands out as a principal framework of wellbeing due to its ability to encompass a substantial portion of prior scholarly work, multi-disciplinary research, and theories of wellbeing into one model. In summary, the GENIAL framework underscores the repercussions of societal crises, often stemming from a disconnection from ourselves, others, and nature. Re-establishing these connections and a sense of relatedness, as emphasised by the inner development goals, is critical for fostering resilience and flourishing within ourselves, our communities, and the planet.

1.5. The Urgent Need for Wellbeing: Relevance to the United Nations 2030 Sustainable Development Goals

When wellbeing is defined holistically, as advocated by the GENIAL framework, it emerges as a fundamental cornerstone for positive societal progress and advancing many of the United Nations Sustainable Development Goals (UNSDGs). The UNSDGs outline a collective aspiration for global peace and prosperity by 2030, presenting a roadmap for improving global health, poverty reduction, equality, and climate action (United Nations, 2015). However, realising this vision necessitates a profound societal shift and transformation across multiple levels of scale.

1.5.1. Individual: Inner Development

Progress on the SDGs has thus far been underwhelming, suggesting that policy alone is not sufficient for collective progress. The concept of "inner development goals" [https://www.innerdevelopmentgoals.org/] has highlighted that attention must also be directed to empowering individuals, and that cultivating capabilities within individuals and groups such as cognitive and social skills, self-awareness, critical thinking, interpersonal skills, and engagement such as activism is key to making global progress (Woiwode et al., 2021). Individuals possess greater agency over their own wellbeing compared to collective and planetary wellbeing (Kemp & Fisher, 2022). Alongside large collaborative efforts such as community partnerships, interdisciplinary collaboration, and policy change, initiatives to improve wellbeing at the individual level can also contribute to increased wellbeing at the community and environmental level by enhancing capacity for contribution, promoting positive role modelling, increasing awareness and engagement, and fostering resilience. For example, SDG 13 is to take urgent action to combat climate change and its impacts. The GENIAL framework acknowledges that individuals must recognise and satisfy their own needs to be able to care for others and protect the environment, and that initiatives to improve wellbeing at an individual level thus can contribute to improving wellbeing at the community and environmental level. Progress on inner development, alongside systemic change, is therefore essential for shaping a future post-growth society.

1.5.2. Community: Reducing Inequalities

Improving wellbeing across communities is integral to supporting the objectives of SDG 10, which seeks to reduce inequalities within and among countries. By prioritizing the enhancement of wellbeing, particularly among marginalized and disadvantaged populations, interventions can address disparities in multiple ways. For example, empowerment and autonomy are central themes in interventions aimed at enhancing individual wellbeing, which enable individuals to fully participate in society (Deci & Ryan, 2008). Additionally, fostering a sense of belonging, social cohesion, and trust within communities can help bridge divides and mitigate social inequalities. When individuals feel connected to their community and trust in its members, it fosters a supportive environment where people are more inclined to work together towards common goals (Putnam, 2000). Individuals require both opportunity and empowerment to effectively promote wellbeing. Empowerment involves feeling motivated to enact positive behaviour change aligning with the competence component of Self-Determination Theory (SDT) (Deci & Ryan, 2000) and the promotion of agency and participation in the capability approach (Nussbaum, 2000). However, if certain social groups lack access to wellbeing due to inequalities, positive behaviour transfer within communities will be limited. Recognising the influential role of social circles on behaviour (A. Haslam et al., 2009; Jetten et al., 2014), it is crucial to ensure that all individuals within a community, particularly those who are most excluded socially, have the motivation, skills, and knowledge to promote wellbeing, in addition to opportunities to experience determinants of wellbeing through access to green spaces, resources for positive health behaviours, psychological support, equal healthcare access, and economic means for social engagement. By fostering both empowerment and opportunity, positive social influence and collective change can be facilitated, ultimately enhancing whole societal wellbeing in an equitable and morally just manner.

1.5.3. Healthcare: Improving Health and Wellbeing

SDG 3, which focuses on "Good Health and Well-being," is dedicated to ensuring that everyone has access to quality healthcare services and can live healthy lives. Non-communicable diseases (NCDs), such as cardiovascular diseases, cancer, diabetes, mental health disorders and chronic respiratory diseases, are significant contributors to illness, disability, and premature death globally and impose a heavy burden on individuals, families, communities, and healthcare systems, impacting both physical and mental wellbeing (Lozano et al., 2013). Improving whole health and wellbeing, as defined by the GENIAL model, will be critical for NCD prevention through interventions promoting positive health and lifestyle behaviours, effective management of stress, social support, and a sense of psychological empowerment over one's life and health. Reducing the burden of NCDs will be essential to strengthen health systems and improve healthcare delivery, in addition to creating healthier communities, reduce health inequalities, and enhance overall wellbeing for individuals and societies alike.

1.6.Conclusion

In conclusion, prioritising wellbeing is not only for the purpose of individual happiness but is the cornerstone for driving positive societal change (Kemp & Fisher, 2022; Mead et al., 2023). Across disciplines, scholars have recognised the complexity of defining and measuring wellbeing. The GENIAL model emerges as a comprehensive biopsychosocial framework that synthesises previous definitions, theories, and evidence, offering a holistic understanding of wellbeing and its determinants. GENIAL defines wellbeing as a sense of connectedness to the self (individual wellbeing), others (collective wellbeing), and nature (planetary wellbeing), whilst recognising the moderating role of behaviour change and socio-structural factors. This holistic approach to wellbeing, aligned with the United Nations Sustainable Development Goals (UNSDGs), underscores the transformative power of wellbeing science in shaping a brighter future for individuals and the planet. Making progress towards peace and prosperity requires a profound societal shift and transformation across multiple levels of scale from individual behaviour to community integration and healthcare models. To build on this foundation, Chapter Two outlines the structure and purpose of the thesis, employing the

GENIAL framework of wellbeing as a guiding lens to explore how wellbeing can be effectively prioritised across various contexts. Spanning scales from individual experiences to community settings and healthcare systems, this chapter sets the stage for the thesis's empirical investigations, each chapter contributing unique insights into the promotion of wellbeing at multiple societal levels.

Chapter Two

2. Thesis Rationale, Aims and Overview

Abstract

This chapter outlines the structure and purpose of the thesis, which employs the GENIAL framework of wellbeing as a guiding lens to explore how wellbeing can be effectively prioritised across a variety of societal contexts. With a focus on scales ranging from individual experiences to broader community settings and healthcare systems, this work aims to contribute a nuanced understanding of wellbeing promotion and its practical implications. Multiple chapters within the thesis present empirical studies, each underpinned by specific rationales and objectives, collectively advancing insights into the prioritisation of wellbeing at multiple societal levels. The findings seek to inform both policy and practice in creating environments where wellbeing is central to decision-making, ultimately supporting the goal of a healthier, more inclusive society.

The primary objective of this thesis is to investigate the influence of wellbeing interventions across various contexts, including individual wellbeing interventions for the general population, initiatives for local communities, and interventions within healthcare services. By delving into these diverse contexts, the aim is to better understand how wellbeing can be prioritised across society.

Chapter One provided a foundational overview of the concept of wellbeing, highlighting its importance not only for individual happiness but also as a driver of positive societal change. It introduced the GENIAL model, a biopsychosocial framework that defines wellbeing through connectedness to self (individual wellbeing), others (collective wellbeing), and nature (planetary wellbeing) (Kemp et al., 2017; Kemp & Fisher, 2022; Mead et al., 2019, 2021). The chapter discussed how wellbeing, when defined holistically, aligns with the United Nations Sustainable Development Goals (UNSDGs). This underscores the potential of wellbeing science to inform policies and practices aimed at fostering healthier, happier, more inclusive societies.

Chapter three establishes the philosophical framework of this research, focusing on critical realism as the chosen ontological stance, which acknowledges an independent reality shaped by social context and experience. This perspective is well-suited for studying wellbeing—a complex, multi-dimensional concept requiring both quantitative rigour and qualitative depth. Throughout this thesis, a mixed methods approach is used to capture both measurable outcomes and personal experiences, enabling a comprehensive understanding of wellbeing. In line with the GENIAL model, which includes individual, collective, and planetary dimensions (A. Kemp et al., 2017; A. H. Kemp & Fisher, 2022; Mead et al., 2019, 2021, 2023), this mixed methods approach supports my aim of addressing wellbeing at multiple scales. The mixed methods framework also facilitates triangulating data from diverse sources, enhancing our understanding and enabling evidence-based decision-making in addressing global wellbeing challenges. Chapter three also reviews wellbeing measurement methods, including self-reports, qualitative interviews, and physiological measures such as heart rate variability (HRV), and summarises the thesis methodologies: network meta-analysis, structural equation modelling, ripple effects mapping, thematic analysis, and psychophysiology. Together, these methods have been chosen with the aim of gaining a nuanced, holistic understanding of wellbeing.

2.1.Promoting Wellbeing Through Individual Interventions

In Western society, the tendency to overly medicalise health often results in a rigid emphasis on the responsibility of the healthcare system and governmental organisations when addressing strategies to improve individual and societal health outcomes. However, conceptualising wellbeing on multiple levels of scale, requires change at multiple levels of scale, and it is imperative to appreciate the interconnected relationships between these levels. For example, at the individual level, wellbeing cannot solely rely on reactive responses from healthcare services, individuals must also actively engage in interventions and cultivate daily behaviours to support their health and wellbeing. Interventions which foster a sense of connection to oneself, such as mindfulness-based interventions, physical activity, yoga, and nature connection interventions, have shown promise in promoting wellbeing (Agteren et al., 2021; Buecker et al., 2020; Carr et al., 2021; Pritchard et al., 2020; White et al., 2019). Somatic interventions, such as breathing techniques and relaxation strategies, can be incorporated into psychological therapies, particularly in treating specific conditions like anxiety and trauma (van der Kolk, 2014). Similarly, physical exercise can be prescribed and used to reduce symptoms of depression (Schuch et al, 2016). Despite this however, many psychological interventions—especially those rooted in positive psychology still rarely integrate physical exercise or health behaviours as additional core components of the intervention program. Whist efforts are moving in the right direction e.g. mindfulness programs being prescribed in conditions historically seen as purely 'physical' health such as cardiovascular disease and chronic pain (Abbott et al, 2014; De Jong et al, 2016), there is a still a way to go to overcome the legacy of mind-body dualism which has led to a siloed and fragmented understanding of wellbeing. To that end, the GENIAL framework integrates insights from across disciplines in a move towards a transdisciplinary understanding of wellbeing and identifies multiple determinants of wellbeing. This prompts the question: how do interventions from different wellbeing domains contribute to enhancing individual wellbeing, and do interventions targeting multiple determinants of wellbeing yield greater efficacy than those with a single focus? To address this questions, Chapter four presents a systematic review and network meta-analysis (NMA) that evaluates the effectiveness of these widely accepted and prescribed wellbeing interventions across disciplines. This study is the first of its kind to use NMA to compare wellbeing interventions, a methodology considered a gold standard in intervention research by Cochrane for evidence synthesis (Higgins et al., 2019). This technique allows for the comparison of multiple interventions simultaneously, even when direct RCT comparisons between all interventions are not available, providing a more comprehensive and robust understanding of the relative effectiveness of different treatments. Through this innovative and methodologically rigorous analysis of the published evidence, Chapter Four aims to provide valuable insights into the most impactful interventions for promoting the wellbeing of individuals in the general population.

2.2.Promoting Wellbeing Through Local Community

Simultaneously, individual focused interventions alone fail to address determinants of health outside of the individual’s control, for example, socio-structural determinants of wellbeing. To eliminate health disparities and promote sustainable wellbeing, it is crucial to build capacity and social capital within communities (Cramm et al., 2013; Jetten et al., 2014; Kawachi et al., 1997; Woolcock & Narayan, 2000). Communities offer an abundance of opportunities to facilitate the GENIAL determinants of wellbeing through opportunities for meaning and purpose, positive emotion, social support, engagement with nature, physical activities. However, these benefits are often underutilised and people who find it difficult to access the community independently often become marginalised. Furthermore, it's important to recognise the unequal distribution of opportunities among local communities. While certain members of society may have access to supportive community resources, others contend with higher levels of deprivation and limited access to opportunities that foster wellbeing. Chapter five presents a mixed methodological empirical study evaluating outcomes and mechanisms of Local Area Coordination (LAC) – a positive, person-centred, community-based approach to promoting wellbeing (Bartnik & Broad, 2021). The aim of this study was to investigate how local community assets can be leveraged to facilitate key determinants of wellbeing. Key questions explored included: what is the impact of a community-based approach on the wellbeing of the community members? What are the essential components and mechanisms underpinning a successful community approach? Does a community-focused approach adequately reach those who need it the most? By triangulating data from multiple sources, including surveys, psychophysiological data and qualitative focus groups, this study aimed to evaluate the effectiveness of LAC in fostering both individual and collective wellbeing and understand the fundamental driving mechanisms required in such an approach. Through rigorous evaluation, insights were gained to inform the development and implementation of community-focused interventions for enhancing wellbeing in communities.

2.3.Promoting Wellbeing Through New Healthcare Models

With a growing number of individuals experiencing chronic physical and mental health conditions, there is a pressing need to innovate and integrate wellbeing into healthcare services. Healthcare services frequently function in isolated silos detached from local communities, preventing the development of sustainable, community-centred healthcare solutions. In addition, traditional healthcare models traditionally have prioritised interventions which address specific symptoms and health ailments and neglected those which promote multiple determinants of whole health and wellbeing. This chapter of the thesis aims to understand how healthcare models may be restructured to bridge the gap between healthcare and community assets and how interventions designed to facilitate the key GENIAL determinants of wellbeing may be utilised. Questions to address include: Can healthcare models for people with chronic conditions be restructured to additionally promote holistic wellbeing determinants in addition to reducing symptoms? Can healthcare services also support people to live happy and healthy lives in the community through partnership working? What impact does this restructuring have on patient wellbeing outcomes? To investigate these questions, two service evaluations of a National Health Service (NHS) community neurorehabilitation service in the UK was conducted. This service adapted its healthcare model by establishing collaborative partnerships between local community organizations and academic institutions, resulting in the development of innovative interventions guided by the GENIAL model of wellbeing.

To that end, Chapter six includes the presentation of original research previously published in Frontiers in Psychology (Wilkie et al., 2021), focusing on a qualitative evaluation of individuals with acquired brain injury (ABI) who participated in group-based interventions aligned with the key areas of the GENIAL framework. These interventions, such as group-based positive psychotherapy and outdoor activity groups, aimed to facilitate domains of wellbeing such as balanced mind, healthy body, social connection, connection to nature, and behaviour change. This work took place in the context of the additional psychosocial challenges posed by the global pandemic. Chapter Six also presents research from an original study previously published in MDPI's 'Sustainability' journal (Wilkie et al., 2022b), examining the impact of "Surf-Ability," an adapted surf therapy intervention delivered in collaboration with a UK neurorehabilitation service, on individuals with ABI. This study integrates quantitative survey data and physiological measures to assess the feasibility and effectiveness of the intervention on patient outcomes and wellbeing. In addition, a qualitative follow up study was conducted one year later using ripple effects mapping to determine the longevity of the intervention's effects. This work provides insights into the role of collaborative partnerships and the application of the GENIAL model within healthcare settings. These evaluations have informed future service development and underscore the importance of integrating wellbeing into healthcare practices.

Chapter Seven offers a thorough discussion of the thesis findings, integrating key insights from across contexts studied. Findings are compared with prior evidence, theories, and considered in the context of the GENIAL framework. Methodological strengths and challenges encountered throughout the research process are discussed, providing valuable recommendations for future studies. Additionally, the chapter examines the impact of this work thus far, and its implications for healthcare systems, community organisations, and policy decisions, highlighting the potential for positive societal transformation.

Chapter Three

3. The Scientific Study of Wellbeing: Reflections on Measurement and Methodologies

Abstract

Chapter Three begins by outlining the philosophical foundations that guide the research presented in this thesis, with a particular focus on critical realism as the chosen ontological stance. Critical realism asserts that while the real world exists independently of human perception, our understanding of it is always mediated by our experiences, perspectives, and social context (Bhaskar, 1975). It further posits that reality is stratified into different levels: the empirical (what we observe), the actual (events that occur), and the underlying mechanisms that drive these events. This layered view of reality aligns closely with the use of mixed methods research, combining both qualitative and quantitative data to capture the complexity of the phenomena under study. The chapter then critically examines the measurement of wellbeing, discussing strengths and limitations of self-report surveys, qualitative interviews, and physiological measures like heart rate variability (HRV). Following this, the chapter provides an overview of the specific methodologies employed in this thesis, which include network meta-analysis, structural equation modelling, ripple effects mapping, thematic analysis, and the use of psychophysiological data.

3.1. Philosophical underpinnings of scientific study

Ontology and epistemology are central to understanding the nature of reality and knowledge in scientific study (Bhaskar, 1975). Ontology concerns itself with what exists—the nature of reality itself. An ontological position involves deciding what is assumed to be true about the world. For instance, one might ask whether reality exists independently of human perception, as in realism, or whether it is constructed by individuals or groups, as in constructivism. Epistemology is the study of knowledge, addressing how we know what we know. An epistemological stance shapes the methods chosen, aligning with beliefs about how knowledge can be acquired. For example, positivism holds that knowledge is best gained through observable, measurable facts, favouring objectivity. In contrast, interpretivism says that understanding is achieved by exploring subjective meanings and experiences, which can vary widely across individuals or contexts.

Realism claims that reality exists independently of any observer with realists arguing that this external, tangible reality can be understood through empirical observation and scientific inquiry (Bhaskar, 1975). This aligns with positivism, an epistemological stance asserting that scientific knowledge should be grounded in empirical evidence, with hypotheses that are testable and verifiable through systematic observation. Positivism's emphasis on empirical observation and verification implies certain ontological assumptions, such as the existence of an objective reality independent of human perception (Harre, 1970). Quantitative approaches align with the philosophical position of positivism, as they aim to collect data that may be analysed statistically to provide descriptive information on phenomena, establish associations between variables, and identify trends and changes in data over time with large population samples.

The primary opposition to realist perspectives comes from constructivism, which questions the realist belief in an objective, pre-existing reality. Instead, constructivism highlights the subjective, socially constructed nature of both knowledge and reality (Berger and Luckmann, 1967). Qualitative research typically aligns with a constructivist viewpoint as it gathers rich information about a person's experiences, perceptions, beliefs, and attitudes.

Critical realism is the philosophy that was employed for the purposes of the research that is presented in this thesis. It merges realism with a critical stance on knowledge, asserting that an objective reality exists beyond our perceptions, though it is complex and layered (Archer et al, 1998). Recognising the limits of perception, critical realism encourages a multi-method approach, integrating research methods with different strengths to triangulate evidence (Zachariadis et al, 2013). In mixed methods research, which combines qualitative and quantitative approaches, critical realism adds depth through retroductive theorising (not only observing *what* happens but *why* it happens). I chose a mixed methods and critical realism approach in my thesis because of the complexity of measuring the impact of wellbeing interventions. This approach allows me to capture both observable outcomes and the mechanisms driving those outcomes.

3.2. Critique of Wellbeing Measurement

There are many challenges when measuring wellbeing because it is a highly subjective, multi-dimensional concept. Definitions of wellbeing vary hugely, which complicates the creation of measurement tools that capture these varied aspects accurately. Three commonly used measures of wellbeing include self-reported survey measures, physiological data and qualitative data.

3.2.1. Survey Self Report

Self-report questionnaires, such as the Warwick-Edinburgh Mental Well-being Scale (WEMWBS) and WHO-5 Well-Being Index, are widely used tools in wellbeing research, they ask participants to reflect on their recent thoughts, feelings, and behaviours related to well-being (Tennant et al, 2007; Topp et al, 2015). These surveys offer several benefits: they enable efficient data collection from large, diverse samples, are standardised for comparability across studies, and provide reliable, quantitative data for significance testing.

However, surveys also have limitations; they often reduce complex wellbeing experiences into scale-based responses. Life satisfaction scores are subject to cultural biases, as different cultures may interpret and respond to satisfaction scales differently (Oishi et al, 2009). This variation can make cross-cultural comparisons challenging. Surveys also sometimes target a single domain of wellbeing, and thus can miss the full complexity of individual experiences. For example, the Positive and Negative Affect Schedule (PANAS) assesses emotions like "excited" or "interested," capturing hedonic wellbeing focused on pleasure but neglecting eudaimonic aspects (Watson et al, 1988). Therefore, some argue that life satisfaction scores are a better measure of wellbeing because they ask individuals directly to rate their overall satisfaction with life, making it a straightforward measure that captures an individual's broad assessment of their wellbeing rather than specific moods or experiences (Diener et al, 1985).

Self-report questionnaires depend on individuals' self-awareness to accurately reflect their feelings. However, the subjective nature of wellbeing measurement means that perceived feelings are often the primary focus for researchers, therefore even participants with limited self-awareness can provide valuable insights, as their subjective experience is the phenomena under study. Thus, while self-awareness affects reliability, the emphasis on subjective feelings justifies using self-report measures to capture individuals' lived experiences of wellbeing.

3.2.2. Physiological Data

In wellbeing research, physiological indicators such as heart rate, heart rate variability (HRV) and cortisol levels are frequently used to infer stress levels and overall wellbeing. By providing a biologically grounded perspective on wellbeing, physiological measures add validity to findings that would otherwise rely solely on subjective reports. Biomarkers can also reveal underlying health conditions or chronic stress effects that may not be apparent in self-reports. For example, elevated cortisol can indicate chronic stress even in individuals who report feeling satisfied with life (Adam & Kumari, 2009).

However, this approach comes with costs. Collecting physiological data often requires specialised equipment and multiple samples (e.g., saliva for cortisol), which can be invasive or burdensome for participants, potentially affecting study feasibility and sample size. Physiological data collection, analysis, and interpretation require expensive equipment and training, increasing the cost of research significantly compared to self-report measures. Biomarkers are also sensitive to external environmental factors (Laborde et al, 2017). For example, activities such as physical exercise, caffeine intake, and diet can significantly impact biomarkers, in addition to situational factors like noise and temperature. Therefore, it is important to standardise sample collection times and taking detailed information on participants’ lifestyle and situational factors to improve the accuracy of physiological data interpretation in large-scale studies (Laborde et al, 2017). To gain a complete picture of wellbeing, physiological measures can be combined with self-reports, but discrepancies can arise between objective and subjective data. For example, someone with high life satisfaction may still exhibit stress markers, complicating the interpretation (Diener et al., 2018).

3.2.3. Qualitative Data

Methods for qualitative data collection include interviews, focus groups, observations and ethnography and case studies. Analysis and interpretation of qualitative data is shaped by the researcher's ontological and epistemological perspectives and is typically analysed by identifying patterns of meaning and themes (Smith, 2015). In relation to wellbeing research, instead of using fixed scales or quantifiable outcomes, researchers might conduct interviews or focus groups to learn about factors protecting or threatening wellbeing in various contexts and populations, to use service user opinions to develop interventions, or understand underpinning mechanisms causing change in wellbeing (Campbell et al, 2016; McKinlay et al, 2021; Pescud et al, 2015). In policy and wellbeing intervention implementation, this allows researchers to capture rich, contextualised insights and understand not only if an intervention is effective, but also why it works. Qualitative data often generates theories or frameworks based on participants' lived experiences and have contributed to frameworks such as Ryff's Psychological Wellbeing model, which emerged in part through exploring subjective dimensions of wellbeing (Ryff, 1989).

Qualitative research however has faced criticism for its subjective nature and that interpretation may be influenced by researchers' personal biases and preconceptions, leading researchers to emphasise the importance of rigor in qualitative methodology to ensure trustworthiness through credibility, transferability, dependability, and confirmability (Hammarberg et al, 2015; Morrow, 2005). Leading qualitative scholars, like Braun and Clarke argue that, when researchers critically reflect on their biases and assumptions, subjectivity can offer deeper insights and interpretations (Braun & Clarke, 2013; 2019).

Qualitative research also often involves small, non-random samples which limits the ability to generalise findings across broader populations. This limitation can be problematic for wellbeing research, as researchers often aim to find interventions with widespread applicability. Qualitative research is also time-intensive, often requiring long periods of data collection, transcription, and in-depth analysis. This complexity can make it impractical for large-scale wellbeing studies, particularly in contexts where time and resources are limited. However, qualitative research is increasingly being integrated into mixed methods research to provide deeper insights and a richer understanding of complex phenomena. This approach allows for a more nuanced exploration of research questions, complementing quantitative data with detailed, context-rich information.

3.3. Opportunity For Mixed Methods Research in Wellbeing Science

Throughout this thesis, I have employed multiple methods to evaluate and study wellbeing, recognising the unique opportunities that a mixed methods approach brings to wellbeing science. Tackling complex global challenges requires integrating data from diverse perspectives and measurement approaches. Mixed methods enable us to capture the richness of human experience while generating reliable data to guide evidence-based decision-making. To truly understand what enables individuals and communities to flourish, we need a comprehensive approach. This includes using a broader framework of wellbeing, such as the GENIAL model, which incorporates individual, collective, and planetary dimensions of wellbeing (A. Kemp et al., 2017; A. H. Kemp & Fisher, 2022; Mead et al., 2019, 2021, 2023). The GENIAL model is an example of synthesising evidence from the wellbeing literature to expand our knowledge. By employing mixed methodologies, we can understand wellbeing at multiple scales and triangulate data from diverse sources to enrich our understanding. Only through an interdisciplinary, integrated approach can we hope to address the complexity of wellbeing and contribute meaningfully towards building a healthier, more sustainable world.

3.4.Methodologies Chosen in this Thesis

This section outlines the methodologies used in each chapter of the thesis, employing a mix of quantitative, physiological, and qualitative data to address the research questions. Chapter Four uses network meta-analysis to synthesise quantitative survey data. Chapter Five applies structural equation modelling and HRV synchrony for quantitative and physiological data, alongside ripple effects mapping for qualitative insights. Chapter Six features pre-post survey evaluation, HRV changes, and includes thematic analysis and ripple effects mapping to explore qualitative data. This mixed-methods approach supports a comprehensive understanding of intervention impacts.

3.4.1. Network meta-analysis

In Chapter Four, I chose to use Network Meta-Analysis (NMA) to address the gap in synthesising and comparing the effectiveness of various wellbeing interventions across disciplines. Previous research has been limited to pairwise comparisons, which only evaluate two interventions at a time. I aimed to use NMA to evaluate multiple interventions - such as psychological, physical activity, social identity, and nature-based approaches - in a single analysis. Additionally, I examined whether multi-domain interventions (e.g., combining physical activity with psychological elements) outperform single focus interventions. As the first empirical chapter presented in the thesis, this also served as a broad literature review and introduction to various wellbeing interventions.

NMA is an advanced statistical approach widely used in evidence-based research, particularly in fields where multiple interventions exist but direct comparisons are limited. At its core, NMA builds on the foundation of Randomised Controlled Trials (RCTs), which are considered the gold standard for testing causal effects in intervention research (Higgins & Green, 2011). RCTs work by randomly assigning participants to treatment and control groups. RCTs provide robust data on the effectiveness of interventions by minimising confounding variables and inferring causality. Meta-analyses enhance statistical power and generalisability by pooling findings from multiple RCTs, providing an overall effect estimate, which is especially valuable in wellbeing science, where individual studies vary in quality, size and reliability (Hedges & Olkin, 1985).

However, pairwise meta-analyses focus on direct comparisons between interventions only (Intervention A versus control). NMA builds on these foundations by allowing researchers to simultaneously compare multiple interventions (Intervention A, B, C and Control), even when direct comparisons between all treatments are not available. NMA constructs a network of evidence, integrating both direct and indirect comparisons, which can provide insights into the relative effectiveness of various approaches (Salanti et al., 2008). This method is particularly valuable in wellbeing research, where a range of interventions such as mindfulness, exercise, and positive psychology interventions exist, but few studies directly compare all options. NMA offers a comprehensive ranking of interventions based on their effectiveness, enabling practitioners to identify the most beneficial approaches for specific outcomes (Caldwell et al., 2005). As such, it is often considered a gold standard in evidence synthesis (Higgins et al., 2019).

However, NMA also has limitations. The accuracy of its findings depends heavily on the quality and consistency of the included studies; variations in study design, participant populations, and outcome measures can introduce heterogeneity, potentially weakening the results. In wellbeing science, where measures often rely on subjective self-report tools, this reliance can introduce bias and impact the validity of the outcomes (Puhan et al., 2012). Moreover, NMA's complexity requires advanced statistical expertise and comprehensive software, which can be a barrier for some researchers. Finally, although NMA allows for indirect comparisons, these are based on assumptions of transitivity. The transitivity assumption requires that studies being compared are similar enough in terms of characteristics such as participants, interventions, and outcomes. This ensures that indirect comparisons between treatments are valid and not driven by external study characteristics. However, maintaining transitivity is complex because it requires careful study selection, specialised statistical and NMA knowledge from the researcher and if violated, can lead to misleading conclusions (Salanti et al., 2008; Jansen & Naci, 2013).

Overall, I chose to conduct an NMA in Chapter Four to address the gap in comparing multiple wellbeing interventions across discipline domains. NMA allows for a comprehensive analysis of various approaches, integrating both direct and indirect evidence. This made it a powerful tool for identifying the most effective evidence-based interventions across wellbeing science.

3.4.2. Structural Equation Modelling

Building on the broad exploration of individual wellbeing interventions using NMA in Chapter Four, I then shifted focus to a more community-based approach aimed at enhancing wellbeing and social capital in broader populations, particularly for those facing socio-structural challenges. For my evaluation of Local Area Coordination (LAC), I used a combination of survey, qualitative, and physiological data to provide a comprehensive understanding of its impact on wellbeing and uncover the mechanisms behind its effectiveness, especially given the limited peer-reviewed evidence on the LAC approach.

In Chapter Five, the evaluation of LAC first included an analysis of survey data. I utilised Partial Least Squares – Structural Equation Modelling (PLS-SEM) to analyse survey data as part of the evaluation of LAC. This analysis aimed to explore the key factors underpinning this community-based approach to wellbeing, focusing on variables such as wellbeing, social connectedness, and relationship quality. PLS-SEM was selected for its effectiveness in handling smaller sample sizes and its flexibility in analysing complex, multi-variable models, making it particularly suitable for wellbeing research where sample sizes are often constrained and multiple interrelated factors are examined (Hair et al., 2017). This quantitative analysis forms part of a broader mixed-methods approach, combined with physiological and qualitative data, to provide a comprehensive understanding of the LAC model.

PLS-SEM offers several advantages in wellbeing research. It is well-suited for exploratory studies and complex models with many constructs, as it allows for iterative refinement of theoretical models. This feature aligns with the critical realist stance in my research, which seeks to develop a deeper understanding of underlying relationships through model adjustment. Additionally, PLS-SEM can handle non-normal data distributions, making it versatile in analysing real-world applied data that often deviates from ideal statistical assumptions (Chin, 2010). However, there are limitations to PLS-SEM. Unlike traditional covariance-based SEM, PLS-SEM does not provide global fit indices, which can make it challenging to assess overall model fit. Additionally, it is more sensitive to measurement error and relies heavily on the quality of the indicators used, which can affect the accuracy of the results. Despite these limitations, PLS-SEM's strengths in managing complex, multi-variable relationships and small sample sizes make it a useful choice for this study, particularly in combination with physiological and qualitative data to enrich the analysis.

3.4.3. Heart Rate Variability and Vagus Function

In Chapters Five and Six, I explored wellbeing using physiological data, specifically Heart Rate Variability (HRV). HRV was selected as a measurement tool in this thesis because of its relevance to the GENIAL framework's emphasis on the vagus nerve in defining wellbeing (Kemp et al., 2017; Kemp & Fisher, 2022; Mead et al., 2019, 2021; Wilkie et al, 2022). The following section will discuss the role of the vagus nerve in wellbeing and explain why HRV was chosen as a measure for assessing its influence.

The vagus nerve, also called CN X (or 10th cranial nerve), is a major nerve of the parasympathetic nervous system, originating from the brainstem and extending throughout the body to influence multiple organs. It is critical in regulating the "rest-and-digest" response by releasing the neurotransmitter acetylcholine, which slows the heart rate, lowers blood pressure, and supports digestion (Porges, 2007; 2011). The vagus nerve also helps regulate respiratory rhythm and reduces inflammation by inhibiting pro-inflammatory cytokines (Breit et al., 2018; Tracey, 2000). Vagus nerve activity indicates the body's capacity for parasympathetic functioning. High vagal tone is associated with better stress resilience and faster recovery after stress, while low vagal tone often corresponds to a dominance of the sympathetic (fight-or-flight) response (Thayer & Lane, 2000).

Myelinated and unmyelinated vagal fibers serve distinct roles in the body's response to social cues, stress, and survival (Porges, 2007; 2011). According to Polyvagal Theory, the body's response system operates hierarchically based on perceived safety or threat, with the myelinated (ventral) and unmyelinated (dorsal) vagal pathways responding accordingly. Myelinated vagal fibers, primarily part of the ventral vagal complex, support rapid responses to social and environmental cues. They regulate heart rate, facial expressions, and other social engagement functions, promoting a calm, adaptive state in safe situations (Porges, 2007; Stellar & Keltner, 2017; Thayer & Lane, 2000). Unmyelinated vagal fibers, associated with the dorsal vagal complex, respond more slowly and are linked to primitive, protective reactions to extreme stress (Porges, 1995; Porges, 2001). When activated, they prompt a "shutdown" response often called the "freeze" response by slowing metabolism, heart rate, and digestion to conserve energy in overwhelming situations (Porges, 2007).

Overall, given the vagus nerve's role in managing stress, maintaining emotional stability, aiding the body's recovery from stress, and fostering relaxation, it is a key contributor to health and wellbeing (Porges, 2007; Thayer & Lane, 2000). Its influence on social engagement such as regulating facial expressions, vocal tone, and helping people feel calm and connected supports emotional resilience and the capacity to interact effectively with others (Kok et al., 2013). This adaptability in response to both stress and social cues is essential for psychological resilience and emotional health (Geisler et al., 2010).

3.4.4. Heart Rate Variability as a Measure of Vagus Function

The vagus nerve directly affects heart rate variability (HRV), which measures variations in the time intervals between consecutive heartbeats (Shaffer et al., 2017; Thayer et al., 2000). Thus HRV is a promising physiological measurement of vagal function and indicator of wellbeing.

In time-domain HRV metrics, the vagus nerve's influence is reflected in measures like RMSSD (Root Mean Square of Successive Differences) and SDNN (Standard Deviation of Normal-to-Normal Intervals), which capture the variability in time intervals between heartbeats that the vagus nerve modulates (Laborde et al., 2017). In frequency-domain metrics, High Frequency (HF) reflects parasympathetic activity and is linked to respiratory sinus arrhythmia (RSA), the way heart rate changes with breathing, a process controlled by the vagus nerve (Shaffer et al., 2017; Thayer et al., 2000). Low Frequency (LF) includes both sympathetic and parasympathetic influences, making it complex to interpret (Billman, 2013). The LF/HF ratio is sometimes used to show the balance between sympathetic and parasympathetic responses, though its accuracy is debated (Billman, 2013; Laborde et al., 2017).

3.4.5. HRV and Wellbeing

A large-scale study by Kok et al. (2013) explored the effects of loving-kindness meditation on HRV and social connection. Over several weeks, participants who practiced loving-kindness meditation demonstrated increased HRV alongside enhanced feelings of social connectedness. This study suggests that interventions aimed at fostering positive emotions and social bonds can have measurable effects on both HRV and subjective wellbeing. On the other hand, some studies have found contradicting evidence to suggest HRV does not always correlate to subjective wellbeing. Sloan et al. (2017) found no consistent correlation between HRV and subjective wellbeing measures. Similarly, Tegegne et al. (2018), in a population-based cohort, observed that while HRV correlated with factors like age and physical health, it did not consistently align with measures of life satisfaction or psychological wellbeing.

Despite these contradictions, given the substantial data and evidence supporting the link between vagally mediated HRV and wellbeing (Kok et al., 2013; Shaffer & Ginsberg, 2017), along with the GENIAL framework's emphasis on HRV as a physiological underpinning of wellbeing (Kemp et al., 2017), I chose to explore HRV as a measure of wellbeing in my thesis research. In Chapter Five I measured HRV synchrony between community members and local area coordinators (see below discussion on HRV synchrony). Whilst in Chapter Six I included pre-post-intervention HRV measurements for the Surf-ability intervention. The metrics used - Root Mean Square of Successive Differences (RMSSD) and normed high-frequency (HF) HRV - were selected because they are widely regarded as indicators of vagal parasympathetic activity

(Laborde et al., 2017). The aim was to contribute to the evidence base and to test the GENIAL framework's theory that HRV serves as a physiological foundation for wellbeing.

3.4.6. HRV Synchrony

HRV synchrony is when two individuals' HRV patterns align or coordinate during social interactions and it is increasingly thought to be potentially recognised as a marker of social connection and emotional co-regulation (Coutinho et al., 2021; Koole & Tschacher, 2016; Tschacher & Meier, 2019). Research suggests that HRV synchrony may enhance feelings of closeness, trust, and empathy, as it reflects the alignment of physiological states between individuals (Palumbo et al., 2017). Studies have shown that HRV synchrony can be particularly beneficial in therapeutic settings, where it helps to establish rapport and a sense of safety (Tschacher & Meier, 2019). In-phase HRV synchrony occurs when two individuals' heart rhythms increase and decrease together, while anti-phase synchrony occurs when their rhythms are opposite.

Building natural relationships is a fundamental aspect of the Local Area Coordination (LAC) approach, with previous research highlighting listening, trust, and time as key elements that support this model's effectiveness (Mason et al., 2021). In Chapter Five, I aimed to investigate whether cardiac synchrony, or HRV synchrony, occurs during interactions between coordinators and the community members they support and whether this synchrony serves as a physiological marker of relationship quality. By examining the presence and extent of HRV synchrony, I hoped to deepen our understanding of how trust and connection manifest physiologically, reinforcing the importance of genuine, trust-based relationships in promoting wellbeing within the LAC framework. This approach additionally allowed me to explore the GENIAL framework's proposition that vagal function underpins wellbeing. If HRV synchrony indeed aligns with social connection, it would support the GENIAL model's hypothesis that vagal function plays a crucial role in fostering wellbeing, co-regulation, and interpersonal connection.

HRV synchrony offers a promising way to complement subjective assessments in wellbeing research, providing a more comprehensive view of relationships and social engagement. By capturing physiological alignment, HRV synchrony taps into nonverbal aspects of communication that traditional self-reports miss. This physiological synchrony allows researchers to study how individuals influence each other's autonomic nervous system responses, this is particularly helpful in therapeutic, caregiving, or support settings such as LAC where emotional connection are essential but may not always be verbally expressed.

However, HRV synchrony has limitations, like individual HRV, it is also influenced by external factors such as physical activity, breathing, and environment conditions. Additionally, it requires very precise 'time stamped' HRV data, making it technically challenging to collect and requires specific resources including a specialised application to collect the data through and costly HRV monitors. Moreover, physiological alignment does not always indicate positive relational outcomes; for example, individuals in conflict may show synchrony due to shared stress responses (Butler, 2011). Baseline HRV variations due to factors like age, health, and lifestyle can also complicate interpretations, making it unclear whether a lack of synchrony reflects relational issues or individual differences (Shaffer & Ginsberg, 2017). Therefore, HRV synchrony data is still exploratory and should ideally be combined with alternative data measurements to provide a balanced and reliable understanding of wellbeing. In Chapter Five, my research on Local Area Coordination (LAC) integrates HRV synchrony data with self-report measures and qualitative data, providing a comprehensive understanding of LAC's impact on wellbeing.

3.4.7. Service Evaluation

In Chapter six, I conducted a mixed-methods evaluation within a neurorehabilitation service in a UK healthcare context. As this was a service evaluation rather than a full research trial, I faced specific ethical and methodological constraints. UK Health Research Authority (HRA) guidelines exclude service evaluations from requiring ethical review (GAfREC 2.3.12; Health Research Authority, 2021). However, I was ethically restricted from randomising participants, allocating them to intervention or control groups, or manipulating their treatment in any way; my role was limited to observing their usual rehabilitation.

To measure changes in wellbeing from the interventions, I chose to use the Short Warwick-Edinburgh Mental Wellbeing Scale (SWEMWBS), administering it pre- and post-intervention. The SWEMWBS is widely used in the context of the UK national health service, it is designed to measure a hedonic and eudaimonic concept of wellbeing, focusing on aspects of both emotional wellbeing (feeling good) and positive functioning (functioning well) (Tennant et al., 2007). It emphasises subjective, positively framed experiences, such as feeling optimistic, useful, and relaxed. This shorter version of WEMWBS is advantageous for use in service evaluations as it reduces time required from participants while maintaining robust psychometric properties (Tennant et al., 2007).

Ideally, a RCT would have offered a more rigorous approach, allowing for causal inference by comparing Surfability's effects against a control group. However, RCTs are often ethically and logistically challenging, especially in health service settings, where they are costly, time-intensive, and was beyond the scope of my PhD project. Given these constraints, a service evaluation using a mixed-methods approach allowed me to maximise validity and reliability by incorporating multiple measurements and perspectives. This integrated approach provided a richer, more nuanced understanding of the wellbeing outcomes associated with Surfability, compensating for the limitations of the observational design. In both Chapters Five and Six, I additionally used Ripple Effects Mapping to collect qualitative data and applied reflexive thematic analysis to identify key themes, as discussed in the following section.

3.4.8. Ripple Effects Mapping

Ripple Effects Mapping (REM) is a participatory evaluation technique that uses visual mapping to capture the broader impacts of programs and interventions by engaging participants in a reflective process. I used REM as a method to collect qualitative data from service users in both Chapter Five's evaluation of LAC and the Surfability evaluation presented in Chapter Six. In REM, stakeholders collaboratively create a visual map of "ripples" or indirect outcomes, revealing how an intervention influences various aspects of individual and community wellbeing beyond the immediate effects (Chazdon et al., 2017). This approach is especially valuable in community-based and wellbeing-focused programs, where outcomes are often complex, interrelated, and not easily captured by traditional quantitative methods.

One of the main strengths of REM is its ability to capture the full spectrum of program impacts, including system-level effects that may otherwise go unnoticed (Emery et al., 2015). REM is also highly engaging for participants, encouraging reflection and generating a sense of ownership and empowerment as stakeholders actively contribute to mapping the outcomes. However, REM has limitations, including the challenge of systematically analysing qualitative data from visual maps. Additionally, it can be time-intensive and may require skilled facilitation to ensure comprehensive and balanced contributions from all participants. Despite these challenges, REM's focus on capturing broader, systemic and often intangible outcomes made it an ideal choice for exploring the complex, ripple effects of the community programs on wellbeing, and in line with the GENIAL framework on wellbeing, allowed me to explore impacts on individuals, collective and the planetary wellbeing (A. Kemp et al., 2017; A. H. Kemp & Fisher, 2022; Mead et al., 2019, 2021, 2023).

3.4.9. Reflexive Thematic Analysis

Upon collecting data using the standardised REM protocol, reflexive thematic analysis can be used to analyse and draw final themes from the data collected. Reflexive Thematic Analysis (RTA) is a flexible and iterative qualitative method used to identify, analyse, and interpret patterns of meaning (themes) within data (Braun & Clarke, 2006). In line with recommendations, reflexive thematic analysis was employed to analyse the data generated from Ripple Effects Mapping in both Chapter Five and Six (Chazdon et al., 2017). Additionally, Chapter Six also included a qualitative study on a variety of psychosocial interventions implemented by the neuropsychology service during the COVID pandemic, designed to target multiple factors contributing to wellbeing (Wilkie et al, 2021). I used RTA to analyse this qualitative data, allowing for an in-depth exploration of participants' subjective experiences.

Reflexive Thematic Analysis (RTA) provides a valuable balance between depth and breadth. It enables rich, detailed analysis of individual experiences while identifying broader themes across datasets. It allows researchers to engage meaningfully with the data through continued reflection, which aligns well with a critical realist perspective (Braun & Clarke, 2019). However, as a non-standardised approach, RTA relies heavily on researcher interpretation, which may introduce bias, and its iterative process can be time-intensive. I chose RTA over other qualitative methods for this research because unlike more structured approaches such as content analysis, RTA's flexibility allows for the depth needed to understand personal narratives while maintaining the breadth necessary for analysing common and shared impacts of the interventions studied.

3.5.Conclusion

In conclusion, this chapter has outlined the philosophical and methodological underpinnings of the scientific study of wellbeing, highlighting both challenges and opportunities. Through the lens of critical realism, the research acknowledges the layered nature of reality, which supports the use of a mixed methods approach to capture the complexity of wellbeing. By examining various measurement tools - self-report surveys, qualitative interviews, and physiological measures such as HRV - this chapter has addressed their respective strengths and limitations. It further justifies the adoption of mixed methods, illustrating how this integrative approach enables a deeper understanding of wellbeing and intervention effectiveness. Ultimately, this comprehensive use of a wide range of methodologies offers novel and valuable insights for advancing both theoretical and practical knowledge in the field of wellbeing science. Building on these philosophical and methodological foundations, the following chapter employs Network Meta-Analysis (NMA) to synthesise and compare the effectiveness of diverse wellbeing interventions. Chapter Four thus serves as both an extension of the GENIAL theoretical framework established in Chapter One and an introduction to specific wellbeing interventions, marking the beginning of empirical investigation within this thesis.

Chapter Four

4. A Systematic Review and Network Meta-Analysis Comparing Wellbeing-Focused Interventions

Abstract

Here I present the first published network meta-analysis (NMA) comparing the effectiveness of wellbeing-focused interventions including psychological, physical activity, and nature-based approaches. NMA allows simultaneous comparison of multiple interventions' efficacy, unlike pairwise meta-analysis which is limited to two interventions. Through systematic review, 183 randomised controlled trials were identified for inclusion containing 22,811 adult participants from the general population. 'Movement combined with psychological intervention' was ranked as most effective, highlighting the potential synergistic effect of combining robust psychological techniques with physical activity. Mindfulness, Compassion-focused interventions, and Yoga were ranked as highly effective. Physical activity performed well, on par with Positive Psychology interventions and Acceptance and Commitment Therapy. Observed effect sizes typically ranged from small to medium. Individual study risk of bias was typically moderate to high, and certainty of evidence comparisons was low to moderate. Overall, our findings highlight the effectiveness of both psychological and physical practices on wellbeing and emphasise the need for future RCTs to evaluate combined multi-disciplinary wellbeing-focused interventions.

4.1.Introduction

Global health is facing numerous interrelated challenges including the relentless rise of non-communicable diseases (Collaborators et al., 2015; HALE et al., 2018; Murray & Lopez, 1997a, 1997b), health inequalities (Asaria et al, 2016; Kadel et al., 2022; Welch et al., 2013) and the threat of climate change (Clayton & Manning, 2018; Kjellstrom et al., 2007; Redshaw et al, 2013; Thomas et al, 2014). A ray of hope, however, emerges through the recognition that bolstering the global wellbeing of individuals, communities, and the planet can support efforts to address these issues (Kemp & Edwards, 2022). Health interventions have often exclusively focused on pain, suffering and disease. Yet, a wealth of research underscores the link between the promotion of positive wellbeing and the enhancement of public health (Diener et al., 2017; Diener & Chan, 2011), resilience (Cosco et al., 2017), prevention of mental health disorders (Keyes et al., 2011), the deepening of social connections (Mehl et al., 2009) and even the cultivation of pro-environmental behaviours (Zawadzki et al., 2020). Therefore, the need for systematic and systemic implementation of interventions to improve wellbeing is growing.

A substantial proportion of research in the field of well-being has centred on psychological interventions explicitly designed to enhance wellbeing such as Positive Psychology Interventions (PPIs) (Agteren et al., 2021; Carr et al., 2021; Sin & Lyubomirsky, 2009; C. A. White et al., 2019). Yet despite evidence that factors like exercise, nutrition, and sleep significantly impact mental health (Kaneita et al., 2007; Moreno-Agostino et al., 2019; Wiese et al., 2018), health behaviour interventions are often studied separately from psychological approaches to wellbeing promotion. Wellbeing science has also faced criticism for focusing on the individual, with less consideration for social and environmental contexts in which they are embedded (Yakushko 2021). In response to these criticisms, a need arose for a comprehensive framework to consolidate existing scholarly literature, multidisciplinary research, and diverse theories into an integrated model. A framework was required to consider the interaction between mind and body, potential physiological underpinnings of wellbeing and broader collective and environmental context beyond the individual. Meeting this need, the GENIAL theoretical framework was developed to offer a structured approach to understanding wellbeing by integrating disciplinary perspectives. The GENIAL model is a theoretical, multi-disciplinary framework of the wellbeing literature (A. Kemp et al., 2017; A. H. Kemp & Fisher, 2022; Mead et al., 2019, 2021, 2023). The framework summarises the key determinants of wellbeing relating to the individual (including emotional regulation and physical-health behaviours), the community (social connection) and planet (connection to nature). The GENIAL model also proposes that the vagus nerve - the tenth cranial nerve which connects the brain to nearly every organ in the body (gut, heart, lungs) and plays a key role supporting the parasympathetic nervous system – provides a structural link between physical and mental health (Wilkie 2022). A large body of research now supports that the key domains of wellbeing both impact and are impacted by vagal function, for example, positive emotions, physical health, social connectedness and time spent in nature (Bello 2020,Kok 2012,McEwan 2021,Natarajan 2020). We have recently summarised wellbeing as a connection to the self, others and planet (Kemp 2022). This holistic definition is supported by evidence demonstrating the efficacy of wellbeing-promoting interventions from across disciplinary domains including psychological interventions (Agteren et al., 2021), physical activity (Buecker et al., 2020), social support (Steffens et al., 2021), and nature-connection (Pritchard et al., 2020).

Psychological wellbeing interventions typically encompass techniques such as cultivating gratitude, promoting acts of kindness, compassion, character strengths, mindfulness and acceptance and commitment therapy (White et al., 2019). Several pairwise meta-analyses have sought to assess the pooled effectiveness of psychological interventions in improving wellbeing outcomes (Agteren et al., 2021; Carr et al., 2021; Sin & Lyubomirsky, 2009; C. A. White et al., 2019). The findings have shown a range of results, with effect sizes spanning from $r = .10$ (White et al., 2019) to g = 0.39 (Carr et al., 2021). Notably, a recent meta-analysis highlighted that multi-component positive psychological interventions (with an effect size of $g = .28$) and mindfulness-based interventions (with an effect size of $g = .42$) had the strongest positive effects (Agteren et al., 2021). Generally, these interventions demonstrate effect sizes that fall within the small to medium range and are influenced by various factors, including the specific target population, the intensity of the intervention, and the mode of delivery (Agteren et al., 2021).

However, psychological interventions compromise only one subset of approaches to promote wellbeing and are typically studied in isolation from interventions of different disciplines. One example is the evidence indicating that physical activity makes an important contribution to wellbeing. Meta-analyses have found a medium main effect of physical activity on subjective wellbeing ($d = 0.360$) (Buecker et al., 2020) and that leisure-time physical activity is associated with positive affect ($r = 0.21$) and life satisfaction ($r = 0.12$) (Wiese et al., 2018). Moreover, recent developments in wellbeing science have also shed light on the importance of interventions targeting groups and communities (Kern 2020; Lomas 2020), recognizing that positive social ties are essential for wellbeing (Kemp 2017). Meta-analyses have shown substantial effectiveness ($g = 0.66$) for social identification-building interventions on wellbeing (Steffens et al., 2021). Additionally, there is robust epidemiological evidence suggesting that proximity to and time spent in nature can have significant positive effects on both mortality rates and mental health outcomes (Bratman et al., 2015; Gascon et al., 2015; Hartig et al., 2014; Twohig-Bennett & Jones, 2018; M. P. White et al., 2012). Meta-analyses have revealed significant effect sizes for the relationship between nature connectedness and both hedonic ($r = .20$) and eudemonic ($r = .24$) wellbeing (Pritchard et al., 2020). Also, connection to nature is a trait associated with pro-environmental behaviours (Richardson 2016) and nature conservation efforts (Hughes 2018). Thus, there's a growing interest in nature-based interventions as a means of promoting wellbeing (Berg et al., 2010; Kamioka et al., 2014).

To our knowledge, no study has yet attempted to synthesise or compare the efficacy of these widely accepted and prescribed wellbeing interventions from across disciplines. Furthermore, prior research has been constrained by pairwise meta-analyses which only allows the comparison of two treatments at a time. The aim of the present study is thus to conduct a systematic review and if possible, use network meta-analysis (NMA) to investigate the comparative effectiveness of multiple wellbeing-focused interventions including psychological interventions, physical activity, social identity building and nature-based interventions in a single analysis. We also aim to decipher whether interventions which target multiple domains (e.g., physical activity performed in nature or combined with a psychological intervention) are more effective than those with a single focus. To ensure the validity of the NMA, we intend to exclusively focus on participants from the general population, as opposed to clinical populations. This reason for this is driven by the need to maintain the assumption of transitivity, which requires there to be no systematic differences between the available comparisons other than the treatments being compared. Including diverse clinical samples could complicate analysis due to the heterogeneous nature of conditions and diseases. By concentrating solely on individuals from the general population, we aim to uphold the rigor of our analysis and draw clearer conclusions from this broad scope of interventions. Additionally, this approach aligns with the concept that mental health exists along a continuum, and thus individuals who are neither mentally ill nor flourishing may represent a large target population for interventions aimed at enhancing wellbeing and preventing onset of mental illness (Keyes, 2007

4.2.Method

4.2.1. Selection of Studies and Data Extraction

The systematic review and NMA was registered with PROSPERO (ID CRD42023403480). The database was developed through a systematic search of Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE, PsycINFO and Scopus in March 2023, and was continually updated by lead author (LW). The search strategy contained key words and MeSH (Medical Subject Headings) standardised terms relating to the interventions being studied, randomised controlled trials and wellbeing (see Appendix A for full search string). References were managed using Covidence (https://www.covidence.org/). Titles and abstracts were screened independently by two reviewers (MSc students who were trained and supervised by lead author), those which resulted in disagreements were automatically included for full-text screening. Two reviewers then also screened the full texts according to eligibility criteria and recorded reasons for exclusions. Disagreements during full text screening were resolved by discussion or by lead author. Data was extracted using a custom form on Covidence which was then checked for accuracy by the lead author. The preferred choice of extraction for outcome measures were means and SDs. When possible, these were calculated using alternative statistics reported, or study authors were contacted (and followed up at least once) via email to request missing data. Studies were excluded if no response was received by time of data analysis. Methodological quality of included randomised control studies were assessed using the Revised Cochrane risk-of-bias tool for randomised trials (RoB 2) by at least one reviewer and was checked for accuracy by the first author. Any disagreements were resolved via discussion with wider review team.

4.2.2. Eligibility Criteria

Eligibility criteria were developed using the PICOS framework and are summarised in table 1. We included randomised controlled trials (both parallel and cluster) published in peer-reviewed academic journals. Participants had to be aged 18 years or older, and not described as having a diagnosable condition, disease or dysfunction or receiving medical treatment for a disease at the time of study. Studies had to deliver at least one intervention described as being a psychological intervention, physical activity intervention, social identity/social support intervention, a nature-based intervention or contain a combination of these components. They could be either individual or group format and could be delivered face to face, online or hybrid. Every study arm was assessed independently against PICOS eligibility criteria (see table 1). Interventions could either be compared to a second eligible intervention or a no intervention or wait list control group.

Table 1 *Summary of PICOS eligibility criteria*

	Inclusion Criteria	Exclusion Criteria
Population	Adults > 18 years old	Participants under 18 years old. Participants described as having a specific condition, disease, dysfunction.
Intervention	Psychological interventions, physical activity, social support, or nature-based interventions. Can be online, in-person or hybrid.	Pharmacological or drug treatment arms.
Comparison	A randomised controlled ‘eligible’ intervention or no intervention or a wait list control.	No randomly assigned control condition.
Outcome	Wellbeing (primary outcome)	Single item measures of wellbeing. Studies which solely define wellbeing as reduction of ill-being (e.g. reduced anxiety scores).
Study Type	Randomised controlled trials.	Observational studies, conference abstracts, non-randomised trials or studies not published as full-length articles in peer-reviewed journals

4.2.3. Outcome Measures

The primary outcome examined was psychological wellbeing. We define wellbeing not as the absence of ill-being, but by the presence of positive or adaptive characteristics such as measures of subjective wellbeing, life satisfaction, happiness, positive affect, resilience, or flourishing. Acknowledging that these characteristics do vary somewhat, ‘category of wellbeing outcome measure used’ was included as a sensitivity analysis to ensure these did not differ significantly or lead to different findings. Studies which solely measured ‘wellbeing’ as a reduction in ill-being (e.g. reduced depression/anxiety scores) were excluded. Common standardised wellbeing scales included Perceived Wellness Score (PWS); Warwick-Edinburgh Mental Wellbeing Scale (WEMWBS); 36-Item Short-Form Health Survey (SF-36): Mental Component Subscale; World Health Organization Wellbeing Scale (WHO-5); PANAS - Positive Affect (this list is non-exhaustive and other measures were included when they met criteria).

4.2.4. Network Geometry and Nodes

The network nodes were defined following discussion between the research team including clinicians with expertise on which interventions could logically be clustered together based on both their underpinning theory and delivery in practice.

4.2.5. Statistical Analysis

Transitivity: The assumption of transitivity requires all interventions to be jointly randomizable. If this assumption holds, common comparisons should not vary significantly on key characteristics, or the validity of the indirect comparisons will be questionable (for example the ‘A’ in ‘A v B’ should not differ significant to the ‘A’ in ‘A v C’, or the ‘B v C’ indirect comparison will be invalid). To assess transitivity, we created a table of important characteristics (study setting, intervention intensity, delivery mode) to examine whether potential effect modifiers were similarly distributed across the comparisons. Variability from different study populations, interventions, and outcomes makes it difficult to ascertain that the treatments are being compared under equivalent conditions. The inclusion of various rather heterogeneous interventions necessitates even more stringent control of population differences. Hence, we opted to use a general population sample, to ensure more uniformity and reliable comparisons.

Pairwise Meta-Analyses: We conducted pairwise meta-analyses for all direct comparisons using a random-effects model. Homogeneity of effect sizes were estimated using Tau^2 and Higgins I^2 values. Standardised mean differences (SMDs) were reported with 95% confidence intervals. *p* values (alpha threshold = 0.05) were used to determine whether the effect sizes for each direct comparison were significant.

Network Meta-Analysis: A random-effect NMA was conducted to estimate a single summary effect for each node in the network. Global inconsistency was assessed using the Q statistic, based on design-by-treatment interaction model of (Higgins et al., 2012). Local inconsistency was assessed by comparing direct estimates to indirect estimates using the node splitting method (SIDE) (whereby $p < 1.0$ indicated statistically significant inconsistency). Treatments were ranked using P-scores, these range from 0 to 1 and can be interpreted as an average degree of certainty for a treatment to be better than the other treatments in the network (Rücker & Schwarzer, 2015).

Small study effects were assessed using a comparison-adjusted funnel plot, which report each study's effect estimate against their reversed standard error. Asymmetry in the plot suggests that larger effects tend to be systematically found in smaller studies.

Additional Analyses: six sub-group analyses were conducted on pre-specified potential effect modifiers. Analyses were first conducted using pairwise meta-analysis of all active interventions versus control. These were sub-grouped by mode of delivery (e.g. in-person, online, live video conferencing or instructions only); treatment format (individual or group); intensity (length) of intervention; setting of intervention (university, workplace, community or online); country (Western or non-Western) and age of participants. In addition, four sensitivity analyses were conducted to compare whether pooled effect of all interventions versus control differed depending on 1) type of outcome measure used; 2) whether control was a waitlist or no intervention; 3) risk of bias and 4) included study size. Additional sensitivity analyses were conducted using full NMA analyses of three alternative models; 1) excluding studies with high risk of bias; 2) using subjective wellbeing as the only outcome measure and 3) excluding small studies.

Confidence in NMA: The risk of bias across studies was assessed with Confidence in Network Meta-Analysis (CINeMA) for NMA (Papakonstantinou et al., 2020). CINeMA considers six domains that impact confidence in the NMA results: 1. Within-study bias; 2. Reporting bias; 3. Indirectness; 4. Imprecision; 5. Heterogeneity; 6. Incoherence. Each treatment comparison was assessed as having "no concerns," "some concerns," or "major concerns" in each of the six domains. Then, judgments across the domains were summarised into a single confidence rating (high, moderate, low, or very low).

4.2.6. Data availability

The dataset generated and analysed in the current study, in addition to the R script used for analysis and data visualisation are available in Open Science Framework repository: https://osf.io/nz59j/?view_only=30f14278418f454e8c6ee297493f2c39.

4.3. Results

4.3.1. Results of the search and included studies

The search returned 9105 unique studies, of which 183 RCTs including 22,811 adult participants were used in the final NMA. The PRISMA flowchart outlining the inclusion process, including the reasons for exclusion, is presented in Appendix B. The mean age of the participants was 38.30 years (range 18-82). Studies took place either at universities (39%), workplaces (27%), communities (22%) or online (12%). 79 % of studies were conducted in western countries. The most frequently reported countries were the USA (25%), China (8%), UK (7%), Australia (6%) and Spain (5%). A table summary of included studies characteristics in addition to a list of references can be found in Appendices C and D, respectively.

In terms of bias risk assessment, the randomisation process was found to have a low risk of bias in 81% of the studies (criteria 1.0). Only 24% of the studies had a low risk of bias on deviations from intended interventions (criteria 2.0), mainly due to insufficient information regarding trial protocols. A considerable portion of the studies (73%) were rated as having a low risk of bias due to missing outcome data (criteria 3.0), while only 33% conducted intention-to-treat analysis. Around 44% were deemed to have a low risk of bias in outcome measurement (criteria 4.0), and 31% demonstrated a low risk of bias in the selection of reported results (criteria 5.0), with many lacking information on a pre-specified analysis plan. Overall, 12 studies (7%) were classified as 'Low Risk,' 61 (33%) were categorized as having 'Some Concerns,' and 110 (60%) were classified as 'High Risk.' A summary table of Risk of Bias (RoB) classifications can be found in Appendix E.

4.3.2. Network Geometry

The most frequently reported active interventions included Mindfulness-Based Interventions (n = 72), Physical Activity (n = 33) and Combined Theoretical Psychological Interventions (n

= 25). Table 2 describes the node labels and the number of study arms included for each intervention.

Some studies (n = 66) or study arms (n = 34) were excluded from the NMA following data extraction. For example, on occasion, interventions being compared across multiple arms of the same RCT were not distinct enough to be classified as separate nodes (for example, full versus partial interventions or three good things v gratitude intervention). In these instances, intervention arms which most closely fitted the other interventions in an existing node was included and the others were excluded. For example, for Single PPIs node, 'three good things' or 'character strength' intervention arms were chosen over less standard PPIs such as 'three funny things' or 'gratitude visit'. When an intervention did not fit into any node categories and there were not enough studies to create a new, distinct node, the arm or full study was excluded from NMA, for example 'Mindful-compassion art-based therapy'.

Following assessment of transitivity and local inconsistency, further nodes (e.g. SOCIAL, MEMS and CBT) had to be excluded from NMA (see Appendix G). Additionally, some nodes had to be re-defined using a tighter description to reduce heterogeneity. See Appendix H for detailed rationale of network geometry adaptions made based on initial transitivity assessments.

Table 2 *Summary of final intervention nodes*

Node Label	**Intervention Brief Description**	**N study arms included**
C	No Intervention Control - includes passive control (e.g., sit still), no intervention and wait list and treatment as usual	162
MIND	Mindfulness-based approaches	72
EX	Physical Activity	33
COMB	Multi-Theoretical Psychological intervention (e.g. combination of CBT, PPI and Mindfulness). Clear psychological paradigms combined into one.	25

PPI	Single positive psychology intervention (e.g. three good things, character strengths or best possible self)	20
COMPAS	Compassion focused therapy	17
ED	Educational program or resources e.g. Psychoeducation or health behaviour education	15
YOGA	Yoga	14
MPPI	Multi-Component PPI	8
ACT	Acceptance and commitment therapy	5
NAT	Nature Interventions	4
EXPSY	Physical movement combined with a psychological intervention (excludes yoga)	3

The final network (figure 1) contained 183 studies, 28 direct comparisons, 38 indirect comparisons and 12 interventions. The network was well connected and had only one subnetwork. Acceptance and commitment therapy (ACT) and nature-based interventions (NAT) were not very strongly attached to the network as they were compared to control conditions only.

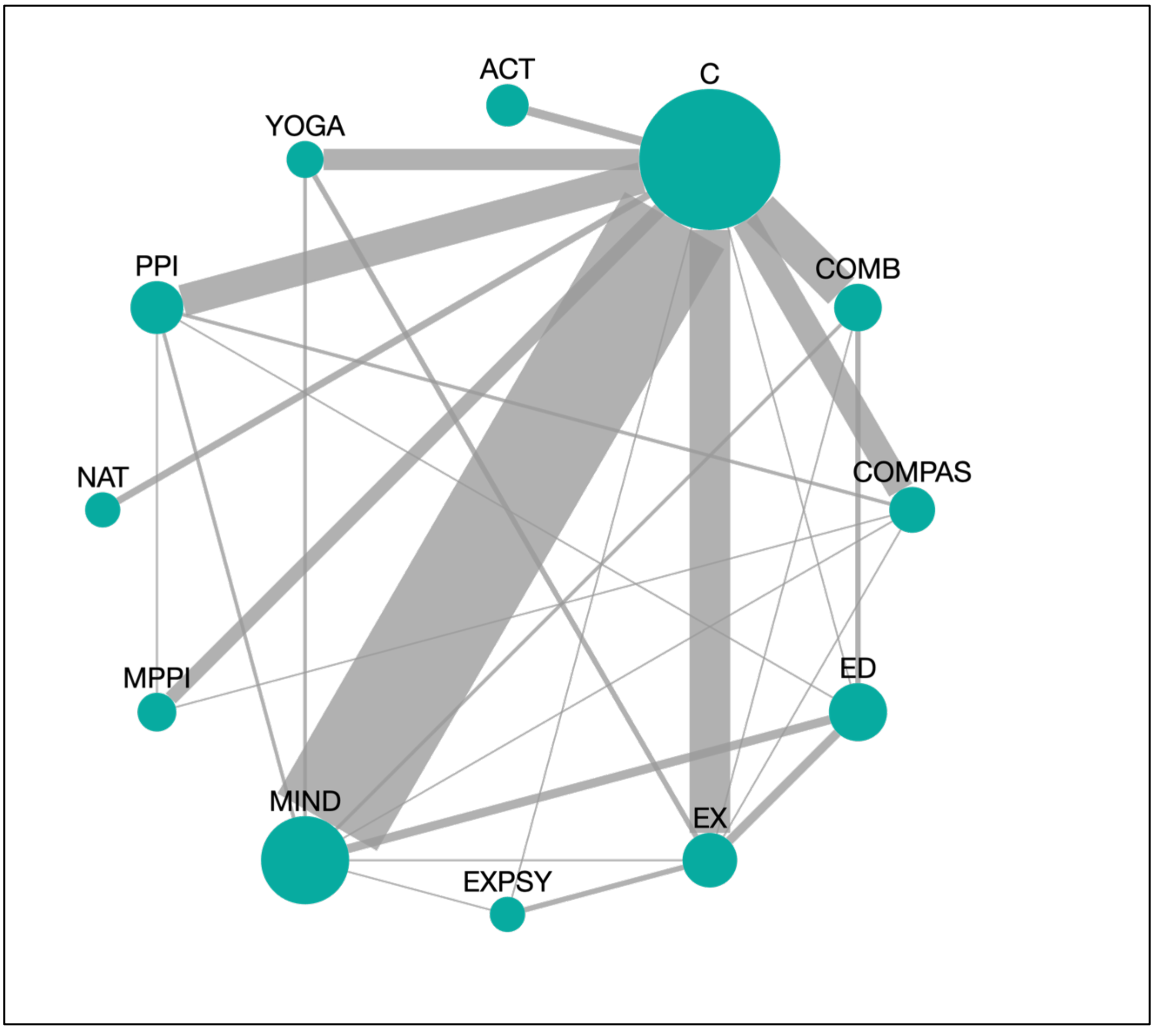

Figure 1 Evidence network graph

Note: thickness of edge represents number of direct comparisons and size of node represents number of studies reporting the intervention. Image created by Lowri Wilkie using package 'netmeta' in R studio.

4.3.3. Transitivity and Consistency

Transitivity: visual inspection of the distribution of potential effect modifiers (Appendix G) indicated that some characteristics (e.g. setting, intensity, delivery, format) were distributed differently across comparisons in the network (for example in some comparisons, 100% of interventions were brief intensity, and in others they were 100% long intensity). However, taken overall the variations in the distribution of effects were not substantial, prompting us to proceed with a statistical examination of inconsistency.

Assessment of local inconsistency: in the final assessment of local inconsistency using the node splitting method (SIDE) (see Appendix J), no comparisons were statistically significant, indicating no inconsistency between direct and indirect estimates.

Assessment of global inconsistency: the design-by-treatment interaction model suggested global inconsistency in the network ($tau^2 = 0.114$; tau = 0.338; $I^2 = 74.2\%$ [70.3%; 77.6%], Q = 65.59, $p < 0.0001$), this supports that a random effects model was appropriate. When consistency was assessed under the assumption of a full design-by-treatment interaction random effects model, Q decreased considerably and between-design inconsistency was no longer significant (Q = 16.53, df = 27, $p = 0.942$). This suggests that a random-effects model at least partly accounted for inconsistency and heterogeneity in the network model.

4.3.4. Network meta-analysis results

All interventions, except for nature-based interventions were statistically significant and therefore more effective than the control condition. A forest plot of the overall network estimates for each intervention are presented in figure 2. A league table of both network and pairwise comparison estimates are presented in table 3.

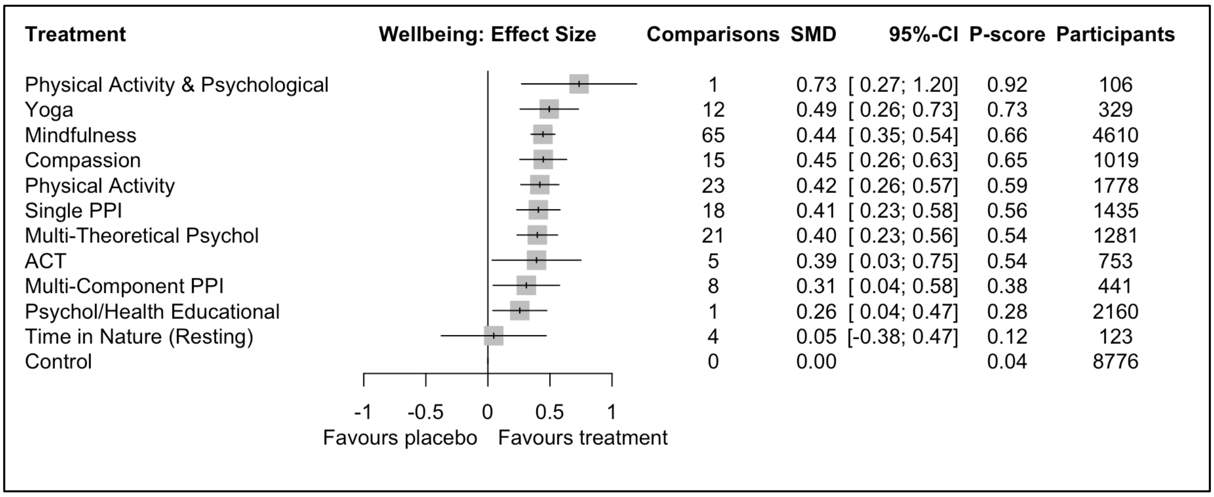

Figure 2 Forest plot presenting overall NMA

Note: contains estimated effect sizes (SMD), 95% confidence intervals, N of comparisons for each treatment, P-score ranking and number of participants. Image created by Lowri Wilkie using package 'netmeta' in R studio.

Table 3 *League table of network v direct evidence*

TREAT	ACT	C	COMB	COMPAS	ED	EX	EXPSY	MIND	MPPI	NAT	PPI	YOGA
ACT	ACT	**0.39 (0.03, 0.75)**	.	.	.	.	.	.	.	.	.	.
C	**0.39 (0.03, 0.75)**	C	**-0.40 (-0.58,-0.22)**	**-0.47 (-0.67,-0.26)**	-0.11 (-0.87, 0.65)	**-0.38 (-0.56,-0.20)**	-0.83 (-1.72, 0.07)	**-0.45 (-0.55,-0.34)**	**-0.31 (-0.59,-0.03)**	-0.05 (-0.47, 0.38)	**-0.40 (-0.59,-0.22)**	**-0.44 (-0.70,-0.18)**
COMB	-0.01 (-0.40, 0.39)	**-0.40 (-0.56,-0.23)**	COMB	.	0.11 (-0.32, 0.55)	-0.15 (-0.91, 0.61)	.	0.03 (-0.58, 0.63)	.	.	.	.
COMPAS	-0.05 (-0.46, 0.35)	**-0.45 (-0.63,-0.26)**	-0.05 (-0.30, 0.20)	COMPAS	.	0.07 (-0.67, 0.81)	.	0.07 (-0.73, 0.87)	-0.08 (-0.89, 0.73)	.	-0.17 (-0.71, 0.37)	.
ED	0.13 (-0.28, 0.55)	**-0.26 (-0.47,-0.04)**	0.14 (-0.10, 0.39)	0.19 (-0.10, 0.47)	ED	-0.27 (-0.63, 0.09)	.	-0.09 (-0.44, 0.26)	.	.	-0.01 (-0.92, 0.91)	.
EX	-0.03 (-0.42, 0.36)	**-0.42 (-0.57,-0.26)**	-0.02 (-0.23, 0.19)	0.03 (-0.21, 0.26)	-0.16 (-0.39, 0.07)	EX	-0.32 (-0.80, 0.16)	-0.13 (-1.02, 0.76)	.	.	.	-0.17 (-0.68, 0.34)
EXPSY	-0.34 (-0.93, 0.24)	**-0.73 (-1.20,-0.27)**	-0.34 (-0.82, 0.15)	-0.29 (-0.79, 0.21)	-0.48 (-0.98, 0.02)	-0.32 (-0.77, 0.13)	EXPSY	0.17 (-0.72, 1.05)	.	.	.	.
MIND	-0.05 (-0.42, 0.32)	**-0.44 (-0.54,-0.35)**	-0.05 (-0.23, 0.14)	0.00 (-0.21, 0.21)	-0.19 (-0.41, 0.03)	-0.03 (-0.20, 0.15)	0.29 (-0.18, 0.76)	MIND	.	.	0.16 (-0.47, 0.79)	0.04 (-0.65, 0.73)
MPPI	0.08 (-0.36, 0.53)	**-0.31 (-0.58,-0.04)**	0.09 (-0.23, 0.40)	0.14 (-0.18, 0.46)	-0.05 (-0.40, 0.29)	0.11 (-0.20, 0.42)	0.43 (-0.11, 0.96)	0.13 (-0.15, 0.42)	MPPI	.	-0.18 (-0.90, 0.55)	.
NAT	0.34 (-0.21, 0.90)	-0.05 (-0.47, 0.38)	0.35 (-0.10, 0.80)	0.40 (-0.06, 0.86)	0.21 (-0.27, 0.69)	0.37 (-0.08, 0.82)	**0.69 (0.06, 1.31)**	0.40 (-0.04, 0.83)	0.26 (-0.24, 0.76)	NAT	.	.
PPI	-0.01 (-0.41, 0.38)	**-0.41 (-0.58,-0.23)**	-0.01 (-0.25, 0.23)	0.04 (-0.21, 0.29)	-0.15 (-0.42, 0.12)	0.01 (-0.22, 0.24)	0.33 (-0.17, 0.82)	0.04 (-0.16, 0.23)	-0.10 (-0.41, 0.21)	-0.36 (-0.82, 0.10)	PPI	.

TREAT	ACT	C	COMB	COMPAS	ED	EX	EXPSY	MIND	MPPI	NAT	PPI	YOGA
YOGA	-0.10 (-0.53, 0.33)	**-0.49 (-0.73,-0.26)**	-0.10 (-0.38, 0.19)	-0.05 (-0.35, 0.25)	-0.24 (-0.55, 0.08)	-0.08 (-0.34, 0.19)	0.24 (-0.27, 0.75)	-0.05 (-0.30, 0.20)	-0.18 (-0.54, 0.17)	-0.45 (-0.93, 0.04)	-0.09 (-0.38, 0.20)	YOGA

Note. Upper right triangle displays effect size (and confidence intervals) estimates based on direct evidence; bottom left triangle displays network estimates. Bold text represents significant at $p < 0.05$.

4.3.5. Treatment Ranking

According to P-score estimates (figure 3), physical movement combined with psychological intervention (EXPSY), yoga (YOGA), mindfulness (MIND), compassion-based interventions (COMPAS), physical activity (EX), single PPIs (PPI), multi-theoretical psychological interventions (COMB) and acceptance and commitment therapy (ACT) were ranked as the most effective treatments.

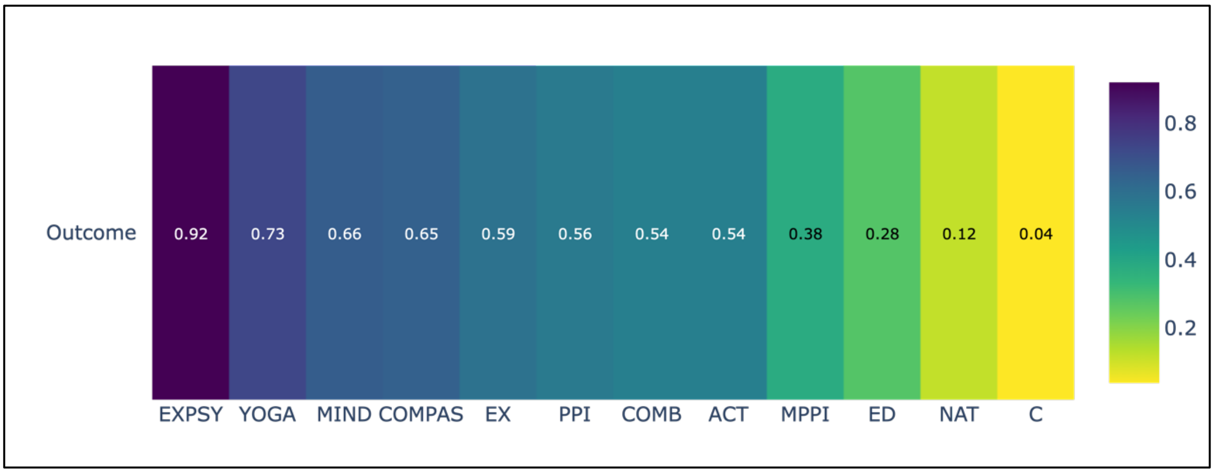

Figure 3 Interventions ranked according to P-scores

Note: Image created by Lowri Wilkie using package 'netmeta' in R studio.

4.3.6. Additional analyses

Sub-group analysis found no statistically significant differences in the pooled effect of all active treatments versus inactive control across delivery mode of intervention (in-person, online platform, self-guided instructions, or live online video conferencing), intervention format (individual v group), setting of intervention (university, workplace, community or online) or country in which study took place (Western v non-Western). A statistically significant subgroup difference (p = 0.001) was found for intensity of intervention (brief, short, medium, or long), whereby medium length interventions (5-8 weeks) resulted in the largest effect size estimate (0.57 [0.69; 0.45], $I^2 = 81.9\%$) across all active interventions versus control. Full results for all sub-group analyses are presented in Appendix K.

Sensitivity analysis using pairwise comparisons of all active interventions versus control also found no statistically significant subgroup differences in type of wellbeing outcome measure used (SWB, resilience, mindfulness, or positive affect), waitlist control (waitlist v no intervention control), or risk of bias (low, medium, or high). Full NMA analyses were conducted (see Appendix L for full sensitivity analysis results) using three alternative models; 1) excluding studies with high risk of bias 2) using subjective wellbeing as only outcome measure and 3) excluding small studies (defined as studies with included arms totalling an N size smaller than the lower quartile of included studies: N = 45).

Exercise with psychological intervention (EXPSY), yoga (YOGA) mindfulness (MIND) and compassion (COMPAS) were consistently ranked in the top five interventions across all sensitivity analyses. Physical activity (EX), single PPIs, combined psychological interventions (COMB) and psychol/health education (ED) all remained significantly more effective than controls across all sensitivity analyses.

In the SWB model, findings were comparable to the main NMA, most treatment rankings remained constant, and the same interventions remained significantly more effective than controls. In the low-medium risk of bias model, multi-component PPIs were no longer significant compared to controls (SMD = 0.36, CI -0.17: 0.89). When small studies were excluded from NMA, the findings were also consistent with the main model, except for yoga which changed position to rank as most effective (SMD = 0.67, CI 0.35; 0.98), with EXPSY moving to second place (SMD = 0.72, CI 0.14; 1.30). ACT was the only substantially inconsistent intervention across sensitivity analyses. ACT was ranked as more effective in the low-medium bias model (SMD = 0.51, rank = 5th) and when subjective wellbeing (SWB) was used as the only outcome measure (SMD = 0.50, rank = 2nd). ACT was no longer significantly different to control in the model excluding small studies (SMD = 0.22, rank = 10th). The likely causes of discrepancies will be explored in discussion.

4.3.7. Certainty of evidence

Regarding certainty of evidence, 71% of comparisons were rated as moderate, 26% of comparisons were rated as low and 3% comparisons were rated as very low. The certainty of evidence for each network estimate is reported in Appendix M. There is no clear trend regarding which intervention comparisons contain low or very low certainty of evidence, suggesting bias is moderately evenly distributed.

4.3.8. Publication Bias

The funnel plot of comparisons using control as reference had asymmetry towards a positive effect size as standard error (SE) increased (Appendix N). Using Egger's test, a significant relationship was observed between the standard error and bias ($t(171) = 3.66$, $p = 0.0003$). This suggests that smaller studies (less precise estimates with higher SE), may be published more frequently if they report positive results, whilst studies with negative or null findings may be less likely to be published. The implications of this are noted in the discussion.

4.4. Discussion

Our systematic review and NMA represents an innovative effort to advance the understanding of the relative impacts of wellbeing interventions, a topic of great research interest and debate (Bolier et al., 2013; Lim & Tierney, 2022; Seligman et al., 2005; Sin & Lyubomirsky, 2009; Weiss et al., 2016). We aimed to assess the comparative effectiveness of wellbeing-focused interventions, with the intention of broadening our scope beyond psychological interventions to actively compare interventions from across wellbeing domains.

Critically, our comprehensive approach moved beyond the traditional confines of pairwise meta-analyses to utilise indirect as well as direct head-to-head comparisons. In doing so, we integrated insights from randomised controlled trials (RCTs) on psychological interventions, physical activity, and nature-based interventions into a single analytical framework. 'Movement combined with psychological intervention' was ranked as the most effective intervention, while mindfulness, yoga, and compassion-focused interventions were ranked as highly effective. Physical activity performed on par with positive psychology interventions, multi-theoretical psychological interventions and Acceptance and Commitment Therapy (ACT).

Our study makes a novel contribution by shedding light on the potential synergies between approaches. According to our findings, the combination of movement and psychological intervention shows significant promise in promoting wellbeing. This node included interventions such as awe walks, (Sturm, 2022); meditation combined with brisk walking, (Edwards & Loprinzi, 2019); and walking groups with positive psychology-focused coaching (Lee et al., 2019). However, it's important to note that this conclusion is drawn from a limited pool of evidence, as the node consisted of only three studies. Among these, two were deemed to have a high risk of bias, and the confidence interval for the pooled effect size was wide (SMD=0.73, CI 0.27-1.20). Despite these limitations, this combination consistently ranked as a top intervention across all sensitivity analyses. Additionally, most comparisons involving this intervention were rated as moderate in certainty according to CINEMA ratings. We had hoped to find studies including diverse forms of exercise combined with psychological interventions, however the studies included were limited to walking only, highlighting a need for further research on this topic. Future research should prioritise rigorous RCTs to further investigate the potential synergistic benefits of combining psychological and movement-based interventions, as well as to explore which combinations are most effective.

Our findings reaffirm the robustness of mindfulness-based interventions in improving wellbeing. Mindfulness consistently maintained a prominent position, ranking among the top four interventions in all sensitivity analyses. The narrow confidence interval of the pooled estimate (SMD = 0.44, 0.35; 0.54), supported by an extensive body of direct evidence (n = 73), supports the consensus in the literature that mindfulness as a consistently effective intervention for enhancing wellbeing within the general population (Khoury et al., 2013, 2015; Sedlmeier et al., 2012). Compassion-focused interventions, which also share overlapping characteristics with mindfulness (Gilbert, 2009, 2014), ranked fourth place in effectiveness and remained consistent across most sensitivity analyses. Yoga also consistently featured among the top three most effective interventions across all analyses. It is noteworthy that mindfulness and yoga share common techniques; most forms of yoga share common elements, including controlled breathwork (pranayama), physical postures (asanas) and meditation (dhyana) (Pascoe et al, 2015). This again underscores the potential of integrated mind and body approaches in the promotion of psychological wellbeing.

In addition, physical activity had a moderate effect size (SMD = 0.39) and consistently ranked among the top six interventions. Notably, its rank and effect size estimate were comparable to those of Positive Psychology Interventions (PPIs), suggesting that exercise may be similarly effective in improving wellbeing outcomes. These findings highlight that there are multiple pathways and room for a personalised approach to wellbeing promotion and that individuals may choose an intervention that aligns best with their preferences and needs. This also further emphasises the potential benefits in combining physical movement with psychology interventions.

The effectiveness of Acceptance and Commitment Therapy (ACT) displayed variations in sensitivity analyses. There was only a limited number of studies (n=5) reporting ACT outcomes. Notably, among these, one study reported no significant difference for ACT compared to a control group (Danitz, 2014) which increased the confidence interval of the pooled effect estimate. In this study, wellbeing was assessed using the Philadelphia Mindfulness Scale which contains two sub-scales reported separately. The decision was made by reviewers to extract the ‘awareness’ subscale, which is framed in a positive manner and assesses ability to be present to experiences e.g. "I notice the emotions that I am experiencing from moment to moment”. The acceptance subscale is negatively framed and assesses degree to which individuals engage in self-criticism e.g. "I am critical of myself for having irrational or inappropriate emotions” and thus was deemed less appropriate to our definition of wellbeing. The study found that ACT significantly improved acceptance subscale but not awareness. In addition, because the post-measure score was extracted, as opposed to a change in mean score, ACT appeared to have a less favourable result than the control group for awareness due to baseline differences. In sensitivity analyses, upon the exclusion of this study, the estimate for ACT increased substantially. Furthermore, the ACT node was poorly connected to the network, as studies only compared ACT with control arms, so nearly all comparisons were indirect estimates only. Despite these complexities, our confidence in the overall effect size estimate and ACT's ranking in our primary NMA model (Figure 2) remains robust and is reinforced by the inclusion of a low-bias study on ACT (Viskovich, 2020), which featured a substantial participant sample (1162 participants) and aligned closely with our overall NMA pooled effect size (SMD = 0.37, CI 0.26; 0.49), affirming the reliability of our findings.

Surprisingly, nature-based interventions were not significantly more effective than control conditions. This node was made up of four studies including: nature activity program (observing/drawing nature), horticultural therapy, photographing nature and being in nature without electronic devices. Critically, this node was poorly connected to the network and relied substantially on indirect evidence for most comparisons. Overall, the quality of evidence for nature interventions ranged from medium to high risk of bias, primarily due to the inclusion of smaller-scale studies. Additionally, we were unable to locate sufficient data to create a node specifically for ‘physical activity in nature.' We hypothesise that such interventions, which involve physical activity within natural settings, may have a synergic effect on wellbeing.

Hence, future research might use larger scale RCTs to examine the potential benefits of exercise in natural environments.

Our network meta-analysis (NMA) also surprisingly indicated that multi-component Positive Psychology Interventions (MPPIs) were less effective than individual Positive Psychology Interventions (PPIs), with the Three Good Things (3GT) gratitude intervention being prominently featured within the single PPI category. This outcome contradicted the findings of a large meta-analysis (Agteren et al, 2021) which favoured MPPIs over single PPIs. A potential explanation for this is that our analysis included a study which directly compared a PPI with a MPPI and reported no significant difference in their efficacy on wellbeing (Neumeier et al., 2017). The slightly larger effect size estimate for single PPIs in our analysis, however, should not necessarily imply a clinical preference for them over MPPIs. We found no statistically significant difference between single and multi-component PPIs, and they had overlapping confidence intervals, meaning contextual factors will play a vital role in clinical intervention selection (Ciarrochi et al., 2022).

Originally, we aimed to include social identity building interventions in the NMA network, but our systematic literature review revealed significant clinical heterogeneity within this category, which impacted on our capacity to synthesise such studies into a single node of evidence. Social interventions identified from our search included a focus on diverse topics, including politics, current events, emotional peer support, and sharing parenting stressors, and comparisons consistently showed a higher average participant age than other intervention nodes, indicating demographic disparities, adversely impacting on the assumption of transitivity. Social identity building interventions were therefore excluded from our NMA. This decision was driven by our commitment to maintaining the validity and reliability of our findings, given the potential compromise in integrity due to the heterogeneity and demographic differences within this category.

Ultimately, the strength of NMA relies on the quality of the included RCTs, and thus our findings are impacted by limitations inherent across wellbeing intervention research including often high individual study risk of bias. The findings revealed only 33% of included studies employed an intention-to-treat analysis. This shortfall raises a need for more rigorous methodological standards in future RCTs. To build a stronger evidence base in wellbeing science, future research should prioritise intention-to-treat approaches and ensure the inclusion of appropriate control groups. Additionally, there are substantial opportunities to address gaps in the literature by exploring multi-component interventions that combine elements from diverse domains.

To enhance the reliability of our conclusions, we took several measures to ensure the reliability of our conclusions such as including only RCT designs, peer reviewed research and valid measurement scales. The observed asymmetry in funnel plots warrants a need for caution and further exploration, however this doesn't conclusively prove publication bias, given that comprehensive sensitivity analyses, excluding studies with low sample sizes and high risk of bias, yielded consistent results with the primary analysis, indicating robust conclusions. While excluding grey literature maintains methodological rigour, future analyses may benefit from its inclusion to help mitigate any potential publication bias. Additionally, in sensitivity analyses, no discrepancy was found between the different types of wellbeing measures used. This consistency implies that the choice of a particular category of wellbeing measure (positive affect, mindfulness, subjective wellbeing, resilience) didn’t impact the conclusions drawn from the analysis.

Whilst opting to exclude participants with clinical disorders limited the generalisability of intervention rankings to broader patient groups, we concur that this was a sensible choice given the considerable heterogeneity observed across the included studies and interventions. This approach ensured a more homogeneous overall sample across comparisons and minimised the potential influence of confounding factors such as health behaviours, socioeconomic status and comorbidities which often vary between clinical and non-clinical populations. Nonetheless, we acknowledge that this decision constrains the utility in using findings to guide clinical decision-making. Therefore, now this foundational work has been conducted, we recommend that future research builds upon these findings by replicating this study's methodology, tailoring to clinical populations.

Finally, the study of wellbeing interventions presented in this chapter highlight that engaging with physical activities, having access to safe spaces to exercise, attending group therapeutic programs and engaging in mindfulness or yoga classes, for example are important for supporting individual wellbeing. However, these are not accessed equally across society, and such ‘wellness’ lifestyles are commonly luxuries requiring financial resources, time and knowledge to participate – factors which reflect broader sociostructural disparities. Variables such as income, disability, geographic location, and structural inequalities fundamentally shape individuals' capacity to engage in wellbeing-enhancing behaviours (Ballas et al, 2007; Marmot et al, 2005; Tzu-Hsuan Chen, 2021). While robust research methodologies, including RCTs remain crucial for identifying effective interventions, addressing structural barriers that limit access is equally imperative. This NMA provides valuable evidence of what works; however, achieving equitable improvements in wellbeing requires simultaneous efforts to understand and tackle inequalities that restrict access to these interventions.

4.5.Conclusion

In conclusion, our work sheds light on novel avenues for advancing wellbeing in the general population. Our findings underscore the potential of holistic approaches, whereby the synergic combination of psychological interventions with physical activity emerges as a key potential strategy to enhance wellbeing. Yoga's consistently strong ranking also highlights this synergy. Our findings highlight the need for more RCTs investigating these integrated interventions, emphasising the value of promoting positive health behaviours and lifestyle changes alongside psychological interventions. Additionally, there is a need to explore through well designed interventions and RCTs whether combining and conducting these interventions in a nature-based setting provides additional benefits. Finally, whilst this chapter has highlighted the potential of individual-focused interventions to enhance wellbeing, it also acknowledges the limitations of these approaches in addressing the broader socio-structural determinants of wellbeing. Recognising the role of community-based resources and social capital in fostering access to wellbeing promoting behaviours and interventions, Chapter Five shifts focus to a mixed-methods evaluation of Local Area Coordination, exploring how community-driven approaches can address disparities and enhance access to wellbeing-promoting opportunities.

Chapter Five

5. Improving Wellbeing Through Local Communities: A Mixed Methods Study on the Role of Relationship Building.

Abstract

Given the rising demands of chronic conditions and mental health challenges, there is an urgent need to reduce burden on formal, statutory services. Local communities are under-utilised yet offer many opportunities to facilitate the key determinants of health and wellbeing. Local Area Coordination (LAC) provides a practical, asset-based approach in which purposefully recruited coordinators meet and build relationships with community members, use their strengths and leverage community assets to help them build their version of ‘the good life’. Here we report on the impact of LAC on wellbeing outcomes and explore potential mechanisms underpinning the approach. A rigorous mixed-methods design was implemented including data from psychophysiological synchrony, a quantitative survey, and qualitative ripple effects mapping. The presence of in-phase cardiac synchrony was found during conversations between coordinators and community members, suggesting that co-regulation in the autonomic nervous system may underpin interaction. Survey data analysed using partial least squares structural equation modelling found that relationship rapport significantly predicted community integration, which in turn, predicted the wellbeing of community members. Longer meeting durations predicted improved relationship rapport, whilst the frequency of meetings did not. Qualitative feedback indicated that the person-centred approach was a key mechanism underpinning its success and that fostering a safe, trusting relationship with community members is crucial for supporting positive behaviour change. Overall, Local Area Coordination’s community-led approach is a promising opportunity to harness community assets, empower individuals, and improve health equality by building wellbeing in people who often have the least opportunity to do so.

5.1.Introduction

While Chapter Four highlighted the potential of individual-focused interventions for enhancing wellbeing, it also underscored the limitations of these approaches in addressing broader, socio-structural determinants of health. With rising global rates of chronic conditions, mental health disorders, and multi-morbidities (Wagner & Brath, 2012), alongside worsening health inequalities in the UK (Anderson et al., 2021), health and social care systems must urgently adapt to meet evolving population needs. Health and social care models designed to support individuals only at the point of crisis or illness can only respond by further increasing demand, which is neither financially sustainable nor morally ideal. To tackle these challenges, a shift toward preventative, community-based approaches is essential - empowering individuals to live healthier and more connected lives within their local communities. Chapter Five explores this shift through a mixed-methods evaluation of Local Area Coordination, examining how integrating community resources can help promote sustainable wellbeing.

The emerging science of wellbeing has highlighted that people have tremendous capacity to promote their own health and wellbeing through self-connection, social connection, and nature-connection (A. Kemp & Edwards, 2022). Communities offer an abundance of opportunities to promote key determinants of wellbeing through faith communities, sports and exercise clubs, leisure activities, social and support groups, community centres or parks. For example, Parkrun, a free weekly 5km running event in the UK, has been shown to increase physical activity, improve mental health, and foster social connections (Stevinson & Hickson, 2014). Similarly, Men's Sheds provide spaces where men, especially older or socially isolated individuals, can gather to work on practical projects, increase physical activity, sense of purpose and sense of community (Ormsby et al, 2010). Both exemplify how grassroots community programs can address health and wellbeing needs but require continued support to reach vulnerable populations.

Community-based approaches to health and wellbeing have also begun to gain prominence in UK government strategies, reflecting a shift towards more local, integrated, person-centered care. For example, the Welsh Government's A Healthier Wales strategy, emphasises the importance of local, community-based services that focus on prevention, early intervention, and a holistic understanding of health (Welsh Government, 2018). Similarly, Public Health England's strategic direction aims to prioritise public health interventions that empower individuals to manage their own health by engaging in community resources (Public Health England, 2019). One of the most prominent community-based approaches is social prescribing, where healthcare providers refer individuals to non-clinical services and community activities such as exercise groups, art classes, or social clubs, aiming to improve overall wellbeing by addressing social and emotional needs. Mossabir et al. (2015) highlights the barriers to implementing social prescribing including role ambiguity for link workers in surgeries, inappropriate referrals for severe mental health conditions, and the difficulty of identifying suitable patients. Individuals with more severe health conditions or greater dependency face more barriers to engagement, such as health-related limitations or being already involved with multiple services. Patient-reported barriers to social prescribing interventions include transport, literacy issues and the appropriateness and accessibility of services (Brandling & House, 2007; Grayer et al., 2008). Without tailored individual support mechanisms to help these individuals access community resources, social prescribing is unable to integrate those with the most needs, further perpetuating health inequalities.

Local Area Coordination (LAC) is an approach that can help address some of these challenges. LAC is a positive, person-centred approach (see figure 4) that aims to strengthen communities and reduce pressure on statutory services by supporting people to find local resources and solutions to their challenges. Purposefully recruited coordinators are embedded within neighbourhoods to leverage community assets, identify, and build relationships with individuals who might need support. LAC helps people to live their version of the 'Good Life' through their aspirations, strengths, contribution, and connections. LAC is a positive, person-centred approach which understands the whole person's context beyond the specific challenge or illness they are experiencing. Evaluations of LAC's approach have found it to be particularly successful in creating sustainable support networks. Darnton (2018) found that LAC in the Isle of Wight led to increased health confidence and wellbeing over an 8-10 week period. Moreover, Roderick et al. (2016) conducted a social network analysis of LAC in Swansea, and reported that coordinators helped build lasting connections between community members and services. LAC's strength lies in its ability to facilitate long-term community engagement, reducing the reliance on statutory services while fostering self-reliance. As Lunt et al (2021) argue, this model aligns with the broader shift in health policy towards co-production, empowering individuals to be active participants in their own health and wellbeing management and emphasising collaboration between individuals, communities, and service providers to develop personalised solutions for wellbeing. However, despite LAC's thirty-year history, there is still a limited body of peer-reviewed research assessing its psycho-social outcomes, with most evaluations focusing on economic benefits. The aim of the present study therefore is to investigate LAC using a rigorous, mixed methods design with a specific focus on wellbeing.

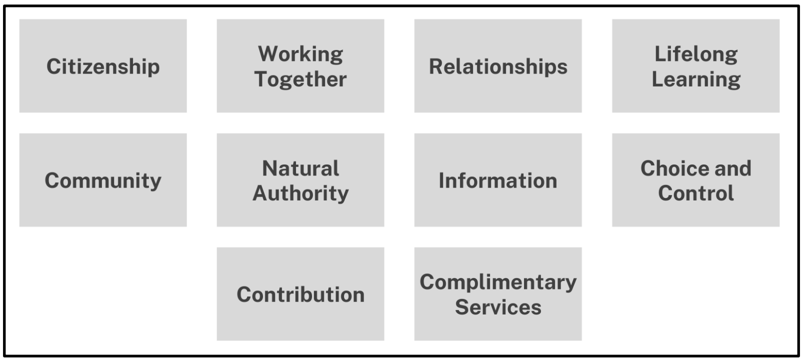

Figure 4 The 10 Local Area Coordination Principles (Bartnik & Broad, 2021)

Note: Image created by Lowri Wilkie using Microsoft Word.

Aligned with LAC's positive approach and drawing from the principles of positive psychology (Seligman, 2011), we characterise wellbeing, not as merely the absence of ill-being, but the presence of positive and adaptive functioning that contributes to a fulfilling and satisfying life. In recent years, there has been an increasing effort to broaden the scope of wellbeing science to encompass higher levels of scale beyond the individual (Kern et al., 2020; Lomas et al., 2020), and target groups and systems within which individuals are embedded (Waters et al., 2022) including communities, workplaces (Lomas et al., 2019; Theeboom et al., 2014), universities (Oades et al., 2011), cities (Ballas, 2013), and nations (Antó et al., 2021; Waters et al., 2022). The GENIAL model (A. Kemp et al., 2017; A. H. Kemp & Fisher, 2022; Mead et al., 2019, 2021) is an interpretative framework of the wider published literature which summarises the core determinants of wellbeing as being influenced by factors related to (1) the self (e.g., effective emotional regulation, positive emotions, meaning and purpose in addition to the presence of positive health behaviours such as sleep, diet and exercise); (2) others (e.g. including personal relationships, social capital, social cohesion and social identity); and (3) the planet (e.g. nature connectedness). The framework also places significance on the moderating role of socio-structural factors (e.g., education, income, culture, occupation, security, political stability, and place of residence) and a mediating role of behaviour change on health and wellbeing (A. Kemp et al., 2017; A. H. Kemp & Fisher, 2022; Mead et al., 2019, 2021).

Therefore, we define wellbeing as the experience of connection to ourselves, others, and the planet, bridging the often-isolated concepts of individual, collective, and planetary wellbeing.

The GENIAL framework also proposes that the vagus nerve – the main component of the parasympathetic nervous system – is a key psychophysiological underpinning of wellbeing and a structural link between physical and mental health (Wilkie et al., 2022). Vagal function is commonly measured via Heart Rate Variability (HRV), the variation between consecutive heartbeats (Acharya et al., 2006), reflecting parasympathetic nervous system functioning (A. H. Kemp & Quintana, 2013). Critically, research on relationships including romantic couples and client-therapist dyads have identified the presence of HRV synchrony during interactions, and this synchrony has been interpreted to reflect the process of emotional co-regulation and may be an index of relationship quality (Coutinho et al., 2021; Koole & Tschacher, 2016; Tschacher & Meier, 2019). Given that natural relationship building is an important feature of LAC's approach and previous findings have identified a so called 'golden triangle' of listening, trust and time as being critical for underpinning LAC's success (Mason et al., 2021), we aim to examine whether cardiac synchrony is present during interactions between coordinators and the community members they support, and whether this synchrony may reflect relationship quality.

The overall aims of the present study are therefore as follows: 1) to determine the presence of physiological autonomic synchrony between coordinator and community member dyads and whether such synchrony is a physiological correlate of relationship quality, (2) to quantitatively investigate the pathways to community integration and wellbeing using structural equation modelling, and (3) qualitatively explore the reported impacts of LAC on individual and collective wellbeing using ripple effects mapping. Specific hypotheses are summarised in Box 1.

Box 1: Summary of hypotheses

H1: Physiological synchrony will be present in coordinator-community member dyads

H2: Physiological synchrony in coordinator-community member dyads will significantly correlate to self-reported relationship quality

H3: The amount of regular contact between community members and their coordinators (both frequency and duration) will significantly predict perceived relationship quality.

H4: Perceived relationship quality will significantly predict the community members' sense of community integration.

H5: Perceived relationship quality will significantly predict the community member's wellbeing

H6: The length of time the community member has known their coordinator will significantly predict their sense of community integration

H7: The community member's sense of community integration will significantly predict their wellbeing.

Part 1: Physiological Synchrony

5.2.Method

5.2.1. Design

Our research is characterised by a mixed, concurrent (also known as convergent), equal status design (Dawadi et al., 2021; Leech & Onwuegbuzie, 2009). This research design is also sometimes referred to as a 'concurrent triangulation design' whereby multiple components are collected at the same timeframe (concurrent) with equal weight (status) (Creswell & Clark, 2011). Quantitative and qualitative elements will be collected and analysed separately, drawing on combined insights at the data interpretation stage. The purpose of methodological triangulation is to obtain complimentary data on the same topic to gain a deeper understanding of the research question. We adopt a critical realism stance to mixed methods based on a realist ontology and subjectivist epistemology. Critical realism bridges the positions of positivism/empiricism and constructivist/interpretivism, by assuming that there is a real social world that can be objectively observed, but that observation is simultaneously shaped by personal, social and cultural frames (Mukumbang, 2023). Critical realism also aligns best with a concurrent/convergent mixed methods design, as this stance allows retroductive theorising (analysing the two components independently and interpreting the results together in an iterative manner) (Mukumbang, 2023).

5.2.2. Participants

All LAC coordinators working in Swansea, UK at the time of study initiation were invited to take part in the study. One requirement was that they were able to find a community member they were currently involved with who was also willing to participate. Six coordinators and eight community members participated, forming 8 dyadic pairs. There were 10 female and 4 male participants. Participant age ranged from 30 to 85 years old (M=51.43, SD=11.33) and all the sub-sample identified as being of white ethnicity.

5.2.3. Materials

Data was collected via Polar H10 strap monitors. The H10 is highly correlated with hospital grade electrocardiogram (ECG) monitors ($r = 0.997$) (Gilgen-Ammann et al., 2019). Real-time data was captured by connecting the monitors to 'Heart Bond Local' app for Apple iPhone using Bluetooth. Heartbond Local (2022) is a smartphone app created by author PG for the recording, signal processing and calculation of HRV synchrony measures from two users in real-time. Additional participant demographic questions necessary to accurately interpret HRV data were also collected including when the participant last exercised, ate, consumed caffeine and alcohol, slept and smoked cigarettes, as well as understanding any blood pressure, heart, or respiratory conditions (Fatisson et al., 2016). Participants also completed survey measures (described in part two of this chapter).

5.2.4. Procedure

Data collection either took place in a private office space at Swansea University or at the community members' own homes in the community when this was appropriate. Participants firstly completed survey measures with an integrated consent form (see part two of study). Once HRV monitors were correctly fitted, the researcher left the room allowing the dyadic pair to continue a normal conversation, involving the community member updating the coordinator on their life since they last met.

5.2.5. Analysis

Signal pre-processing was conducted to obtain cardiac measures (heart rate, low frequency HRV and high frequency HRV). A despike algorithm was applied, whereby any value more than +/-20 bpm between beats was replaced with running average HR (also known as interpolation of degree zero) (Salo et al., 2001) for a 30 second window. Recordings were also manually examined visually for ectopic beats and artifacts to check the algorithm. Discrete Fourier Transform was computed using despiked HR every second using a running 32s window. High frequency bin values ranged from 0.157 - 0.406 Hz and low frequency values ranged from 0.063 - 0.157 Hz.

The statistical software Surrogate Synchrony (SUSY) written in R was used to quantify physiological synchrony (http://www.embodiment.ch) (Tschacher & Haken, 2019; Tschacher & Meier, 2019) and the presence of synchrony was calculated by testing the effect size of dyadic synchrony scores against zero using a one sample t-test. Additional methodological detail on quantification of physiological synchrony is provided in Appendix O.

5.3.Results

5.3.1. Presence of Synchrony

An example of low frequency HRV synchronisation taken from one dyad, plotted visually is available in Appendix P. Both non-absolute heart rate and low frequency heart rate variability were significantly higher than zero (see table 4), suggesting physiological synchrony was present in both.

Table 4 *Descriptive Statistics and One Sample T-Test Results for Presence of Synchrony*

Measure	Mean	*SD*	*t*	*df*	*p*
ESabs HR	0.067	0.139	1.365	7	0.214
ESnoabs HR	0.155	0.114	3.861	7	0.006*
ESabs LF	-0.040	0.133	-0.845	7	0.426
ESnoabs LF	0.174	0.136	3.634	7	0.008*
ESabs HF HRV	0.032	0.195	0.464	7	0.656
ESnoabs HF HRV	0.057	0.086	1.880	7	0.102

5.3.2. Assessment of Correlation between Synchrony and Self-Reported Alliance

The assessment of correlation between synchrony and self-reported alliance was analysed using non-absolute synchrony only, as synchrony was only present in non-absolute values. A Spearman's correlation revealed that ES_{noabs} measures of physiological synchrony were not significantly correlated with coordinator nor community member relationship alliance scores (see Table 5). Thus, H2 was not supported (see table 6).

Table 5 *Results of Spearman's rho correlation of synchrony with self-reported alliance*

Variable		**ES_{noabs} HR**	**ES_{noabs} LF HRV**	**ES_{noabs} HF HRV**
Coordinator Alliance (WAI-SR)	Spearman's rho	0.313	0.229	-0.349
	p-value	0.450	0.586	0.396
Participant Alliance (WAI-SR)	Spearman's rho	-0.323	0.539	0.311
	p-value	0.435	0.168	0.453

*Below 0.05 significance threshold

Table 6 *Part one hypothesis testing*

Hypotheses	Is Hypothesis Supported?
H1: Physiological synchrony will be present in coordinator-community member dyads	Supported

H2: Physiological synchrony in coordinator-community member dyads will significantly correlate to self-reported relationship quality	Not supported

Part 2: Cross-Sectional Survey

5.4.Method

5.4.1. Participants

A cross-sectional survey was conducted across 12 regions of England and Wales in which were implementing Local Area Coordination in collaboration with the LAC network (https://lacnetwork.org/). Participants were community members living in regions where LAC was implemented, and who had any involvement with their coordinator at the time of study. They were recruited via posters and dissemination of study information through coordinators' own network, word of mouth and social media platforms. A total of 52 participants completed a cross-sectional survey, comprising 36 females, 14 males and 1 non-binary. Age ranged from 18-65+ and all reported being of white ethnicity. 33% of respondents reported experiencing loneliness, 33% reported having a mental health condition and 25% reported a physical health condition. When asked to rank between 1-10 where on a slider they felt best represented their social standing the mean ranking for their community standing was M=4.91 (SD=2.41) and for their overall standing in the country was M=5.24 (SD=2.04).

5.4.2. Survey Measures

Demographic information including age, gender, and ethnicity was collected. One single item (In general I would say my health is…) was taken from the Happiness Index (Musikanski et al., 2017) to measure overall health via a 5-point Likert scale. The MacArthur Scale of Subjective Social Status (SSS) (Adler et al., 2000) was used as an indicator of socioeconomic status. Respondents were also asked to identify whether they had a learning disability, physical health condition, mental health condition, experienced loneliness, substance dependency, homelessness, or were a migrant, asylum seeker, refugee or immigrant to the UK. They were also asked how long ago they were introduced to LAC, how frequently they engage with their coordinator and the average duration of their interactions. Wellbeing was measured using the Warwick–Edinburgh Mental Wellbeing Scale—Short Version (SWEMWBS), a measure that correlates extremely well to the original scale (0.95) (Fat et al., 2017). Community integration was measured using The Brief Sense of Community Scale (BSCS) (Peterson et al., 2008). The BSCS has high internal consistency, cronbach's alpha = .92 overall (range .77-.94), and factorial validity (Peterson et al., 2008). Perceived relationship quality with coordinator was measured using the Working Alliance Inventory – Short Revised (WAI-SR). This was initially developed to measure therapist-client alliance. Whilst the relationship between coordinators and the community members differs to a therapist-client relationship, the WAI-SR measure was chosen as it most accurately captures the nature of the relationship (e.g., respect, shared goals and affective bond) compared to relationship measures designed for romantic partners or friendships. The WAI-SR has good reliability (0.91-.097) (Hanson et al., 2002), and has been replicated in community settings (Munder et al., 2010).

5.4.3. Survey Procedure

The survey was developed using Qualtrics software (https://www.qualtrics.com) and contained an integrated information sheet and consent form. Responses were collected between June and September 2022.

5.4.4. Survey Analysis

Partial Least Squares – Structural Equation Modelling (PLS-SEM) was used to analyse the survey data. PLS-SEM is particularly suitable for smaller sample sizes and complex models, as it is a non-parametric method that allows flexibility in including or excluding latent variables or indicators (measured survey items) to improve predictive relevance (Hair et al., 2019). Deductive quantitative methods such as SEM align well with the critical realist stance of the study, as it supports the iterative refinement of theoretical models (Brown et al., 2021; Mukumbang, 2023). The theoretical model was constructed using Smart PLS 4.0 software (Ringle et al., 2022) (see Figure 5). PLS-SEM does not assume normal data distribution, making it appropriate for a smaller sample size. Following the "10-times rule," which suggests that the minimum sample size should be 10 times the largest number of structural paths directed at a construct (Hair et al., 2011), the study initially met the requirement with a sample size of

50. However, during the analysis process, one latent variable had to be split into two separate variables, resulting in six structural paths. Given the "10-times rule" in PLS-SEM (Hair et al., 2011), this adjustment meant that an ideal sample size would have been 60 participants. While the sample size of 52 was slightly below this revised threshold, this slight shortfall may have marginally affected the statistical power, slightly increasing the risk of Type II errors. However, the difference was minimal and unlikely to significantly impact the overall results.

5.4.5. Rationale for the Structural Model

The structural model was developed based on the GENIAL framework and social support theories, which highlight the interconnectedness of social relationships and wellbeing (A. Haslam et al., 2009; Jetten et al., 2014; A. H. Kemp et al., 2017; A. H. Kemp & Fisher, 2022; Mead et al., 2021; Williams et al., 2020). In the context of LAC, community integration is likely a significant predictor of wellbeing because evidence shows social cohesion and social capital - which describe the collective dimensions of social ties - positively influence individual health and wellbeing through providing social support, especially in deprived neighbourhoods and for individuals with chronic illnesses (Kawachi et al., 1997, 1999; Waverijn et al., 2014, 2017).

Unlike some community ‘referral’ based approaches, LAC emphasises relationship building between coordinators and community members. High-quality relationships, characterised by compassion, patience, and 'purposefully unprescribed' conversations, are predicted to be essential for bridging effective community integration (Bartnik & Broad, 2021; Mason et al., 2021). Regular contact with coordinators is hypothesised to enhance relationship quality, as consistent interactions foster trust and rapport. As a test of the efficacy of LAC as an approach, we also predict that the amount of time spent engaging with LAC, will predict how integrated the person is to their community. By incorporating these constructs, the model aims to reveal how LAC may enhance community integration and wellbeing through relationship rapport.

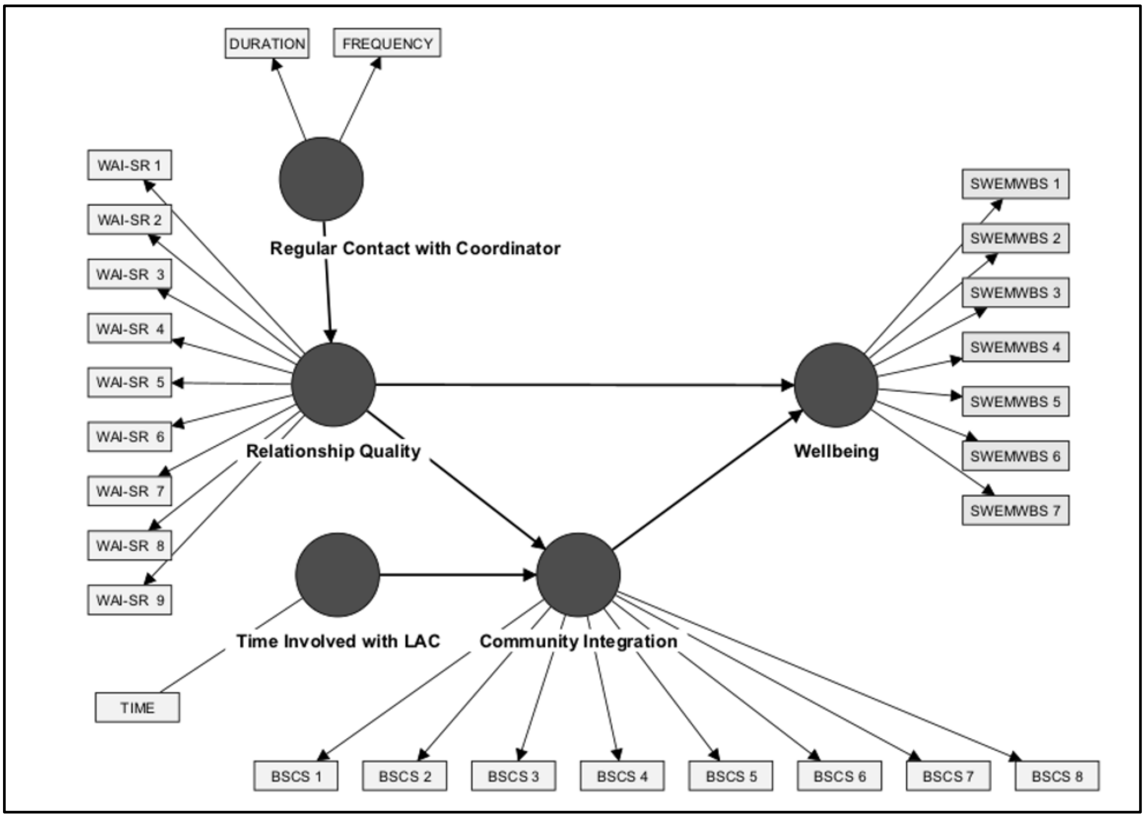

Figure 5 A-priori theoretical model for hypotheses 3-7

Note: Image created by Lowri Wilkie using Smart PLS.

5.5.Results

Smart PLS (Ringle et al, 2022) was used to assess the model. Reflective measurement models are evaluated using (1) indicator loadings (2) internal consistency reliability (3) convergent validity and (4) discriminant validity. Following this, one change was made to the model. As the indicator 'frequency' was inversely loaded (-0.869) on the latent construct of 'Regular Contact with Coordinator', it was removed to form a separate construct in its own name (Frequency of Contact), whilst the construct 'Contact' was changed to 'Duration of Contact' which only contained the one indicator of duration (see figure 6). Analysis of measurement model suggested satisfactory internal consistency reliability (composite reliability of each latent construct ranged between 0.901 and 0.945), satisfactory convergent reliability (all latent constructs had an Average Variance Extracted (AVE) between 0.628 and 0.683) and discriminant validity (heterotrait-monotrait - HTMT ratio of the correlations were all below recommended threshold of 0.85). See Appendix Q for further details.

Assessment of the structural model included 1) collinearity; 2) R^2 value; 3) Q^2 value; 4) PLSPredict. Variance inflation factors (VIF) were all below recommended threshold of 3 suggesting collinearity was not an issue. R^2 values suggest 36% ($R^2 = 0.361$) of variance in wellbeing can be explained by the model (see table 7). Q^2 for the model fell between 0.050-0.189 which reflects small predictive accuracy. PLSPredict (Shmueli et al., 2016) is an algorithm in SmartPLS (Ringle et al, 2022) which executes a k-fold cross validation, whereby the dataset is split into a given number of folds and is used to evaluate the model's predictive power. PLSPredict was run on the present model on the recommended setting of $k = 10$ (Hair et al., 2019). Most indicators (20/22) in the PLS-SEM analysis yielded smaller prediction errors compared to the LM. This indicates medium predictive power. Path coefficients of model (and p-values) are displayed visually in figure 6.

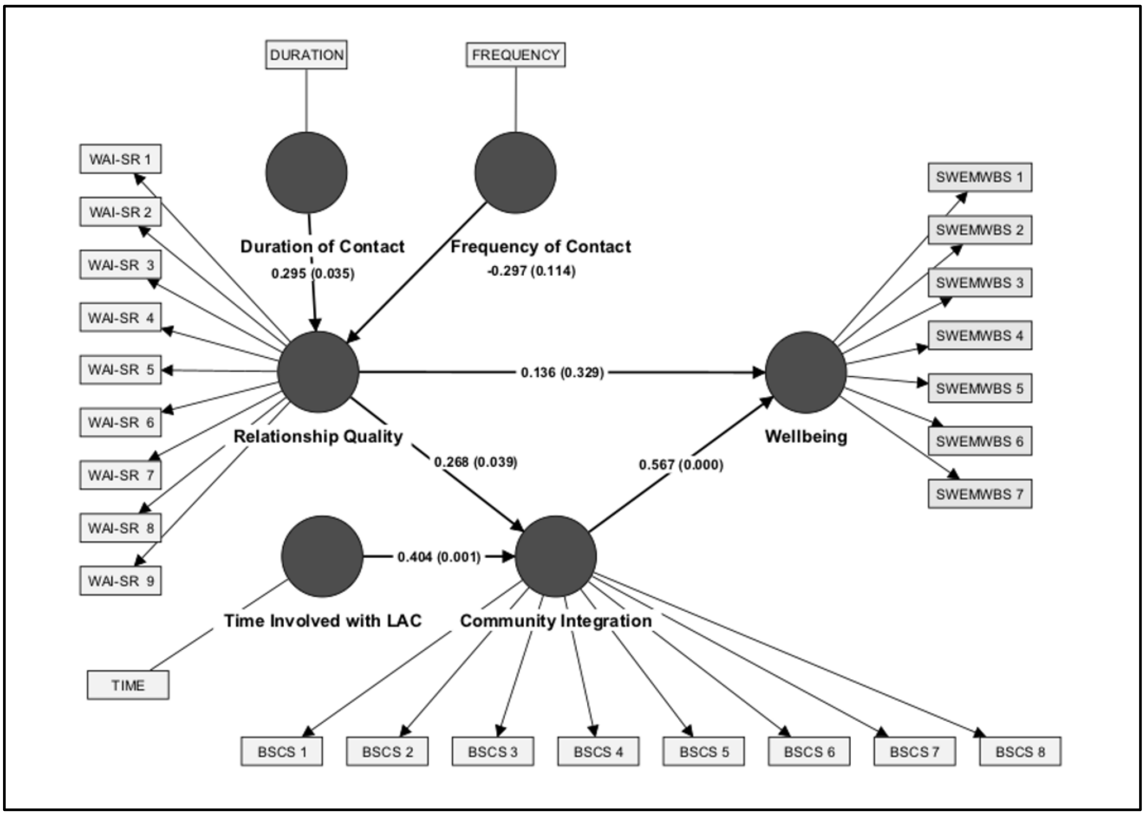

Figure 6 Final model whereby path coefficients and (p-values) are displayed

Note: Image created by Lowri Wilkie using Smart PLS.

Table 7 *R2 and Q2 Scores*

	R-square	R-square adjusted	Q^2predict
Relationship	0.264	0.234	0.189
Sense of Community	0.251	0.220	0.148
Wellbeing	0.386	0.361	0.050

Table 8 *PLS SEM Significance Testing Results*

	T-statistic	P-value
Duration of Contact -> Relationship Quality	2.107	0.035*
Frequency of Contact -> Relationship Quality	1.581	0.114
Relationship Quality -> Sense of Community	2.063	0.039*
Relationship Quality -> Wellbeing	0.976	0.329
Sense of Community -> Wellbeing	5.376	0.000*
Time Since First Contact -> Sense of Community	3.33	0.001*

*Represents p <.05

Significance testing (see table 8) revealed that duration of contact had a significant impact on relationship quality, but frequency of contact did not. Therefore, H3 was partially supported. Relationship quality had a significant impact on sense of community integration, thus H4 was supported. Relationship quality did not significantly impact on wellbeing and so H5 was not supported. H6 was supported, as time since first contact had a significant impact on sense of community integration. Sense of community integration had a significant impact on wellbeing, thus H7 was supported (see table 9).

Table 9 *Part two hypothesis testing*

Hypotheses	Is Hypothesis Supported?
H3: The amount of regular contact between community members and their coordinators (both frequency and duration) will significantly predict perceived relationship quality.	Partially supported (duration, but not frequency predicted relationship quality)
H4: Perceived relationship quality will significantly predict the community members' sense of community integration.	Supported
H5: Perceived relationship quality will significantly predict the community member's wellbeing	Not supported
H6: The length of time the community member has known their coordinator will significantly predict their sense of community integration	Supported
H7: The community member's sense of community integration will significantly predict their wellbeing.	Supported

Meditation analysis was also performed to assess the mediating role of community integration for the path between relationship quality and wellbeing (see Table 10). No significant indirect effect representing the mediation was observed.

Table 10 *Mediation Analysis Results*

Total Effects (RQ->WB)	Direct Effect (RQ->WB)	Indirect Effect of RQ->Com->WB

Coefficient	T value	p-value	coefficient	T value	p-value	Coefficient	SE	T value	P value	95% CI
0.288	1.699	0.089	0.136	0.976	0.329	0.152	0.081	1.878	0.06	-0.04-0.294

Part 3: Ripple Effects Mapping

5.6.Method

Qualitative data was collected from stakeholders involved in Local Area Coordination (LAC) to explore the impact of LAC on wellbeing and potential underpinning mechanisms. As the qualitative study was exploratory, no a-priori predictions were made.

5.6.1. Design

Ripple Effects Mapping (REM) is a qualitative tool designed to capture the wider impacts of an intervention. It involves four key components; (1) appreciative inquiry (participants share their experience in pairs); (2) a participatory approach; (3) interactive group interviewing and reflection; and (4) "radiant thinking" (mind mapping to visualise the impacts). These components guide a focus group session, where the key impacts are captured on a mind map. Variation three of REM 'Theming and Rippling' was employed in the present study, whereby participants report aloud a few of the most significant effects they discussed during their appreciative inquiry interviews. Impacts are mapped out on a whiteboard and the group collectively summarises the core themes discussed. REM makes use of the Community Capitals Framework (CCF) (Emery & Flora, 2006) as a viewpoint to analyse community changes which occur because of a program. CCF defines seven indicators of a community's "capital:" natural, cultural, human, social, political, and built capitals.

5.6.2. Participants

Participants were either 1) Coordinators employed as Local Area Coordinators working within the Swansea region, or 2) Community members living in Swansea who had any involvement with their local coordinator. Coordinators were required to have at least one community member who was willing to participate who they could bring with them to the session. In total, 5 coordinators and 7 community members participated (See Appendix R for individual participant characteristics).

5.6.3. Procedure

The focus group took place in June 2022 at Swansea University and lasted two hours. Participants firstly completed survey measures with an integrated consent form (see part 2). Lead author (LW) facilitated the REM process. Definitions of the community capitals framework were printed out and placed on the table to prompt participants to think about all possible impacts of LAC beyond the individual. Participants first interviewed each other in pairs on their experience with LAC. The group then came together, and each participant shared their most significant impacts. key details were mapped on a whiteboard by the facilitator for everyone to see. The facilitator used probes such as 'what happened next?' or 'what did that lead to?' to capture consequential 'rippling' effects. The group then collectively identified a list of key themes which they felt were common across reflections, leading to the creation of a mind map (see Appendix S).

5.6.4. Analysis

All data were analysed using ATLAS.ti for Windows (2022). A reflexive approach to thematic analysis (TA) was used to synthesise participants' experiences into meaningful concepts (Braun & Clarke, 2006, 2019, 2022). In line with recommendations (Byrne, 2022), coding was conducted by one researcher in the team (AD), while the first author (LW) later collaborated to sense-check themes and offer alternative interpretations of the data with the aim of developing richer meanings, as opposed to achieving coding consensus. A combination of both deductive and inductive analysis was used. A deductive (top-down) approach was firstly applied, using the GENIAL framework (A. Kemp et al., 2017; A. H. Kemp & Fisher, 2022; Mead et al., 2019, 2021) and The Community Capitals framework (Chazdon et al., 2017; Emery & Flora, 2006) as a lens for interpretation. Secondly, the data was analysed again using an inductive (bottom up) approach to explore the potential mechanisms which arose directly from the participants' data in an exploratory manner. Results are integrated into a general discussion that draws on observations and findings from the first two studies, consistent with a mixed-method concurrent triangulation design approach (Creswell & Clark, 2011).

5.6.5. Author Positionality Statement

As a PhD student conducting research through a critical realist lens and employing thematic analysis, I recognise that my background and experiences can influence my interpretation of the data. My academic journey has been shaped by my work with the GENIAL framework, which has framed my understanding of wellbeing in particular ways. I acknowledge that I am thus accustomed to viewing wellbeing through the lens of a particular model which uses certain language and concepts. Professionally, I am also a mindfulness and yoga teacher, which means my understanding of wellbeing is also influenced by contemplative practices and holistic approaches to health. I made a conscious effort to ensure that the data drove my thematic analysis. This is evident in the findings, where themes such as social equality and a personalised approach emerged as central, despite not being concepts I had heavily focused on in prior research.

I am aware that my personal background informs how I engage with the participants. Growing up as a white woman in Wales, most participants were from broadly a similar social background and so I am used to engaging with this population. This allowed me to relate to the language and cultural references used by the participants, fostering a deeper understanding of their perspectives. However, I was careful to remain open to their diverse experiences.

My work with LAC was not driven by prior personal investment in the approach itself. My interest in LAC stemmed from a desire to explore its potential to enhance wellbeing at a larger scale, as my previous work focused on smaller-scale interventions. In summary, while my personal and professional background shapes my understanding of wellbeing and influences my engagement with the research process, I have strived to maintain a reflexive stance, allowing the participants' voices to guide the analysis and ultimately provide fresh perspectives on the potential of Local Area Coordination in improving wellbeing.

5.7. Results

Table 11: Summary of results from qualitative ripple effects mapping

Theme Name	Example Quotes	Brief Summary
Rapport and Relationship Quality	"My coordinator just always seemed endearing, and he always wanted to help me, and he was always there for me. And that was what I felt was fundamentally important. I wasn't a number; I wasn't a figure" (Participant five)	Importance of rapport between coordinators and community members. Coordinators' non-judgmental attitude and active listening helped establish trust, making participants feel valued, respected, and understood.
Personalised Approach	"She [my coordinator] is persistent. But I mean that's brilliant, because to me that's the best thing about her, that she does care." (Participant seven)	Coordinators tailored their approach to individual needs, increasing participants' self-confidence.
Personal Growth	"I gained the confidence to just get out there and meet people." (Participant seven) "The breathing and the meditation, and yoga, it helped me get through the beginning when my anxiety kicked in again, it made me look at why it was happening, rather than running from it" (Participant three).	Participation in social groups led to personal growth, positive affect, self-efficacy, and new adaptive coping strategies.
Community Integration	"I saw [social group] as a safe place to be for guys to come no matter if you are feeling one hundred percent, we created a space where we were able to come and be like that, struggle but feel accepted" (Participant five)	Opportunities created by LAC for participants to increase their social networks and sense of belonging.

Social Support	"I got so much nice company. I can phone them if I am low". "It's just wonderful to me. You know, it's made a big difference, I got so many friends now… I'm not lonely anymore." (Participant one) "I got the support I needed not through one of the formal ways" (Participant three)	Development of new, close, emotionally supportive relationships that provided reassurance and reported reduced reliance on formal healthcare services.
Social Equality	"It's [support is usually] all about what you can't do. And that absolutely has not been the case here. It's, it's very much a case of what would you like to do? How can I help you do that? How can I make it achievable?" (Coordinator four)	LAC's role in supporting vulnerable populations to access community resources. Overcoming barriers related to disabilities and mental illness.

5.8. Discussion

The aim of the present study was to employ a mixed method design to (1) determine whether HRV synchrony was present between dyadic pairs and whether this correlated with relationship quality, (2) investigate the pathways associated with community integration using structural equation modelling, and (3) qualitatively explore the impacts of LAC on individual and collective wellbeing using ripple effects mapping. A visual summary of findings across all three parts of the study is presented in figure 7.

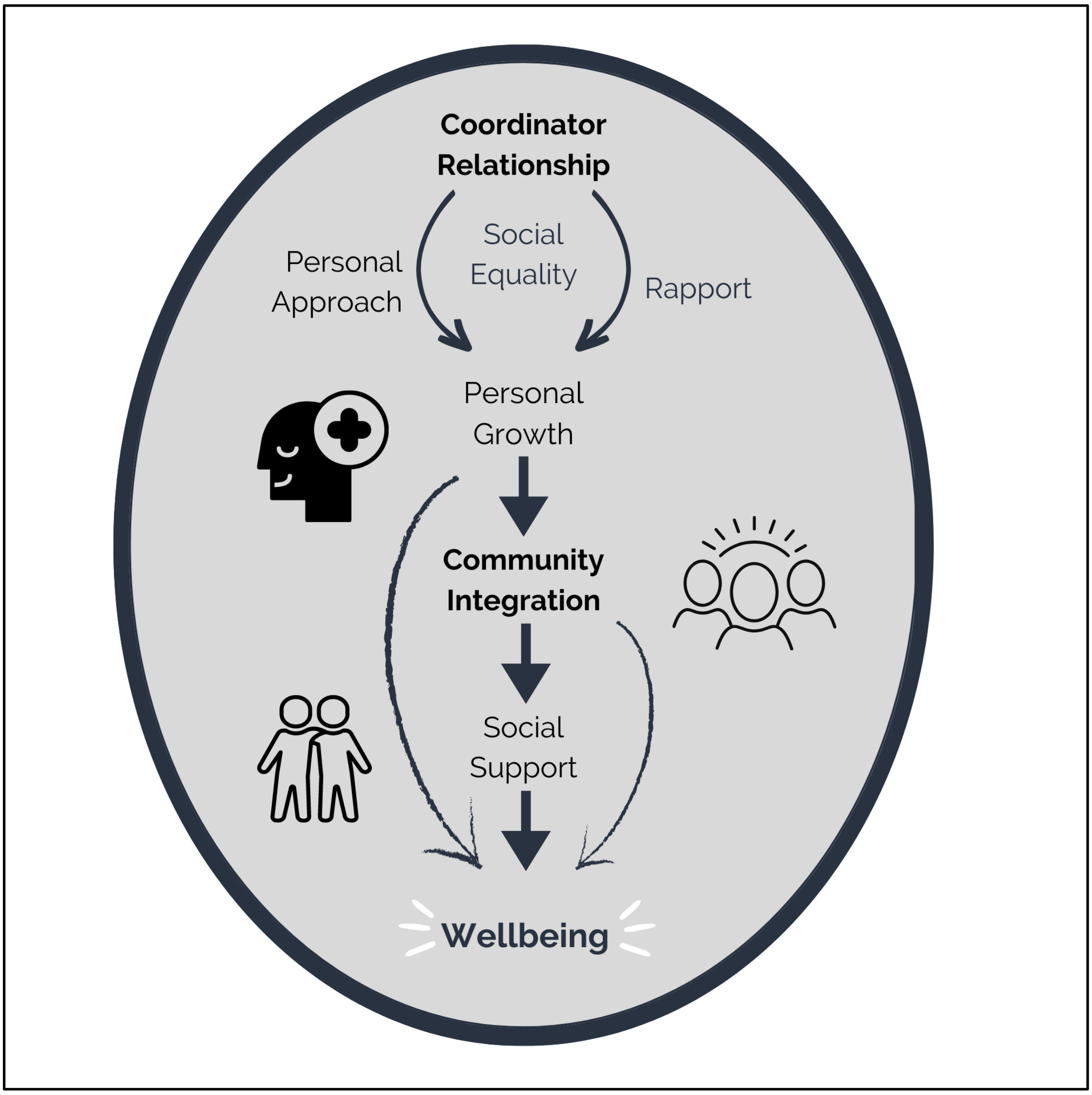

Figure 7 Visual summary of overall LAC findings

Note: Image created by Lowri Wilkie using Canva

5.8.1. Part One Discussion

Evidence was found for the presence of heart rate and low frequency HRV synchrony between coordinators and community members. This finding was only present for non-absolute values when distinguishing between positive (in-phase) or negative (anti-phase) correlations. This suggests in-phase synchrony, whereby cardiac time series data typically covaries in the same direction. Contrary to our predictions, physiological synchrony did not however correlate with self-reported relationship quality scores, differing from the findings of Tschacher & Meier (2019). One possible explanation for this is social desirability bias. We did our best to avoid this by asking participanty to discretely write their score down on paper and fold it for the researcher. However, it is still possible that participants may have inflated their alliance scores due to the coordinator's presence (being in the same room) or fear of negatively impacting the relationship. This is supported by the high overall mean score (38.25/45).

Research on HRV synchrony is in early stages. Nonverbal synchrony is complex and contextual (Ramseyer, 2020). The relationship between synchrony, HRV, relationship quality, and wellbeing is still unclear. Key predictors of a robust therapeutic alliance include being flexible, honest, respectful, trustworthy, confident, warm, interested, and open (Ackerman et al, 2003). Other studies propose that HRV synchrony serves as one non-verbal indicator of the therapeutic alliance, which can support independent emotional regulation (Koole & Tschacher, 2016). Future studies could use larger samples and integrate physiological data with structural equation modelling (SEM) to investigate potential traits and predictors underpinning synchrony and relationship quality. A study recruiting dyadic pairs from various relationship types, such as therapeutic, health or social care, friendships, and romantic relationships, would also deepen understanding of how alliance and physiological synchrony differ and change across contexts.

5.8.2. Part Two Discussion

The findings of part two highlight the role of relationship rapport between community members and their coordinators in predicting community integration ($r = 0.268$). Interestingly, the quality of the relationship alone did not significantly predict overall wellbeing in our model. This might reflect LAC's approach to avoid community members becoming overly reliant on coordinators (Roderick et al., 2016). While relationship quality is crucial for community integration, it appears that community integration itself, rather than the relationship, promotes wellbeing. Additionally, our study found that the length of time spent in each meeting significantly influenced relationship quality, whereas the frequency of meetings did not. This indicates that longer, less frequent interactions are more effective in building rapport than shorter, more frequent ones. This insight challenges the typical structure of formal services, which often operate with brief, time-bound appointments. In contrast, our evidence shows LAC coordinators on average reported spending 1-2 hours per meeting. Moreover, the length of time community members had been engaged with LAC significantly predicted how integrated they felt to their community, further highlighting the overall potential for LAC as an approach to facilitate community integration.

5.8.3. Part Three Discussion

Theme 1: Rapport and Relationship Quality

"My coordinator just always seemed endearing, and he always wanted to help me, and he was always there for me. And that was what I felt was fundamentally important. I wasn't a number; I wasn't a figure" (Participant five)

The key finding from the present study was the importance of the rapport between coordinators and community members they walk alongside. It was noted that the coordinators' non-judgemental attitude, and active listening skills helped to establish trust. Participants described feeling valued, respected, and understood, and felt that the coordinators truly cared about their needs and wants. Coordinators are recruited to be compassionate, patient, and thoughtful and their conversations with community members are described as 'purposefully unprescribed' (Bartnik & Broad, 2021). Our findings suggest that building rapport enabled individuals to feel safe and confident enough to participate socially. This also supports previous findings highlighting the "golden triangle" of listening, trust and time as being critical for success in LAC (Mason et al., 2021).

Theme 2: Personalised Approach

"She [my coordinator] is persistent. But I mean that's brilliant, because to me that's the best thing about her, that she does care." (Participant seven)

Participants reported that their coordinators were alert to their individual needs, adopting a positive and personal approach that appeared to increase participants' self-confidence. A recent development in positive psychology (Ciarrochi et al., 2022) proposed a process-based-approach whereby the individual needs of a client are firstly conceptualised, and interventions are specifically chosen to target positive processes relating to their needs. LAC's principles align closely with those of positive psychology and local area coordinators are in an excellent position to foster positive processes. Thus, one recommendation might be for coordinators to receive positive psychology and wellbeing training to further enhance their capacity to support wellbeing of community members. Moreover, participants' experiences of stretching their comfort zones also appeared to improve their self-efficacy. Self-efficacy refers to individual beliefs in their capacity to perform tasks and has been found to influence health and wellbeing related processes e.g., health behaviour change (e.g., smoking, diet, exercise) and medical regime adherence (Harris & Thoresen, 2006). This also supports our view that initially attending groups with community members provides assurance and a sense of safety, allowing confidence to be built, and enhancing capacity to integrate. This theme also has implications for healthcare, as it suggests that some people might first require a consistent and trusting individual relationship with a professional before they will agree to participate in group-based interventions or take up new behaviours.

Theme 3: Personal Growth

"I gained the confidence to just get out there and meet people." (Participant seven)

"The breathing and the meditation, and yoga, it helped me get through the beginning when my anxiety kicking in again, it made me look at why it was happening, rather than running from it" (Participant three).

Community members were introduced to social groups which led to the development of positive personal growth; for some this was increased positive affect, for others this was a sense of meaning, self-efficacy or learning new adaptive coping strategies. These outcomes are important contributors to individual wellbeing and align with the GENIAL framework's domain of a 'balanced mind' (i.e., building positive emotions, managing difficult emotions, and meaning and purpose) (Mead et al., 2021). One participant described how they learned new positive adaptive coping strategies through their yoga group classes, which they then began to use to self-manage mental health difficulties (via acceptance, self-awareness, and positive reframing). This participant had joined the yoga group alongside their coordinator and took great interest in this new philosophy and practice. This highlights the role for autonomous interest in closing the 'intention behaviour gap'. In line with self-determination theory, sustained engagement in behaviour (including adaptive, wellbeing-promoting behaviours) are dependent upon autonomous motivation such as personal interest or perceived value, consistent with three basic psychological needs, autonomy, competence, and relatedness (Deci & Ryan, 2012). Thus, supporting individuals to follow new ventures, groups and activities which are intrinsically appealing to them is thus likely to be a more successful way of promoting positive behaviours than, for example, trying to convince every individual to attend a yoga class, regardless of their interest. Unfortunately, this same participant reported that the yoga group they were attending was being provided free of charge via grant funding in a relatively deprived area of Swansea, and that the funding was running out at the time of interview. This highlights a wider systemic inequality in access to health-promoting leisure activities, which are commonly unaffordable to individuals and communities with lower incomes. Health and illness across the world follow a social gradient whereby the lower the socio-economic position, the worse the health (Marmot, 2005). Therefore, ensuring sustainable funding is provided for wellbeing-promoting social groups, particularly in deprived areas will be critical when aiming to utilise community resources to reduce healthcare burden.

Theme 4: Community Integration

"I saw [social group] as a safe place to be for guys to come no matter if you are feeling one hundred percent, we created a space where we were able to come and be like that, struggle but feel accepted" (Participant five)

LAC created opportunities for participants to increase their social network and as a result, all participants reported feeling less lonely and more socially connected through working with their coordinators. In addition, participants reported an increased sense of belonging by connecting with other community members who shared their values, experiences, and interests. According to the GENIAL framework (A. H. Kemp et al., 2017) and social identity theory (Haslam et al., 2018), social ties are a key pathway to health and wellbeing, and these claims are supported by the vast number of findings that people with larger social networks and increased social connectedness have better mental and physical health (Cohen, 2004; Jetten et al., 2009; Uchino et al., 1996). Group membership has even been described as the "social cure" because of its potential to enhance health and wellbeing (Haslam et al., 2018; Jetten et al., 2014). The reported social groups joined by participants also aligned with the core determinants of wellbeing illustrated in the GENIAL model, including a walking group (exercise - positive health behaviour); Men's Shed community garden (connection to nature); yoga class (balanced mind & exercise); a nutrition and cooking course (diet - positive health behaviour) and several social groups or quiz nights in local cafes or pubs (social ties).

Theme 5: Social Support

"I got so much nice company. I can phone them if I am low". "It's just wonderful to me. You know, it's made a big difference, I got so many friends now… I'm not lonely anymore." (Participant one)

"I got the support I needed not through one of the formal ways" (Participant three)

In addition to a wider social network, some participants reported that they developed new, close, and emotionally supportive relationships who provide reassurance, aid, or care during challenging times. Some participants reported that they were less reliant on formal healthcare services because of these new supportive connections, whom they now went to for support during times of difficulty. One explanation for why social support is beneficial for health and wellbeing is because it facilitates positive affect, which might be associated with lower heart rate, higher heart rate variability, blood pressure and inflammatory markers (Steptoe et al., 2009). Individuals who experience poor physical health, mental health, loneliness, or disabilities are more likely to experience lower vagal function, which inhibits their capacity for social engagement, leading to further social isolation. LAC thus offers an opportunity to support individuals who might have the fewest opportunities to experience positive relationships yet might benefit from them the most.

Theme 6: Social Equality

"It's all about what you can't do. And that absolutely has not been the case here. It's, it's very much a case of what would you like to do? How can I help you do that? How can I make it achievable?" (Coordinator four)

The theme 'social equality' highlight's LAC's ability to support vulnerable populations to access community resources. Community members reported being able to overcome barriers related to visual impairment, learning disabilities and mental illness which previously thwarted access to the local community. One participant described how with the support and company of their coordinator, they met new social groups, discussed their needs with the facilitators and gained confidence accessing those groups independently via public transport. Two key factors arose as being particularly important for participants to overcome these barriers: 1) the time taken by the coordinator to develop a trusting relationship and 2) the initial presence of the coordinator during social participation. This supports the findings from theme 1 - rapport and relationship quality – that developing rapport and promoting feelings of safety and support, are important for facilitating positive behaviour change, confidence, and integration. In the UK, there has been increased interest in social interventions within health service delivery, such as the implementation of social prescribing which aims to connect patients with their communities by referring them to new social activities (Bickerdike et al., 2017; Mossabir et al., 2015). One important consideration is that individuals from disadvantaged populations such as people with disabilities or mental illness might 1) avoid attending in the first place if they are too nervous to attend alone/have accessibility issues or 2) find themselves in uncomfortable situations with no one initially on hand to support them if it is too distressing. Our findings suggest that a trusting relationship with a professional, built through longer-length sessions is needed to facilitate a sense of safety. Furthermore, we found that coordinators increase the likelihood of independent community integration, further supporting efforts to reduce inequalities.

5.9. Limitations and Future Directions

One limitation of the present study is its correlational and cross-sectional design, which precludes the ability to capture causal effects of LAC implementation on wellbeing. However, given that empirical research on LAC is in its infancy, this observational data is essential for understanding the key mechanisms involved and supporting the design of future trials. The next steps for LAC evaluation should involve recruiting an area planning to implement LAC and matching it with a socio-structurally similar area for comparison. This approach would enable tracking changes over time and potentially drawing causal conclusions.

Another primary limitation is the small and racially homogenous sample size, which constrains the generalisability of the findings. Future studies should aim to meet or exceed the required sample size for optimal power. While PLS-SEM is a non-parametric method capable of handling small sample sizes (Hair et al., 2011), future research should include larger, more diverse samples to enhance the robustness and applicability of the findings. To overcome the limitation of sample size and diversity, future research on LAC will require additional manpower and funding. Securing research assistants dedicated to in-person HRV data collection and appointment organisation will be crucial. A dedicated person for reaching out to coordinators and networking is essential to recruit more community members, especially from ethnically diverse areas of the UK. Additionally, it is important to reach out to individuals who have disengaged from their coordinators to understand their reasons and ensure a comprehensive capture of feedback, not just from those who remain engaged. Despite these challenges, the novel and exploratory nature of this methodology offers valuable insights and paves the way for future LAC impact evaluation and for future research to utilise mixed, diverse methodologies to measure wellbeing, including psychophysiological data.

5.10. Conclusion

In conclusion, findings suggest that fostering a strong relationship rapport is crucial for supporting individuals to make positive behaviour change. The importance of the coordinators being present whilst community members initially joined new social groups was highlighted. Their presence fostered a sense of safety, enabled social connection, increased confidence, and supported future independent community integration. Initial cardiac synchrony findings suggest that co-regulation in the autonomic nervous system may underpin coordinator-community member interaction, however the relationship traits associated with synchrony remain unclear. Relationship rapport also appeared to depend more strongly on longer meeting durations, and less so on the frequency of meetings. Importantly, findings support that local communities hold an abundance of opportunities to promote overall health and wellbeing via factors such as social identity, social capital, emotionally supportive relationships, positive emotions, meaning, autonomy, increased physical activity and time spent in nature. Given the rising demands of chronic conditions, there is an need to reduce the burden on statutory services. LAC’s community-led approach is a promising opportunity to utilise community assets and promote health equality by supporting those with fewest opportunities to live happier and healthier lives in their own communities. Building on these insights, Chapter Six examines how healthcare systems can leverage wellbeing science to inform interventions and form local partnerships to connect patients with their communities, creating opportunities for positive, wellbeing-promoting behaviours that support individuals in thriving beyond traditional healthcare settings

Chapter Six

6. Promoting Wellbeing Through New Healthcare Models: Evaluating Interventions for Individuals with Acquired Brain Injury

Abstract

This chapter presents research from two evaluations of healthcare interventions for individuals living with Acquired Brain Injury (ABI). The first study uses qualitative data and thematic analysis to explore group-based interventions aimed at facilitating pathways to wellbeing. The evaluation was conducted with 14 individuals who participated in a series of COVID-adapted group interventions designed to improve wellbeing. From this evaluation, eight themes emerged: Facilitating Safety, Fostering Positive Emotion, Managing and Accepting Difficult Emotions, Promoting Meaning, Finding Purpose and Accomplishment, Facilitating Social Ties, (Re)Connecting to Nature, and Barriers to Efficacy. The second study presented in this chapter utilised mixed-methods to provide an in-depth evaluation of one of the interventions: "Surfability". Following five surf therapy sessions with 15 participants, within-subjects analysis revealed significant improvements on the Warwick-Edinburgh Mental Wellbeing Scale ($t(15) = -2.164$, $p = 0.048$), as well as increases in anxiety and happiness measured via a brief visual analogue. However, no significant changes were observed in the Hospital Anxiety and Depression Scale (HADS) or resting heart rate variability (HRV). A ripple effects mapping (REM) session conducted at a 6-10 month follow-up ($n = 6$) revealed that the nature-based challenge facilitated a mindset shift in participants, leading to long-term behaviour changes. These changes were noted across three levels: (1) individual wellbeing - improved mindfulness and physical activity; (2) collective wellbeing - enhanced relationships and community participation; and (3) planetary wellbeing - stronger connections to nature. Overall, the results suggest that healthcare providers, particularly neurorehabilitation services, can enhance interventions by incorporating innovative factors that improve wellbeing, such as nature connection and social opportunities. Bridging the gap between healthcare and community projects is essential for helping individuals with ABI overcome barriers to accessing community resources, thereby enabling them to experience key determinants of wellbeing in their daily lives.

6.1. Introduction

Building on the evidence from Chapter Five, which highlights the potential of community-led approach - Local Area Coordination - in empowering individuals and promoting health equity, Chapter Six turns to the role of healthcare systems in fostering sustainable wellbeing. By utilising interventions that align with the key determinants of wellbeing and connecting patients with community resources, healthcare services can also support individuals in building meaningful relationships and engaging in positive, wellbeing-promoting behaviours that enhance their health and wellbeing long term, beyond the clinical setting. This chapter explores these ideas through research from two evaluations of healthcare interventions for individuals living with Acquired Brain Injury (ABI).

6.1.1. Acquired Brain Injury

ABI is the United Kingdom's leading cause of death and disability in young people aged 1–40 years (NICE, 2019). An estimated 1.3 million people live with the effects of brain injury at a cost to the United Kingdom economy of £15 billion per annum; equivalent to 10% of the annual NHS budget (Barber et al., 2018). Acquired Brain Injury can lead to long-term cognitive, physical, psychological and social impairments (Kuenemund et al., 2016). Cognitive problems following ABI can lead to a range of difficulties including impairments in short term memory, executive functioning (for example, impulse control, problem solving, and self-monitoring), attention, information processing, vision, speech and language (Rabinowitz and Levin, 2014). Physical difficulties may include post traumatic epilepsy, fatigue, headache, pain, vestibular symptoms; changes in taste, smell, vision, hearing and motor impairments such as hemiparesis (Khan et al., 2003; Cantor et al., 2008; Reinkensmeyer et al., 2014). Individuals with ABI commonly report psychological distress with the prevalence for depression following brain injury estimated at 27–64% (Glenn et al., 2001; Jorge et al., 2004; Osborn et al., 2014) and a fourfold increased risk of suicide (Teasdale and Engberg, 2001). Many individuals are unable to resume their premorbid roles within the family unit following their ABI, and some become more reliant on loved ones for care (Gan et al., 2009). Post-injury, individuals with ABI often describe feeling misunderstood by 'old' friends leading to a loss of friendships (Douglas, 2019). The lack of social relationships is a common experience for many individuals with ABI, and reduced social integration often endures long-term, even over 10 + years post-injury (Lefebvre et al., 2009).

6.1.2. Models of Healthcare

The 'medical model' is dominant in western health care settings (Wade and Halligan, 2017). Underpinning the medical model, is the assumption that a person is a passive recipient of care and can receive a treatment that will return the individual to a 'pre-injury state', thus, there is a focus on 'fixing' or reducing impairment. Whilst critical during the acute stages of ABI, in the post-acute and community rehabilitation phase, this model cannot support the holistic needs of individuals with ABI. This is because, firstly, despite best efforts to reduce its impact, many of the cognitive, physical and psychosocial consequences of ABI are pervasive (Colantonio et al., 2004; Ponsford et al., 2014; Forslund et al., 2019). Secondly, there is a need for people with chronic conditions to be active participants in their treatment because neuro-rehabilitation efforts can only be fruitful if the person is a collaborator in their care (Kristensen et al., 2016). Thirdly, health and wellbeing is not simply the absence of impairment (Anderson, 1995).

6.1.3. Neurorehabilitation

Neuro-rehabilitation aims to facilitate the highest degree of cognitive, functional and physical functioning and to maximise quality of life post-injury (Prigatano, 1999; Khan et al., 2003) and to enhance community integration (Perumparaichallai et al., 2020). Nonetheless, neurorehabilitation is often defined with reference to reducing deficits rather than promoting factors critical for health and wellbeing. For example, Chua et al. (2007), p33) describes neuro-rehabilitation as "a problem solving educational process aimed at reducing disability and handicap experienced as a result of disease or injury". Several theories and models of neuro-rehabilitation exist, which historically focus solely on ameliorating behavioural and cognitive deficits (see Wilson, 1997, 2002 for a comprehensive review).

However, there is now a general consensus among practitioners in favour of a holistic model of neuro-rehabilitation (Ben-Yishay, 1996; Prigatano, 1999), at least in community settings. This approach considers the dynamic relationship between a person and their environment and the psychological, social, cognitive and physical impact of the injury on the person as well as the reciprocal relationship between these domains (Prigatano, 1999; Tate and Pledger, 2003; Leonardi and Martinuzzi, 2009; Ben-Yishay and Diller, 2011). For example, the patient may still receive cognitive rehabilitation to improve specific deficits such as attention or memory impairment, combined with psychological therapies addressing emotional coping strategies. They may also simultaneously receive physical or occupational therapy to support motor function, adapt to disabilities and improve autonomy in day-to-day life. Holistic neurorehabilitation may also include participation in social support and peer groups. The approach is often person-centred and relies on an inter-disciplinary team of professionals to address different aspects of recovery.

One criticism of the holistic approach to neurorehabilitation is that of all the components, social contributions to recovery are most poorly defined (Haslam et al., 2018). Yet evidence suggests that it is the difficulty maintaining a social life that make the cognitive and physical impairments detrimental to lives. For example, one study found that cognitive symptoms in stroke are associated with reduced wellbeing (r = -0.36), but this relationship is mediated by one's capacity to maintain group memberships (r = -0.30). This suggests that cognitive symptoms negatively impact wellbeing only by the extent to which they hamper one's capacity to integrate socially (Haslam et al., 2008). According to social identity theory, belonging to multiple social groups protects wellbeing following ABI, as it provides individuals with more opportunity for social interaction, and thus time to develop self-regulation skills (manage emotional distress, take goal-oriented action, and conform to societal rules) (Kinsella et al., 2018). It is essential that neurorehabilitation moves beyond individual social skills training and creates opportunities for patients to acquire new social groups in the community post-ABI e.g. through sports clubs, religious groups, social meet ups, based on their individual interests, particularly given the common loss of social roles within the family, work and leisure participation (Douglas, 2019; Morton & Wehman, 2009; Roundhill et al., 2007; Wise et al., 2010).

6.1.4. Integrative Approach

There is evidence supporting the need for both targeted individual therapy and holistic, community-based interventions. Individual therapy, such as cognitive rehabilitation or psychotherapy for symptoms of trauma or depression, often focuses on symptom reduction and addressing specific disease mechanisms. For instance, Cognitive Behavioral Therapy (CBT) when specifically aimed at targeting anxiety or depression symptoms, can significantly improve symptoms (Waldron et al, 2012), which will also likely enhance quality of life by therefore increasing autonomy and capacity to participate socially. However, transitioning to community-based programs can further promote long-term wellbeing by offering sustained opportunities for social connection, identity rebuilding, and meaning-making in day-to-day life, beyond the clinical setting. A dual approach that combines symptom-focused, individualised therapy with holistic, community-based interventions provides a comprehensive pathway to recovery. Implementing a stepped-care or integrative model in health services could help optimise resources and engagement, ensuring that individuals receive intensive, individualised therapy to address specific disease mechanisms and symptom reduction when needed, and can progress to holistic wellbeing interventions when they are ready. This approach maximises therapeutic impact while supporting long-term recovery and well-being.

We argue that there is therefore further opportunity for the holistic model of neurorehabilitation to be enhanced by taking into consideration theories of wellbeing and advances in wellbeing science (Fisher et al., 2020). To further illustrate this point, key wellbeing theories and research are presented, of which, guided the development of several interventions evaluated in this work.

6.1.5. GENIAL Model of Wellbeing

Our own theoretical model of wellbeing, 'the GENIAL model,' defines wellbeing as a sense of connectedness to ourselves as individuals, as well as to the communities and environments within which we live (Kemp et al., 2017; Mead et al., 2019). Psychological connectedness refers to an awareness, acceptance and alignment of behaviour (Klussman et al., 2020), and is associated with positive emotions, positive social ties, and the extent to which we see ourselves as part of nature (Richardson et al., 2020). While connectedness may be improved and maintained by individual behaviour change, various sociostructural factors at higher levels of scale may either restrict or facilitate the experience of wellbeing. We propose several core domains of wellbeing, comprising the individual (including a balanced mind and a healthy body), community (social connection), the natural environment (connection with nature), the role of behaviour change and socio-structural factors, which are summarised below. The GENIAL model is entirely consistent with recent developments in positive psychology (Mead et al., 2019; Wong, 2019; Kern et al., 2020; Lomas et al., 2020), described as second and third-wave positive psychology, which places importance on emotional balance, meaning and purpose, social ecology and interdisciplinarity. This evolution in positive psychology has been described as a series of waves reflecting dynamic fluidity and continued refinement (Lomas et al., 2020). In this regard, the GENIAL model has been inspired by these recent developments and provides an exemplar of how the latest wellbeing science might be applied to improve wellbeing in people living with chronic conditions in particular, laying the foundation for a more sustainable healthcare sector.

The core domains of the GENIAL model (*see* figure 8) are presented below as headings to summarise recent advances in wellbeing theory and research. This will provide a rationale for the interventions delivered to service users.

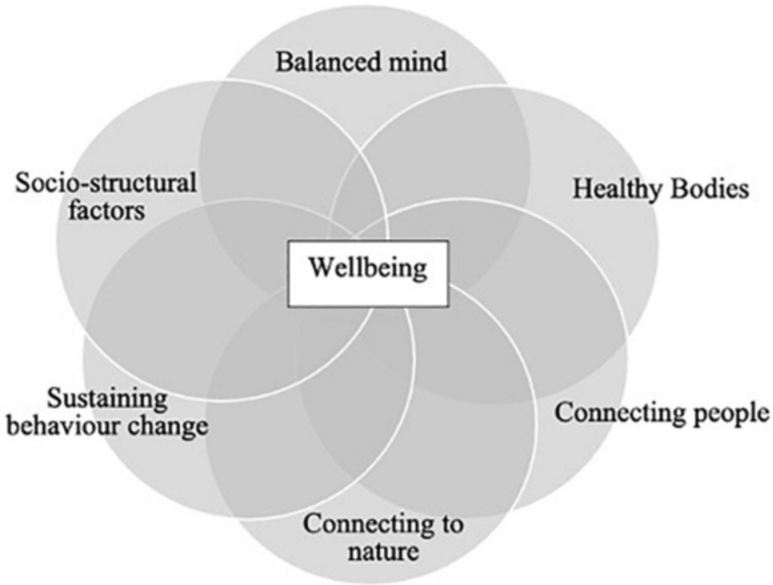

Figure 8 Summary of the core components of interventions based on GENIAL framework

Note: Image created by Lowri Wilkie using Microsoft Word

Balanced Mind

Psychological theories exploring factors that underpin individual wellbeing have historically fallen into two categories (Deci and Ryan, 2008) firstly, hedonic theories such as Subjective Wellbeing theory (SWB, Diener, 1984) and Broaden and Build theory (Fredrickson, 2004) and secondly, eudemonic theories such as Psychological Wellbeing theory (PWB, Ryff, 1989). Seligman (2011, 2017) PERMA model combined both hedonic and eudemonic theories of wellbeing: Positive Emotions, Engagement, Relationships, Meaning and Accomplishments. According to this model, all five pillars of wellbeing contribute to flourishing in life. The PERMA model led to the development of positive psychology interventions (PPI), which aim to cultivate positive emotions, behaviours and thoughts and subsequently enhance wellbeing (Parks and Titova, 2016). However, over emphasising positive affect can be counterproductive, as negative emotions guide us toward positive change (Wong, 2011). Paul Wong's existential positive psychology (PP 2.0) emphasises that it is not always possible to maintain positive emotion, especially during periods of illness, fear and uncertainty, such as living with the impact of brain injury during the COVID-19 pandemic. Positive Psychology 2.0 places importance on meaning and finding meaning, despite and even as a consequence of suffering. According to this approach, a meaning-focused perspective involves enhancing the positives when possible, while regulating emotions associated with the negatives in order to build wellbeing in the midst of suffering (Wong, 2011). Taken together these frameworks indicate the need for a 'balanced mind' which includes developing strategies to increase positive affect, manage distress, and to promote the acceptance of difficult emotions as well as an appreciation of the value of negative affect.

Healthy Bodies

Psychological models of wellbeing (Diener, 1984; Ryff, 1989; Seligman, 2011) and holistic models of neuro-rehabilitation typically neglect the evidence-based impacts of positive health behaviours on wellbeing. While health behaviours are typically thought of with respect to their impact on physical health, there is now increasing evidence that health behaviours impact on both physical and mental health, thereby providing opportunities for connecting mind and body, and promoting wellbeing. For example, Wise et al. (2012) showed that individuals with ABI who exercise more than 90 minutes a week have lower depression scores and higher perceived quality of life. In contrast to many other theoretical models of wellbeing (Diener, 1984; Ryff, 1989; Seligman, 2011), the GENIAL model (Kemp et al., 2017; Mead et al., 2019; Fisher et al., 2020) – proposes that health behaviours including exercise, diet and sleep, play a key role in facilitating health and wellbeing. The GENIAL model also focuses on the vagal nerve as a structural link between physical and mental health, mediating the beneficial impacts of positive health behaviours on wellbeing. A recent meta-analysis on 157 studies, reported a small beneficial effect of physical activity ($d = 0.360$) on measures of subjective wellbeing (Buecker et al., 2020) and this finding was independent of prior fitness levels, characteristics of the intervention and research design. Another systematic review (Zhang and Chen, 2019) reported that as little as 10-min of physical activity per week may be sufficient for increasing levels of happiness. Moreover, for people with neurological conditions, exercise has been shown to contribute to maintaining cognitive function (Spirduso and Asplund, 1995; Kramer et al., 2005). In fact, it has been argued that physical exercise could enhance the process of recovery for people with brain injury (Grealy et al., 1999).

Social Connection

Neuro-rehabilitation approaches are typically designed to reduce behavioural/psychological barriers to social and community integration for example, through social skills training and social communication training (Struchen, 2005). However, reducing barriers to social and community integration is not sufficient in itself to facilitate social connection and social cohesion, which have been shown to be key components for the experience of wellbeing. Moreover, psychological models of wellbeing and the holistic model of neuro-rehabilitation highlight the important role of personal relationships in contributing to individual wellbeing (PERMA, Seligman, 2011). However, the GENIAL model (Kemp et al., 2017; Mead et al., 2019, 2020) extends beyond personal relationships, encompassing perceptions of social connectedness, social capital, social cohesion and social identity. The underlying premise here is that individuals (as members of the community) can combine their resources to benefit the individual and collective (Woolcock and Narayan, 2000; Lin, 2002). Social capital refers to bonding (links between individuals) and bridging (uniting people from various diverse backgrounds and social cleavages) (Putnam, 2000). Social support from bonding networks have been shown to be associated with increased positive emotions (Diener and Oishi, 2005) and enhanced subjective wellbeing (Williams, 2006) as well as being protective against the impact of stress (Umberson and Montez, 2010). The related concept of social cohesion refers to the extent to which a geographical space achieves 'community' through the sharing of values, co-operation and interaction (Beckley, 1995). Social cohesion elicits feelings of belonging and acceptance (Elliot et al., 2014) in addition to creating a context for positive relationships with others (Vries et al., 2013). Social cohesion has been associated both with wellbeing (Silva et al., 2005) and physical health (Yang et al., 2016). Social identity theory also provides a useful context for appreciating the influence of community on the wellbeing of the individual, by providing meaning and purpose to an individuals' life (De Vroome et al., 2013), social support (Levine et al., 2002; Cohen, 2004) and a sense of efficacy and power (Haslam et al., 2018). Therefore, interventions which seek to foster positive social ties including both positive social relationships and an increased sense of community have much to contribute to enhancing the wellbeing of individuals with ABI.

Connecting to Nature

Human beings have a complex and inter-connected relationship with nature (Seymour, 2016). A growing body of evidence suggests that both individual and collective wellbeing are deeply intertwined with the health of the natural environment. For long-term, sustainable wellbeing, interventions which simultaneously consider planetary wellbeing and nature connection will become increasingly essential. Yet, currently many approaches to healthcare, including the holistic approach to neurorehabilitation does not specifically utilise nature connection as a strategy to promote wellbeing. Feeling connected to nature including living animals, plants, geological processes, 'blue' and 'green' environments such as parks, forests, mountain ranges, oceans, rivers or lakes may reflect a basic human psychological need (Baxter & Pelletier, 2019). This argument is supported by the ever-growing body of evidence that spending time in natural environments promotes individual wellbeing. One example is from a representative survey of the English population (n = 7,814) which found that having access to a domestic garden was associated with improved self-reported wellbeing (White et al., 2020). Furthermore, a study on census data on 48.2 million people in England found that people who rated their health as 'good' were more likely to live in closer proximity to the coast (Wheeler et al., 2012). Nature-based interventions such as Shinrin-yoku ('forest bathing') have been found to improve physiological markers of health and wellbeing such as increased parasympathetic activity (increased heart rate variability - HRV) (Park et al., 2009). In addition, improving nature-connectedness may aid us in moving toward the goal of achieving 'planetary wellbeing' – defined as "the highest attainable standard of wellbeing for human and non-human beings and their social and natural systems." (Antó et al, 2021, p1). This is supported by recent evidence (N = 4,960) that nature connectedness is positively related to eudemonic wellbeing and increased pro-environmental behaviour (Martin et al., 2020), leading the authors to propose that interventions which 'promote contact with and connection to nature are needed to make harmonious progress to both human and planetary health' (Martin et al., 2020). Moreover, there is evidence to suggest that nature connection may be particularly beneficial for individuals with ABI. Firstly, According to Attention Restoration Theory (ART) (Kaplan, 1995), being in natural environments trigger involuntary attentional processes, which allow top-down controlled mechanisms a chance to replenish (Berman et al., 2008). Given that individuals with ABI commonly suffer with fatigue (Ziino & Ponsford, 2006) and are more likely to suffer from heightened sensory sensitivity to light and noise (Alwis et al., 2013), nature might likely improve their ability on tasks which require such controlled processing. Moreover, individuals with ABI commonly face challenges with emotional regulation, particularly individuals with damage to the prefrontal cortex, given its role in to dampening down emotionally charged signals from the amygdala (Banks et al., 2007; Horn et al., 2016; Motzkin et al., 2015). According to Stress Reduction Theory of Nature (SRT) (Ulrich et al., 1991), being in the presence of nature supports individuals to experience a parasympathetically dominated 'relaxation response', reducing cortisol, heart rate and blood pressure (Ewert & Chang, 2018; Song et al., 2015). Both these hypotheses thus warrant further exploration of the potential positive role of nature connection in ABI neurorehabilitation.

Sustaining Change

There is a critical role for positive behavioural change when considering wellbeing domains (Kemp et al., 2017; Mead et al., 2019), as without continued practice, one is unable to sustain positive changes to wellbeing beyond the course of the intervention. It is important therefore to consider the 'intention-behaviour' gap (Cappellen et al., 2017), and understand that successful change requires more than psychoeducation (French et al., 2017). Moreover, individuals with ABI have impairments on aspects relating to behaviour change including motivation, planning and self-regulation, highlighting a need to consider, adapt and implement behaviour change strategies to ensure that improvements to wellbeing are sustainable.

Socio-Structural Factors

Models of wellbeing are typically characterised by a focus on the individual or on wider societal determinants, and seldom integrate both perspectives (Mead et al., 2019). However, it is impossible to discuss wellbeing without also considering the role of socio-structural factors. For instance, research shows that there are major socioeconomic consequences following an ABI, often due to job loss, divorce and in many countries, high health costs (Dewan et al., 2016). Moreover, research shows that individuals with ABI who are of a lower socio-economic status have the poorest recovery, thus those who have the least access to financial resources are those who require the most support (Haines et al., 2019).

Vagal Function

The vagus nerve is the tenth cranial nerve that connects the brain to most organs including the heart, gut and lungs and plays a key role supporting the parasympathetic nervous system, making it a worthy candidate for supporting wellbeing (A. H. Kemp et al., 2017). The functioning of the vagus nerve can be measured using Heart Rate Variability (HRV) (Paso et al., 2013), whereby a higher HRV reflects greater vagal tone. The GENIAL model is supported by evidence that vagal function is promoted via interventions which increase self, social and nature connectedness, for example via promoting a healthy lifestyle (Jandackova et al., 2019), mindfulness-based interventions (Heckenberg et al., 2018), yoga and tai chi (Zou et al., 2018), loving kindness meditation (Kok et al., 2012) and forest bathing (Park et al., 2009). Across healthcare settings, there is still a focus on individual recovery which neglects the role of collective and planetary wellbeing, despite large epidemiology studies showing that social connections and nature connectedness reduce all-cause mortality and improve health/wellbeing outcomes (Helbich et al., 2018; Holt-Lunstad et al., 2010; Mitchell & Popham, 2008; Wilker et al., 2014).

6.1.6. The Design of Interventions

To provide a truly 'holistic' approach to neurorehabilitation, it is vital that services begin to implement the latest advances in wellbeing science and consider the individual, collective and planetary wellbeing when designing interventions. The healthcare service described herein (a National Health Service – NHS – community neurorehabilitation service in the UK) adapted its service model by forming collaborative partnerships between local community organisations and academics to create novel interventions for patients. We utilised co-design, a collaborative approach to developing healthcare interventions, which actively involved ABI patients in the design process. Throughout the development of the service, these patients engaged with the team to express what would best support their journey to recovery, articulate their visions for the future, and identify how they could be effectively assisted in achieving those goals. This iterative process has continuously evolved over the past few years, with patients providing ongoing feedback at each stage of development. Their insights have been invaluable in shaping the interventions, ensuring they are relevant and aligned with the patients' needs. Patients consistently reported that the most important aspects of their lives included having a sense of purpose, feeling connected to others and their families, and actively participating in their communities. In response to this need, we embarked on a search for a deeper understanding of wellbeing. Collaborating with clinicians within the service and academic psychologists at the university, we developed the GENIAL model of wellbeing (Kemp et al., 2017; Mead et al., 2019, 2020; Fisher et al., 2020), grounded in scientific literature. This model served as a foundation for co-designing interventions that were not only evidence-based but also tailored to the specific preferences of the patients. This collaborative approach ensured that the interventions were co-created, empowering patients to take an active role in shaping their recovery journey and fostering a sense of ownership over their wellbeing. By involving patients in the design process, we have developed a service that truly reflects their needs and aspirations.

The aim of this chapter is to present the work which evaluated the impact of these interventions on patients' wellbeing. This chapter presents two studies. Firstly, a detailed qualitative evaluation of the experiences of individuals with ABI following as series of these group-based intervention(s) designed to facilitate pathways to wellbeing (GENIAL framework). Secondly, the chapter will present the findings of a second study focused specifically on evaluating one of these interventions 'Surf-Ability' surf therapy in more depth, utilising a mixed methodological approach. Table 12 describes how the interventions were designed to tap into the previously described key areas of wellbeing theory and core activities of the holistic neuro-rehabilitation model.

Table 12 *Link between interventions and previously identified predictors of wellbeing*

Intervention	Balancing Minds	Promoting health	Connecting People	Reconnecting to nature	Sustaining change
Online Group Psychotherapy	Using principles of ACT and Positive Psychology 2.0 to introduce mindfulness, value-based living and acceptance. Encourages acceptance of negative emotions and promotion of positive emotion. Exploring values to find meaning.	Mind-body connection using mindfulness techniques and deep breathing to activate parasympathetic response.	Promoting social capital (i.e., coping resources), cohesion (peer support, interaction) and identity ('shared experience').	N/A	Facilitated self-regulation e.g. noticing own thoughts and having ability/skill to self-manage emotions at home.
Online Group Psycho-education and peer support	Staff and participants shared popular emotional strategies that they have found successful in their experience, e.g. positive	Participants taught how to successfully manage fatigue e.g. self-regulating energy	Promoting social capital (i.e., mentors shared useful coping resources, psychoeducation, peer support	N/A	Group involved goal setting. Participants wrote actions plans for the upcoming months based on what they had learned in the group and what aspect of

Intervention	Balancing Minds	Promoting health	Connecting People	Reconnecting to nature	Sustaining change
	psychology technique '3 good things exercise'	levels, sleep routine and hygiene.	based on own lived experience), cohesion (Interaction) and identity (shared experience).		their recovery they would like to work on. They discussed possible barriers and how to overcome.
Online 'Fun' Social Support Group	Opportunity to cultivate positive emotion through fun games and quizzes, e.g. have a joke and laugh with each other.		Promoting social cohesion (peer support, interaction) and identity (shared experience).		Participants exposed to same group of people every week for them to meet new people and increase the chances of them forming long term social bonds.
Surf-Ability	Opportunities for positive emotion through socialisation, achievement and exercise. Opportunity to find meaning through engaging with a new hobby – promote adaption to new identity. Clinicians present in the group encourage participants to be mindful whilst in the water. Clinicians also help reduce participants anxiety at the start of the group by talking through concerns/thoughts.	Introduces participants to a new outdoor exercise. Experience benefits of surfing. Opportunity for weekly exercise.	Promoting social capital (i.e., sharing psychoeducation, based on own lived experience, sharing surfing tips), cohesion (participants and their families meet other individuals with ABI, Watch and encourage each other.) and identity (shared experience). participants also have opportunity to have a coffee together following the group – chance to form bonds.	Takes place on a beach in the Gower Peninsula (area of outstanding natural beauty). Participants spend time significant amount of time in the ocean and feel the benefits of blue spaces. Many Participants report not having been in the sea since childhood.	Participants are taught basic surfing skills so they could continue hobby beyond the group. Are given professional advice regarding wetsuits, buying surfboards etc. Also offered opportunity to continue using the project in future independently or sometimes as a volunteer (depending on their ability).
Bike-Ability	Opportunity for positive emotion via socialisation,	Opportunity for participants	Promoting social capital (i.e.,	Takes participants outdoors.	Build psychological resources (confidence,

Intervention	Balancing Minds	Promoting health	Connecting People	Reconnecting to nature	Sustaining change
	achievement and exercise. Opportunity to find meaning through engaging with a new hobby – promote adaption to new identity. Clinicians help reduce participants anxiety at the start of the group by talking through concerns/thoughts.	to experience the benefits of exercise. Promotes cycling as a hobby and a cognitive remediation strategy.	participants and their families meet and can share coping techniques and also share tips for cycling), cohesion, (participants stop for a coffee together and a chat half way through the cycle – chance to form bonds) and identity (shared experience).	Cycle down a cycle path through woodland. Feel benefits of green spaces.	competence) to continue cycling beyond group setting. participants have option to continue using the project independently in future.

Study One: Qualitative Evaluation of The Impact of Psycho-Social Interventions on The Wellbeing Of Individuals With Acquired Brain Injury During The Covid-19 Pandemic

6.2. Study One Methodology

6.2.1. Context in which the research was conducted

On March 11th 2020, the World Health Organisation (WHO) declared the COVID-19 outbreak a global pandemic. COVID-19 is a respiratory virus which involves symptoms such as fever, loss of smell and persistent cough, with more severe cases requiring ventilation (Wang et al., 2020). From March 2020, Community Neurorehabilitation services in the United Kingdom were forced to cancel face-to-face outpatient appointments and community projects due to the COVID-19 Pandemic (Coetzer and Bichard, 2020). Multi-disciplinary teams were approximately halved due to clinicians having to 'shield', work from home, or be re-deployed (Coetzer and Bichard, 2020; Laxe et al., 2020; Silva et al., 2020). Some services were able to provide telephone appointments or video calling where possible, however this presented challenges including the unreliability or inaccessibility of video conferencing software, the need to maintain patient confidentiality and difficulty using technology (Coetzer and Bichard, 2020). The brain injury charity 'Headway' (Tyerman, 2020) conducted a survey on over 1000 ABI survivors and their families during this period. 57% of respondents claimed that they were unable to access rehabilitation and 42% said their rehabilitation had been negatively impacted. Other evidence indicates that the impact of the COVID-19 pandemic and resulting lockdown measures has had a negative psycho-social impact on the general population (Alzueta et al., 2020; Dawson and Golijani-Moghaddam, 2020) including reductions in wellbeing (Mead et al., 2020). Unemployment, lower social support, having a physical or mental health condition, emotional regulation difficulties and poor sleep quality increased the risk of experiencing negative psycho-social effects and loneliness during the pandemic (Groarke et al., 2020). All of these factors are a common neuropsychological consequence of ABI which are likely to have been exacerbated by the impact of the COVID pandemic. The Headway survey (Tyerman, 2020) indicated that 65% of their ABI respondents reported feeling isolated as a result of lockdown and 60% reported that it had a negative impact on their mental health (including increased anxiety and fear of their future). Study one evaluated the experience of 14 participants who completed at least one psycho-social intervention offered by the community neurorehabilitation service, based at a major hospital located in South Wales, during the COVID-19 pandemic.

6.2.2. Participants

Participants were invited by letter to attend at least one of five psycho-social interventions described in Table 11. Of the 24 participants invited, a total of 16 participants attended the interventions described herein. Of the 16 participants who attended the interventions all were subsequently invited to provide qualitative feedback about their experience of the intervention/s via a telephone call. One participant was unable to give qualitative feedback due to a language impairment (Aphasia) and one participant chose not to provide feedback. Accordingly, a total of 14 participants provided qualitative feedback about the experiences of attending at least one psycho-social intervention during the COVID pandemic. Of the 14 participants, 10 attended one of the interventions, two attended two interventions and two attended three of the interventions.

Participants were invited to take part in the interventions if they met the criteria for the Community Brain Injury Service: accordingly, all participants needed to be 18 years of age or above; have an ABI diagnosis; live in the community and in the health board catchment area; be able to engage in active neurorehabilitation. In addition to the service criteria, participants were invited to the interventions based on their individual rehabilitation goals and their ability to meaningfully engage with the intervention as determined by their treating clinician. Exclusion criteria included: language difficulties to the extent that a participant would be unable to meaningful engage with the intervention as determined by their treating clinician; medical, physical, cognitive or psychosocial reasons based on clinician risk assessments (for example, uncontrolled epilepsy would preclude participants attending surf-ability) or unable to provide informed consent.

All participants had been receiving neurorehabilitation in the service prior to being invited to the described group interventions. Participants will be referred to using pseudonyms (e.g., P1, P2). Table 12 shows demographic data for the 14 service-users who provided qualitative information about their experience of least one of five different interventions designed to improving wellbeing during the COVID pandemic.

Table 11 *Sample characteristics*

ID	Sex	Age	Injury Type	Injury Location	Time Since Injury	Employment	Intervention (s) attended
P1	M	39	Moderate-Severe TBI	Left temporal pole and postereo-lateral temporal pole. Left frontal and temporal operculae	4 Years	Unemployed	Surf-ability
P2	M	45	Moderate-Severe TBI	Inferior medial frontal lobes	3 Years	Medically Retired	Surf-ability
P3	M	29	Moderate TBI	Right frontal lobe.	8 Months	Unemployed	Surf-ability
P4	F	54	Mild-Moderate TBI*	Not Applicable	2 Years	Early medical retirement	Surf-ability
P5	F	59	Moderate-Severe TBI	Left occipital lobe. Bilateral inferior frontal lobe. Right temporal lobe.	1 Year	Employed (currently on sick leave)	Surf-ability, Online Psychotherapy, Online Fun Group
P6	M	56	Severe TBI	Diffuse axonal injury. Frontal lobe.	5 Years	Early medical retirement	Bike-ability, Online Psychotherapy, Online Fun Group
P7	F	57	Moderate-Severe TBI	Right frontal lobe, genu and splenium of corpus callosum, left thalamus, left temporal lobe and mid brain. Left parietal lobe	1 Year	Early medical retirement	Online Psychotherapy, Online Psychoeducation
P8	F	56	Stroke	Left frontal lobe	2 Years	Unemployed	Online Psychotherapy
P9	M	63	Moderate-Severe TBI	Left and Right temporal lobes	5 Years	Unemployed	Bike-ability, Online Psychoeducation
P10	M	48	Moderate-Severe TBI	Bi-lateral frontal lobe	26 Years	Unemployed	Online Fun Group
P11	M	46	Severe TBI	Frontal and anterior temporal lobes.	4 Years	Employed	Online Fun Group
P12	M	59	Haemorrhagic Stroke	Anterior communicating artery aneurysm.	4 Years	Early medical retirement	Online Fun Group

P13	M	36	Ischaemic stro ke – Right medullary infarct	Right medulla. Right parietal lobe. Right posterior frontal cortex.	1 Year	Unemployed	Online Fun Group
P14	M	54	Haemorrhagic Stroke	Left temporal lobe.	3 Years	Early medical retirement	Online Fun Group

6.2.3. Design and Context

A qualitative evaluation was conducted (Tayabas et al., 2014) to gather in-depth accounts of the experiences of the participants. This is in line with the requirements of the United Kingdom National Health Service to conduct on-going evaluations of patient experiences and services. The evaluation employed Thematic Analysis (TA) in order to analyse and synthesise large amounts of data from naturalistic settings into meaningful accounts (Braun and Clarke, 2006). Thematic Analysis is not limited to one epistemological framework, therefore a critical realist epistemological perspective was employed (Archer et al., 2013). This perspective claims that individuals make their own meaning of their human experiences, whilst also acknowledging the need for theories to help identify the broader social context driving the experience (Fletcher, 2016). The present evaluation adhered to all characteristics of a good qualitative analysis (Yardley, 2000), including sensitivity to context, commitment. rigour, transparency, coherence, impact and importance.

6.2.4. Ethical Considerations

The United Kingdom-based Health Research Authority online decision-making tool confirmed that ethical review was not required, as service evaluations in the United Kingdom are excluded from ethical review (GAfREC 2.3.12). This exemption was confirmed by the research and development officer in Swansea Bay University Health Board on the basis that data present in the manuscript was pseudonymized.

6.2.5. Interventions

The community neurorehabilitation service offered five 'COVID adapted' interventions either online or outdoors to support the psycho-social needs of participants during the COVID pandemic between March 2020 and November 2020. The five interventions included: -

Online ‘Fun’ Social Support Group

This was an informal group delivered via the online video conferencing platform, ‘Zoom.’ The group was led by an assistant psychologist from the Neurorehabilitation service who would prepare social games and quizzes for the group to play together. The facilitator encouraged group discussions to support social connection between group members. Sessions lasted one-hour per week and ran for a total of eight weeks. This group was set up following requests from patients as a means to break up the day during the pandemic.

Online Psychotherapy Group

6 × 2-hour sessions combining compassion focused therapy, mindfulness and acceptance and commitment therapy. This was led by a trainee clinical psychologist from the Neurorehabilitation service and was delivered via the online video conferencing platform ‘Zoom.’ Participants were guided through the program using a PowerPoint presentation, plus interactive questions, videos and exercises. This group was set up in response to participants feedback indicating a need for psychological support during the pandemic. The group was based on ACT and was designed to help participants manage distress, make room for difficult emotions and to enhance positive affect.

Online Psychoeducation Group

This was led by a consultant clinical neuropsychologist and clinical nurse specialist. This was a six session intervention for patients at the earlier stages of their rehabilitation. A ‘mentor’ was present during the group to provide experiential peer support. The group provided education around the cognitive, emotional and behavioural aspects of ABI. The content of the sessions was determined by group members. Examples of topics discussed include behaviour change, irritability, anxiety, pain, fatigue and the impact on family. Staff and mentors shared strategies/tips on the management of these difficulties. Activities and exercises were weaved through sessions based on the content that arose. These included developing action plans, exercises to support well-being (e.g., three good things, positive emotions) and mindfulness exercises.

Surf-Ability

This project was able to run outdoors in person from September 2020, as lockdown restrictions were partially eased in the local area. This group ran as a result of a partnership between 'Surf-ability' a local charity in the community and the Neurorehabilitation service. The project provides inclusive, adapted and assisted surfing lessons for individuals with cognitive or physical disabilities. The intervention took place on a beach in the Gower peninsula, Swansea, United Kingdom. Participants were required to be socially distanced from one another and plastic face visors were worn by instructors in the water. The group was two hours long and ran weekly for five weeks. Five participants attended the group per cohort and two cohorts were run in total. Qualified surf instructors from surf-ability led the sessions, each participant was given one-to-one support on a surfboard (either a qualified member of staff or a trained Surf-ability volunteer) to practice surfing from the water into shore. A clinical psychologist and a rehabilitation coach from the Neurorehabilitation service attended every session to (1) help participants with any practical issues such as finding their way to the beach or health concerns and (2) facilitate wellbeing e.g., talking through anxiety-related concerns, setting weekly surfing goals and facilitating mindfulness practice whilst in the water.

Bike-Ability

This project was also able to run outdoors in person from September 2020. This group was also a result of a partnership between 'Bike-ability,' a local community project and the community neuro-rehabilitation service. The group was one and a half hours long and ran weekly for only three weeks until it had to be postponed due to a second local 'lockdown'. Participants were still interviewed in order to capture their experience of having attended the intervention briefly. The intervention involved participants meeting together at the Bike-ability site and firstly practicing cycling around the small car park on different types of adapted bikes e.g., tandem bikes, handcycles. Following the first session, participants would then choose whichever bike they felt comfortable with and ride on a public cycle path through the woods together. Families were also welcomed to cycle alongside the participants. At least one member of staff from Bike-ability was present for every session. A clinical psychologist and a generic technician from the Neurorehabilitation service also attended every session to assist participants with practical issues (e.g., monitoring participants' fatigue levels and ensuring they rest) and also help facilitate wellbeing (e.g., introducing participants and families to one another to facilitate connections).

Outdoor groups were risk assessed both in terms of the physical environment as well as with respect to the abilities of each participant. For outdoor groups, strict COVID protocols were put in place including social distancing (where possible), temperature checks, frequent hand sanitation and face masks. Each intervention was developed to facilitate key components of wellbeing with reference to theoretical models of wellbeing as described previously and key activities which form an integral part of the Holistic Model of Neurorehabilitation. Table 11 provides a summary of the five interventions evaluated and an indication of which wellbeing components the intervention had the potential to facilitate. Although on the face of it each intervention appears very different, each load on to the previously identified factors which predict wellbeing (Kemp et al., 2017; Mead et al., 2019, 2020).

6.2.6. Data Collection

Interviews took place in November 2020. The data was collected using semi-structured interviews which were conducted by telephone. The first author (LW) conducted the interviews, only the participant and LW were present. LW holds a BSc in psychology and is an assistant psychologist and Ph.D. candidate. She did not attend the interventions described here in order to avoid demand characteristics. Participants understood that the interviews were being conducted for service evaluation and were informed that anonymised data would be used for service development. Participants gave verbal consent via telephone interview, this consent was transcribed and filed in the patient records. A topic guide containing the interview questions was prepared in advance by the first author. This contained a total of 16 questions categorised under either; 'experiences of ABI,' 'experiences of the pandemic,' and 'experiences of the interventions' (see Appendix T). Interviews were recorded using a voice recorder app on a secure NHS networked Apple iPad. Interviews were on average 36 min long, ranging from 23 min to 55 min in duration. Participants gave verbal consent for the audio files to be transcribed. The interviews were typed verbatim on to a word document, with the exception of the participants' names and locations, so that data were anonymised. The transcripts included stutters, false-starts, interruptions and utterances, in order to fully capture participant responses and avoid misinterpretation.

6.2.7. Data Analysis

ATLAS.ti 8 Scientific Software Development GmbH for Mac was used to manage the data. Data analysis followed the six-step procedure to good Thematic Analysis provided by Braun and Clarke (2006) (see table 13).

Table 12 *Braun and Clarke (2006) six-step guide to good thematic analysis*

Phase	Examples of Procedure for Each Step
1. Familiarisation	Transcribing data: reading and re-reading; noting down initial codes
2. Generating Initial Codes	Coding interesting features in the data in a systemic fashion across the data set, collating data relevant to each code
3. Searching for Themes	Collating codes into potential themes, gathering all data relevant to each theme
4. Involved Reviewing Themes	Checking if the themes work in relation to the coded extracts and the entire data-set; generate a thematic map
5. Defining and Naming Themes	Ongoing analysis to refine the specifics for each theme; generation of clear names for each theme
6. Producing the Report	Final opportunity for analysis selecting appropriate extracts; discussion of analysis; relate back to the research question or literature; produce report

Step 1 to 4 were completed by first author (LW). Transcripts were repeatedly read to become familiar with the data (step 1). Relevant quotes from the raw data were then assigned initial codes that were closely related to the material and context (step 2). Codes were then grouped into potential themes and subthemes (step 3) and the themes were then reviewed and refined, ensuring the highlighted quotes in each code were relevant and related to the theme assigned (step 4). All authors then reviewed and finalised the names of each theme (step 5). Finally, a selection of quotes from the transcripts were selected for presentation that were considered to reflect each theme and sub-theme (step 6). The data was analysed by one coder only as multiple coders do not always improve the accuracy of the coding process (Braun and Clarke, 2006). In line with recommendations (Braun & Clarke, 2019; Byrne, 2022), coding was conducted by lead author only, then co-authors later collaborated to sense-check themes and offer alternative interpretations of the data with the aim of developing richer meanings, rather than coding consensus. In terms of data saturation, Guest et al. (2006) reported that level of saturation may be reported as the point at which 80% or 90% of themes in a dataset are identified. The coder had already identified 90% of codes by the final transcript N = 14), thus, it is reasonable to assume that sufficient data had been collected to comprehensively assess the experience of participants reported here.

6.3. Study One Results

All participants who attended the intervention/s and provided feedback reported psychosocial difficulties including loss of friendships, an end to their “social life” (P13) and feeling “lonely” (P6). In a few cases, romantic relationships had broken down, including the end of a “ten-year relationship” (P4). It was also very common for psychological difficulties to be noted such as poor mental health (“Anxiety” P12 “Depression” P6; “Panic” P9), lack of “confidence” (P5) and an influx of mood swings and negative emotion (such as“fear” P4).

6.3.1 Themes Emerging

Thematic analysis identified eight overarching themes and 24 sub-themes (see table 14). Overarching themes included: Facilitating Safety, Fostering Positive Emotion, Managing and Accepting Difficult Emotions, Promoting Meaning, Finding Purpose and Accomplishment, Facilitating Social Ties, (Re)Connecting to Nature, and Barriers to Efficacy (see figure 9). See Appendix U for themes and sub-themes grouped according to intervention.

Table 13 *Themes and sub-themes identified from the transcripts. F, frequency of times theme is mentioned within the transcripts*

Theme	Sub-Themes	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14
Facilitating Trust and Safety (F = 49)	Shared Understanding (F = 35) Therapeutic Milieu (F = 14)	F = 1	F = 5	F = 0	F = 7	F = 3	F = 1	F = 3	F = 5	F = 3	F = 11	F = 5	F = 1	F = 0	F = 4
Fostering Positive Emotions (F = 42)	Happiness (F = 20) Excitement (F = 5) Improved mood (F = 6) Gratitude (F = 11)	F = 1	F = 1	F = 4	F = 3	F = 4	F = 4	F = 3	F = 4	F = 0	F = 1	F = 4	F = 6	F = 1	F = 4
Managing and Accepting Difficult Emotions (F = 16)	Acceptance (F = 7) Learning Coping Skills (F = 9)	F = 0	F = 0	F = 0	F = 1	F = 2	F = 2	F = 0	F = 4	F = 2	F = 0	F = 0	F = 2	F = 0	F = 2
Promoting Meaning (F = 36)	Hope and Optimism (F = 14) Altruism (F = 12) Self-transcendence (F = 10)	F = 0	F = 0	F = 0	F = 5	F = 6	F = 5	F = 7	F = 3	F = 5	F = 0	F = 4	F = 1	F = 0	F = 0
Finding Purpose and Accomplishment through Activities (F = 44)	Goal setting (F = 7) Cultivating and re-building Skills (F = 8) Accomplishment (F = 12) Purpose (F = 17)	F = 4	F = 0	F = 1	F = 1	F = 9	F = 5	F = 9	F = 1	F = 3	F = 4	F = 0	F = 1	F = 1	F = 2
Facilitating Social Ties (F = 91)	Friendship and Social Connection (F = 47) Building ABI Community (F = 27) Social Comparison (F = 17)	F = 1	F = 9	F = 0	F = 11	F = 5	F = 12	F = 7	F = 8	F = 9	F = 11	F = 1	F = 5	F = 0	F = 8
(Re) Connecting to Nature (F = 31)	Enjoy Outdoor Environment (F = 13) Relaxation (F = 10) Mindfulness and Psychological Flow (F = 8)	F = 2	F = 6	F = 7	F = 9	F = 3	F = 0	F = 1	F = 1	F = 1	F = 0	F = 0	F = 0	F = 0	F = 0
Barriers to Efficacy (F = 21)	Weather Conditions (F = 2) Recovery stage (F = 6) Apprehension (F = 10) Difficulties using technology (F = 3)	F = 0	F = 1	F = 4	F = 2	F = 7	F = 0	F = 1	F = 1	F = 0	F = 3	F = 1	F = 1	F = 0	F = 0

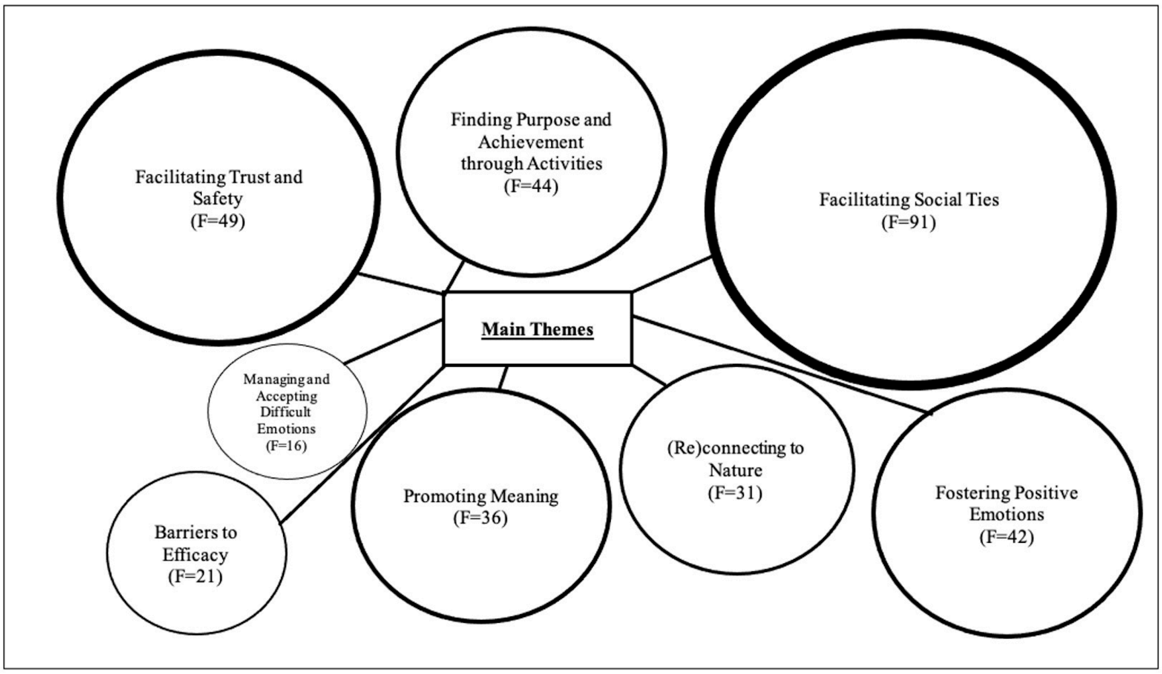

Figure 9 Figure representing the main themes from the results

Note: F, Frequency of times theme is mentioned within the transcripts. Size of theme represents frequency mentioned. Image created by Lowri Wilkie using Microsoft Word

6.3.2. Facilitating Trust and Safety Theme

This theme captures how participants felt "safe" and "supported" during the intervention(s). Participants reported feeling (often for the first time) "understood" by both clinicians and peers. This enabled them to be their authentic selves, without fear of feeling judged.

"It's like we understand each other. We don't feel as if we're being, I don't feel as if I'm being judged then. Whereas if I go somewhere, I'm afraid sometimes that I won't have confidence because I don't know what's going to come out of my mouth. Whereas in the group it doesn't matter." (P4)

Meeting other participants who had shared experiences of ABI initiated some relief that they weren't alone, thus making the experience less isolating and reducing self-criticism.

"I immediately met people who were the same, who had the same thoughts or feelings, because they're not normal thoughts or feelings so they're things you can't really say to people and

when you find other people like that it was like a massive weight lifted off my shoulders you know like ah, I'm not different or mental or whatever." (P10)

Meeting others with ABI and receiving education and support from peers and clinicians increased self-understanding and self-acceptance, as participants learned more about their injury.

"It gives me more understanding of what I'm going through and what other people go through, sort of just helps you learn your way through adjusting your life." (P14)

Participants acknowledged the benefits of having clinicians present during community-based outdoor interventions, as they provided a "safety net" from whom they could ask for advice and support. They also described the community neuro-rehabilitation service as being a place where they feel "cared" for.

"you don't realise when you get into trouble there are people out there that can help you. You know, you just don't realise there's people out there that genuinely do care and help and like, you know? That's what I found with the brain injury service." (P2)

6.3.3. Fostering Positive Emotions Theme

This theme captures how the intervention(s) fostered positive emotion for participants. Participants typically reported being either relieved or excited when they were invited to attend the intervention(s) during lockdown. They reported feeling grateful and thankful for having the opportunity. One participant described the groups as being a "*life saver*" *(P12)*. Another participant went out and bought a laptop solely to take part in the online interventions.

"Oh I was thrilled (takes a deep breath) I was thrilled to the point that we went, um, they went and got me a laptop, (pause) my own." (P8)

Participants described feeling positive emotions during and following the intervention(s) such as happiness, excitement and overall improved mood.

"Brilliant, it did cheer me up a lot to be honest, it was something that I had to look forward to every week, it's like meeting friends again or the family, it was a real feel-good factor." (P14)

A couple of participants reported that they struggle to experience positive emotions such as happiness. They did however still report that the intervention was a positive experience and that they still looked forward to returning every week.

"Even though I didn't feel 'happy' after the group, I still look forward to the group coming, I was glad that I had participated in the group and then afterwards I couldn't help but look forward to the next, so it lifted me then, it lifted my spirits a touch, and I felt a lot better, I wouldn't say happy, I've forgotten what happy means really but yeah it did lift me I did feel better." (P11)

6.3.4. Managing and Accepting Difficult Emotions Theme:

Some participants reported becoming more accepting of their ABI limitations.

"right at the start, I wouldn't say anything to anyone because I didn't want to get involved with the conversation because I didn't… want to reveal the limitations that I had. But now I've got more acceptance of those limitations." (P6)

Some participants mentioned that they had learned specific coping techniques such as *'relaxation'* and *meditation' (P8).*

"I think yourselves have given me the tools to recognise my own trigger points and to slow down." (P4)

Others spoke more generally about being reminded to be easier on themselves.

"you've got to try and remind yourself to look after you and by having those meetings I did." (P8)

6.3.5. Promoting Meaning Theme

This theme captures participants' comments on how the intervention made them feel as though their life had meaning or value. Some participants expressed self-transcendent feelings, feeling part of something bigger than themselves.

"A session on Zoom, just to see everybody does pick you out of that hole and makes you feel, I know this sounds stupid, but it makes you feel wanted again, you know what I mean? Makes you feel part of something instead of just, nothing, being by yourself." (P12)

Some participants described how the intervention gave them the opportunity to help and support others, which in turn helped their own wellbeing too.

"but not just getting what I can from the course for myself helps me, If I see I've helped someone else, I get a big boost, that, that, you know." (P12)

Participants also found meaning through realising their own capabilities and thus developed a sense of hope for their future. One individual described this as feeling as seeing "*light at the end of the tunnel"* as they described how Bike-ability had made them realise their own potential to achieve, and how they might use this in future.

"I think it's made me think positively about what I can do. Like it filled a very important bit of my life and now it's not there I'm thinking well what else could fill that bit? You know like [pause] well maybe one day my friend I could go and hire the bikes at BikeAbility ourselves." (P7)

6.3.6. Finding Purpose and Accomplishment Through Activities Theme

This theme captures the experience of participants given through engaging activities which providing opportunities for purpose and accomplishment.

"I think I enjoyed, or what I thought I enjoyed the most was going out and having a purpose. Going out and doing something. Like having a mission." (P7)

These activities gave individuals an opportunity to challenge themselves, work toward goals and feel a sense of pride and accomplishment.

"It took me out of my comfort zone, and I was really proud of myself." (P5)

The intervention also gave participants the opportunity to learn new skills. For example, several individuals commented on how they had learned how to surf via Surf-ability.

"I got on the surfboard and then I was shocked that I got on it and then stood up, my first session, so a good feeling." (P1)

In addition, participants had the chance to re-build old skills or parts of their pre-morbid identity which they had lost since their ABI.

"cycling, that is a major thing for me because I never thought I would get, I got back on a bike." (P6)

6.3.7. Facilitating Social Ties Theme

This theme captured how the intervention(s) facilitated social connections and a sense of community. They provided an opportunity for participants to socialise at a time when they were increasingly isolated.

"we would all be very lonely and that does bring you down sometimes when you've got nobody to talk to but because of these groups, you have got someone to talk to, you can see someone, it's only an hour, but that hour gives you a buzz all day." (P12)

Long-term friendships and social connections formed as a result of the intervention(s). One participant commented on how they had lost their friendships following their ABI and so they now rely on their ABI friendships for social connection.

"My existing friends before my injury, they were all concerned after my injury but they soon sort of disappeared… so the only way to have conversation is with people under the same conditions who can relate to and share your conditions through recovery." (P14)

The interventions also gave participants the opportunity to be a part of a community of individuals with ABI who have suffered similar circumstances.

"the fact that there are other people out there struggling in similar kind of ways has had a really positive effect [pause]. Because you know if you feel like you're the only one like this, then that makes you feel alone. Whereas, I've found a community of people that have got cross-over similarities and that makes a big difference. That's really encouraging." (P7)

From this community, they had the opportunity to share their own experiences, receive and provide peer support. One participant decided to set up an independent online coffee morning to provide a space for continued peer support after the intervention.

"We set up the coffee morning just purely for a chat, anyone who wants to just drop in and have a word, it gives you a, if you have a question, you're speaking to somebody who's been through it prior." (P6)

One participant also independently set up a mobile messaging group as a result of the intervention, where participants continued to chat to each other daily. It was noted that this 'group chat' improved social connection during lockdown.

"I just felt like I was going around in circles [during lockdown], you know when the weeks are turning into months, and obviously not having contact with anyone, but I think we were lucky because [participant name] set up the What's App group." (P4)

Participants also described how they compared themselves to other participants in the groups who were further along the recovery trajectory, this sometimes fostered a sense of hope for their own future.

"And well you know, that gave me massive encouragement that he was there and now he's here. So maybe the same is possible for me." (P7)

Similarly, when individuals compared themselves with those worse off, this often created a sense of gratitude for their own abilities.

"It makes you think then, you know, these people worse off than you." (P1)

6.3.8. (Re)Connecting to Nature Theme

This theme captures the uniqueness of the nature-based interventions. Nearly all of the participants who attended outdoor interventions (surf-ability and bike-ability) reported some benefit of the intervention taking place outdoors or in nature.

"Being outside is me. I'm not really – I'm not one to stay inside. Like I just like being outside. I don't know what it is. It just feels nicer." (P3)

Several participants reported experiences of relaxation, mindfulness and 'flow' during the Surf-ability intervention, with several reports of "*losing track of time" (P3).*

"It's [The ocean] just so calming… I just feel as if I'm connected." (P4)

One participant described how surfing made them feel present in the moment, which allowed them to experience positive emotion despite their difficult life circumstances.

"I was quite… I was overwhelmed I was, just being out there and really enjoying and not really thinking about anything else that was happening, like, my break-up or not seeing my kids and

not having my car. Nothing really comes out like. So, I was just like, really happy that I was out… out there really." (P3)

6.3.9. Barriers to Efficacy Theme

This theme reflects any concerns about the intervention(s) which were highlighted by the participants.

Weather was noted as a barrier for the outdoor groups, especially in Autumn/Winter. One participant in particular highlighted that they did not want to attend in the rain or cold.

"I've also said no, I'm not doing it. Not that I don't want to go and see people and do something but because I don't particularly want to go in the sea in November." (P5)

Most participants reported feeling apprehensive and anxious before attending the groups.

"Oh, nervous. I was really nervous, yeah." (P3)

A few participants also highlighted difficulties managing technology for online groups.

"I've never done zoom before, I didn't know how to work the iPad or anything." (P10)

One participant had some concerns regarding the online messaging group chat. This participant was early on in their recovery and didn't feel they were a part of the friendship group, as the others were further along in their recovery process.

"it's more like a friendship thing and they've been on this journey a lot longer than me." (P5)

The same participant had heard about the peer support coffee morning and had not been invited and so felt like an "*outsider." (P5)*

In addition, seeing another participant with an ABI who was further down in their recovery but still struggling, made them realise that they wouldn't return to their 'old' selves which had a negative impact on them.

" Is that going to be me in five years?"(P5)

6.4.Study One Results Discussion

This evaluation explored the experiences of people living with ABI following online and outdoor interventions that were developed to improve wellbeing during the COVID-19 pandemic. Findings indicate that the intervention(s) promoted wellbeing in people living with ABI during the COVID pandemic. Elements of both eudemonic and hedonic aspects of wellbeing were identified in the analysed transcripts. Furthermore, themes extended beyond the individual experience, and encompass support from clinicians and peers, friendship and social connection. Moreover, in addition to highlighting the importance of relationships on wellbeing, participants also describe the importance of a sense of community and social cohesion. The GENIAL model (Mead et al., 2019, 2020) provides a framework for building wellbeing in people living with chronic conditions including a focus on mind and body in combination with a focus on building connections, and context-specific factors associated with the reduction of barriers and provision of opportunities. The themes that were identified in this evaluation will now be discussed, after which, the contributions to positive psychology and associated developments in the field will be reflected upon.

6.4.1. Facilitating Trust and Safety

Participants commonly highlighted how ABI is a hidden disability and that they often experience misunderstanding and stigmatization from family, friends and the general public. This is in line with previous research which has demonstrated negative attitudes toward individuals with ABI (McLellan et al., 2010). In addition, research has shown that the adverse effects of brain injury, such as anxiety, are worsened by the public's misunderstanding, as individuals often try to hide symptoms, leading to overcompensation or societal withdrawal (McClure, 2011). In addition, participants described how suffering an ABI can be an extremely isolating experience, which involves a great deal of self-criticism. The 'facilitating safety' theme therefore captures how participants felt the interventions gave them a safe and supported space, where they were understood by staff and peers. This enabled them to be their authentic self without feeling as though they should hide their symptoms or worry of being judged. Meeting other individuals who shared similar experiences and symptoms and working with clinicians facilitated self-understanding and relief when they realised that their symptoms were a part of their condition, as opposed to a character flaw. These findings are in line with research on relatedness and ABI which suggests that a sense of belongingness is associated with psychosocial wellbeing (Bay et al., 2002, 2012). Being in a supportive environment allowed participants to challenge themselves outside of their comfort zone, in turn promoting opportunity for accomplishment and autonomy. Without this 'safety net', participants felt they that may have been unwilling to take part or push themselves, consistent with Maslow (1970) hierarchy of needs, which claims that lower-level needs such as 'safety' must first be met in order for higher level peak-experiences to take place. More recent evidence further demonstrates that social and psychological safety underpins the motivation to achieve (Popovych et al., 2020).

6.4.2. Fostering Positive Emotions Theme

Consistent with hedonic theories of wellbeing, the intervention(s) cultivated positive emotion such as happiness, joy, interest, excitement and gratitude, all of which are critical for the promotion of wellbeing. Positive emotion was commonly associated with taking part in new activities, accomplishment and building social ties. This is in line with Barbara Fredrickson's Broaden and Build Model Fredrickson (2004), which holds that positive emotions promote creative actions, ideas and social bonds, which in turn build that individual's social and psychological resources. Importantly, research has specifically linked positive emotion, increased social connectedness and vagal functioning (Kok and Fredrickson, 2010; Kok et al., 2013), and demonstrated that positive psychological attributes are associated with cardiovascular health (DuBois et al., 2012; Huffman et al., 2017).

6.4.3. Managing and Accepting Difficult Emotions Theme

Participants reported that interventions helped them to better manage and accept difficult emotions. Research has shown that people who are able to accept negative emotions, experience better psychological health compared with people who struggle to accept negative emotions, judging them as 'bad' or 'unacceptable' (Baer et al., 2004; Cardaciotto et al., 2008; Kohls et al., 2009). The interventions included elements of Mindfulness, Acceptance and Commitment therapy (ACT) and Positive Psychology 2.0, which present psychological distress as a universal aspect of human experience and encourage individuals to live with acceptance (Nordin and Rorsman, 2012) thereby altering the individual's relationship to their psychological and contextual experiences (Hayes et al., 2006; Kangas and McDonald, 2011). Mindfulness-based approaches have been shown to facilitate acceptance of negative emotion and better psychological health (Cardaciotto et al., 2008; Kohls et al., 2009). Mindfulness was a core feature of all of the interventions, including 'Bike-ability' and 'Surf-ability' during which this technique was taught alongside associated activities.

6.4.4. Promoting Meaning Theme

Some participants reported that they struggled to feel positive emotion. For example, one participant described how he suffers from depression and therefore claimed that he was unable to experience 'happiness.' Herein lies the importance of reflecting on wellbeing as something greater than the experience of positive emotions (or hedonic wellbeing). PP 2.0 (Wong, 2011), has repeatedly emphasised that meaning provides scope for experiencing wellbeing, even in times of distress and suffering as is the case for many struggling to adjust to life post ABI – a struggle which for many was exacerbated during the COVID pandemic. Consistent with PP 2.0 and eudemonic theories of wellbeing, participants in the present evaluation derived a sense of meaning from the interventions. Most commonly, meaning was derived through peer support, which enabled participants to share their experiences, feel listened to and valued for helping others. This sometimes led to self-transcendent experiences; "identifying with something greater than the purely individual self, often engaging in service to others" (Koltko-Rivera, 2005, p.306). Turning one's attention outward to other people has long been recognised as necessary for living a meaningful life (Frankl, 1966). In 1970, Maslow extended his theory of basic human needs (1943) to include self-transcendence, as he highlighted that basic human needs can only be fulfilled through other human beings. This finding is also in line with evidence that pro-social behaviour exemplified through volunteering is associated with greater meaning in life, often mediated through self-esteem (Klein, 2016). Other evidence indicates that a sense of meaning is especially important for coping and resilience with the COVID-19 pandemic (Blustein and Guarino, 2020; Dawson and Golijani-Moghaddam, 2020). Consistent with the core aims of PP 2.0, the intervention(s) enhanced meaning in life during the COVID-19 lockdown, an especially important component of wellbeing for individuals with ABI, particularly those who have difficulty experiencing hedonic wellbeing.

6.4.5. Finding Purpose and Accomplishment Through Activities Theme

Another key theme that emerged was an opportunity to find purpose through activity leading to a sense of accomplishment. Following ABI, participants reported that their daily activity had significantly decreased, whether this be through job loss, an inability to participate in previous hobbies or due to a lack of independence (i.e., the inability to drive). In keeping with the holistic model of neurorehabilitation, this theme highlights the importance of designing interventions which facilitate meaningful and functional goal-directed activities. Lack of meaningful activity was also exacerbated as a result of the COVID-19 lockdown and restrictions, as participants reported that any remaining opportunity for them to socialise or mix with the community was taken away from them. Discussing this change in activity often led participants to highlight differences between their pre-injury and their current sense of self, consistent with the Y-shaped model (Gracey et al., 2009), which holds that having forms of activity and social participation taken away creates a discrepancy in one's sense of identity.

Participants reported that the intervention(s) provided new opportunities for them to participate in activity. In line with Ryff's Psychological Wellbeing theory (Ryff, 1989), personal growth, purpose and environmental mastery were highlighted in regard to opportunity for activity. For example, participants developed skills such as learning to cycle or surf, deriving a sense of accomplishment when doing so. These opportunities allowed some individuals to integrate aspects of their old identity with new skills and activities. This is in line with the Y-Shaped model (Gracey et al., 2009) which claims that as an individual works to resolve identity discrepancies, aspects of continuity of self are discovered and developed leading to a new, adaptive sense self.

In addition, participants often set themselves goals such as continuing to participate in activities beyond the intervention. From the intervention(s), participants developed a weekly routine (a new positive habit), developed psychological resources needed to continue the behaviour (e.g., self-confidence), the motive to change their behaviour long-term (personal goals) and had a supportive social group (environment) to help keep them motivated. Thus, the interventions successfully facilitated several of the common predictors of long-term behaviour change (Kwasnicka et al., 2016). For example, one participant started an online coffee morning group, and invited other participants to attend weekly in order to maintain peer support and socialisation beyond the group.

6.4.6. Facilitating Social Ties Theme

In line with the typical sequalae of ABI, participants universally experienced a reduction in social support following their ABI, as friendships and sometimes romantic relationships broke down (Hoofien et al., 2009; Morton and Wehman, 2009). This lack of social support was also exacerbated as a result of the COVID pandemic. For some, lockdown and subsequent restrictions made them feel significantly more isolated than before. For others, they felt they were used to being isolated every day anyway, and so lockdown did not feel very different. The most commonly reported benefit of the group interventions was increased social ties. Recent work in psychological science has reinforced the importance of positive social ties (Kemp et al., 2017; Haslam et al., 2018) highlighting a key role of social identity in health and wellbeing. Individuals from diverse backgrounds were brought together with a shared commonality – the experience of living with ABI – and learned to share resources such as emotional support, ABI education and coping mechanisms. The interventions therefore promoted social capital (Woolcock and Narayan, 2000; Lin, 2002), as participants utilised each other's experiences for a collective goal (peer support). The interventions also facilitated social cohesion, important for eliciting feelings of belonging and acceptance (Elliot et al., 2014). Previous research has found that people with chronic conditions are less likely to report deteriorating health if they live in neighbourhoods with high levels of social cohesion (Waverijn et al., 2014). Moreover, Maslow himself Maslow (1970), p87) stated that; "the need for community (belongingness, contact, groupness) is itself a basic need", in relation to his hierarchy of needs. By delivering interventions in group format, new social identities are promoted, consistent with participants reporting feeling as though they 'belong' to an ABI community of people who understand their experiences. A focus on building social relationships has recently been described as the new psychology of health (Haslam et al., 2018). Having a variety of participants from different points in their recovery trajectory enabled exposure to role models. Participants felt that seeing others further along the ABI recovery trajectory changed their perception of themselves and their own capabilities. This is in line with social comparison theory (Festinger, 1954), as individuals developed 'hope' for their own recovery via upward social comparison.

6.4.6. (Re)Connecting with Nature Theme

Participants who attended outdoor interventions (Surf-ability and Bike-ability) experienced positive states of mind such as feeling present and being fully absorbed in the activity. This supports previous findings that exposure to the natural environment can increase psychological flow, mindfulness and wellbeing (Nakamura and Csikszentmihalyi, 2014). The theme was most frequently mentioned by participants in Surf-ability and most of these observations were related to the restorative effect of being in the water, thus supporting research on the benefits of blue spaces on human health and wellbeing (Grellier et al., 2017). This also suggests the natural environment restored limited cognitive resources in participants, thus supporting Attention Restoration Theory (ART; Kaplan, 1995). There is an ever-growing literature on the benefits of 'green spaces' and natural environments have become a popular method to help facilitate wellbeing in the healthcare sector (Ulrich, 1986; Kaplan, 1995; Stigsdotter and Grahn, 2002). Capaldi et al. (2015) concluded in a review that; exposure to nature is a wellbeing strategy underutilised by mental healthcare providers and that the evidence suggests that nature-based interventions provide opportunities to promote wellbeing at low cost.

6.4.7. Barriers to Efficacy Theme

The majority of barriers highlighted were participation obstacles such as apprehension, concerns with the weather or difficulty managing the technology needed to participate. All participants were able to circumvent these barriers and some went on to use their new skills to connect with others outside of the interventions (setting up of online coffee mornings) as well as to connect with their families socially. As noted by Coetzer and Bichard (2020), the use of online video interventions with individuals with ABI can present significant challenges. However, this evaluation demonstrates that with sufficient time, support and adaptation, participants with ABI were able to engage successfully with online rehabilitation. Moreover, given that it is often difficult for people with ABI to physically access community interventions (e.g., inability to drive, financial constraints or fatigue) this evaluation indicates that use of technology to facilitate social connection and psychological interventions may be a useful tool post COVID.

The barrier 'recovery stage' was noted by one participant only, who felt there was one negative consequence of the 'fun group.' She felt that as her peers were further along in their recovery than her, she didn't feel a part of the friendship group and their limitations made her realise that she wouldn't return to her old self. Previous research has highlighted that psychotherapy groups should consider grouping patients according to their perceived stage in recovery (Tulip et al., 2020). However, as previously noted, being in a mixed group that included service-user mentors was beneficial for most due to upward social comparison (Festinger, 1954), and so grouping interventions according to recovery stage would compromise those benefits. Moreover, the realisation that one cannot return to their old selves is part of an on-going process of acceptance, that is a necessary factor contributing to post traumatic growth following ABI

(Karagiorgou et al., 2017). Therefore, it may be argued that whilst this process of realisation was difficult for this participant, acceptance is more beneficial for their growth in the long-term (Fleming et al., 2009). This feedback was useful from a service evaluation perspective as it allowed clinicians to offer individualised support for the service-user to support their recovery in a different way. It is also noted that participant 13 gave very little feedback on the intervention. This individual wanted to participate in the evaluation, and highlighted that he enjoyed the group, however, he often responds in a yes/no manner and so descriptive data was lacking.

6.4.8. Contributions to Positive Psychology

This evaluation examined the experience of individuals who were faced with the challenge of adjusting to a life changing condition, while also enduring additional suffering associated with the COVID-19 pandemic. The suffering that participants had to endure accentuates the inadequacy of positive psychology (PP 1.0), which is characterised by a focus on positive emotion. PP2.0 and associated developments in the field are thus a more nuanced and balanced approach to positive psychology. According to Wong (2019), PP.20 is focused on the following principles and practices: (1) accepting the reality of suffering, (2) sustainable wellbeing can only be achieved through overcoming suffering, (3) the balance of positive and negative emotions, and (4) finding joy in bad situations. These contributions have been incorporated into the service and the interventions, and are reflected in the experiences of participants.

Firstly, the findings support the notion that acceptance of suffering is key to achieving wellbeing, particularly within ABI, as participants commonly noted the necessity of learning to accept their ABI limitations. Secondly, it is acknowledged that there is a need for wellbeing science to be more inclusive of wider systemic issues. Moreover, we raise concern that many definitions of wellbeing often do not allow for people living with living with chronic conditions to experience wellbeing (Kemp et al., 2017; Mead et al., 2019). Here, findings suggest that individuals are in fact capable of wellbeing, despite significant suffering. Thirdly, as previously noted, interventions were successfully designed to balance the positive and negative aspects of all emotional experiences, and this was successfully reflected in participant experiences. Fourthly, the fundamental role of post-traumatic growth (PTG) following the trauma of an ABI is highlighted. PTG refers to the occurrence of positive psychological changes following a traumatic life event, whereby the person achieves higher levels of functioning than the ones they had before the event (Tedeschi and Calhoun, 2004). PTG is thus a good example of finding joy in suffering. The themes identified in the interventions align with factors associated with PTG. The interventions were found to promote social support, self-understanding (ABI education), and meaning in life, all of which have been previously identified as factors correlated with PTG after ABI (Sawyer et al., 2010; Grace et al., 2015; Pais-Hrit et al., 2019). Moreover, learning new skills, re-learning old skills and being active in the community are also associated with PTG (Karagiorgou et al., 2017; Kersten et al., 2018), all of which were expressed by participants in the evaluation. PTG in ABI has also been described as involving a realisation that there is 'life after brain injury' (Lyon et al., 2020). Participants frequently reported a shift in attitude, experiencing hope and optimism for the future. The interventions thus successfully facilitated many of the factors associated with PTG, which, in line with PP2.0, is a fundamental process of adjustment, growth and wellbeing following trauma. Overall, the evaluation provides qualitative evidence for the contributions of PP2.0 to psychotherapeutic practice. It uniquely contributes to PP2.0 through the use of advances in wellbeing science and holistic neurorehabilitation to demonstrate processes through which the principles of PP2.0 can be achieved in an ABI population (i.e., the development of interventions which build on core components of wellbeing).

Moreover, positive psychology (PP) and wellbeing science have been critiqued for having a reductive and de-contextualised focus on the individual that ignores the wider systemic barriers to wellbeing such as inequality (Mead et al., 2019). Recent developments in the field, including the so-called 'third wave' of PP, highlight a need to consider higher levels of scale and the communities and environments within which the individual is embedded (Kemp et al., 2017; Mead et al., 2019; Fisher et al., 2020; Lomas et al., 2020). The interventions were designed with these considerations in mind. We argue that neurorehabilitation projects designed in partnership with community providers create a context for sustainable wellbeing post discharge by bridging the gap between the health service and the local community. A core activity in the community brain injury service has involved working with community providers to co-construct interventions as well as securing funding to run them. In doing so, patients who typically have limited financial means are provided opportunities which otherwise would not be available to them. The present findings thus contribute to this new 'third wave' of PP as the need for wellbeing interventions to consider the impact of wider socio-structural factors is highlighted. It should be noted that the evolutions of PP should not be seen as having clearly defined boundaries, but are instead overlapping waves (Lomas et al., 2020). The findings of this evaluation thus support and contribute to both the second and third wave of PP.

This evaluation provides new qualitative data to support the use of online and outdoor interventions to enhance wellbeing in individuals living with ABI during the COVID-19 pandemic. In congruence with PP 2.0, findings indicate that it is possible to improve the wellbeing of people with ABI, despite the impairments caused by their condition and the psycho-social issues exacerbated by the lockdown restrictions. Thus, findings support the proposal that providing a context for positive experience and emotion, while also emphasising opportunities for meaning, purpose and personal growth may be an effective way to build wellbeing despite suffering (Wong, 2011). The way community neurorehabilitation services are run is likely to change, as at the time of writing the world is continuing to navigate the global pandemic and is likely to be continually impacted by its legacy. Although many participants were apprehensive about using technology the majority were able to engage in the interventions and several felt that this new skill allowed them to better access neurorehabilitation, as getting to face-to-face appointments could be difficult. This is in line with recent promising evidence for the use of online psychological interventions (Dores et al., 2020; Mendes-Santos et al., 2020). Accordingly, online rehabilitation may provide a useful tool for some aspects of neuro-rehabilitation post COVID. Although outdoor interventions are noted as being an effective way of adapting interventions during the COVID pandemic, there is now a robust rationale to support the inclusion of such groups in neuro-rehabilitation programmes to enhance health and wellbeing post COVID. Finally, this paper has synthesised advances in wellbeing science and guided by the GENIAL model of wellbeing, offers insights that complement and extend on the dominant Holistic Model of Neurorehabilitation, paving the way for novel interventions that seek to not only reduce impairment and distress but also create opportunities for meaning and enhanced wellbeing post ABI.

Study Two: A Mixed Methods Evaluation of a Surf-Therapy Intervention on Patients with Acquired Brain Injury

The aim of study two was to investigate one of the previously reported interventions – 'Surf-Ability' - in depth, to assess whether the surf-therapy intervention promotes wellbeing according to quantitative survey and physiological data. The second aim was to conduct a ripple effects mapping session with a sub-sample of participants at approximately one year follow up, to assess whether the impact of the intervention has longevity, and thus ensure it is an appropriate long-term use of service resources.

6.5. Study Two Methodology

6.5.2. Study Design

A partially mixed sequential equal status design was employed (Leech & Onwuegbuzie, 2009). Sequential describes the qualitative and quantitative phases of the study occurring separately, in this instance quantitative occurred at the time of the intervention and the qualitative phase occurred at 6-10 month follow up. In partially mixed methods, both the quantitative and qualitative elements are conducted before only being mixed at the data interpretation stage. The design puts equal emphasis on both qualitative and quantitative components with respect to addressing the evaluation aims.

6.5.3. Quantitative Study Design

The quantitative component was a within-subjects repeated measures design. Participants who attended the intervention each completed a routine series of survey measures related to wellbeing prior to and upon completion of the intervention. The aim was to compare participants' scores using within subjects' analysis to establish whether there was a change in wellbeing related measures following Surfability. A within-subjects comparison was used because between subjects' comparison is not possible during a routine service evaluation.

6.5.4. Qualitative Study Design

Ripple Effects Mapping (REM) (Chazdon et al., 2017) was used to facilitate a follow-up session 6-10 months prior the intervention. REM is a qualitative tool to evaluate program outcomes using both participants and stakeholders such as group facilitators or clinicians (Chazdon et al., 2017). This method of evaluation was employed because it aligns with the goal of 'co-production', given that it engages participants to reflect upon and visually map the effects of the program. REM has four key components: 1) appreciative inquiry whereby participants in the session briefly share their experiences in pairs, (2) a participatory approach (participant involvement), (3) interactive group interviewing and reflection, and (4) "radiant thinking". All of these components are incorporated in to one session, and end with a mind map of key themes and effects, as well as a recorded transcript of all discussions. REM is unique in its ability to capture a complex chain of events triggered by programs. There are three variations of REM, to be chosen depending on the context of the intervention. Variation two: 'In Depth Rippling' was used in this instance, which involves mapping out rich and detailed narratives from each of the participants describing follow up stories from the intervention. This approach was chosen because it allows us to capture short-, medium- and long-term outcomes as resulting 'ripples', which is important in ensuring interventions are helpful for patients long-term and thus limited resources are used efficiently. In addition, it was felt that it would be beneficial for patients to share their personal stories in-depth, given this is an activity which is therapeutic in itself (D'Cruz et al., 2019).

6.5.5. Participants

Participants were patients receiving neurorehabilitation under the Regional Neuropsychology or Community Brain Injury Service at Swansea Bay University Health Board. Patients were invited to attend the surf-therapy intervention if 1) they met the eligibility criteria for the service and 2) their treating clinician felt they would benefit from attending the group, because it had the potential to support them to achieve their rehabilitation goals and they would be able to engage in the intervention safely and meaningfully. Of 27 patients who were invited, 18 attended and 9 had to drop out before starting the intervention or very early on, due to travel or health restrictions. Everyone who attended gave informed consent. See figure 10 for participant CONSORT flow diagram.

Participants were not randomly assigned to the intervention because the data was collected as part of a service evaluation and so it was not appropriate to assign patients randomly. Participants were selected to attend the intervention based on a joint decision made by clinician and patient. This decision was centered around whether surf-ability might help them achieve their individual rehabilitation goals. Common goals which participants' involvement aimed to address included: creating new social connections, developing social skills, initiate the process of forming a post-injury identity, increasing independence, finding purpose in life, increasing physical activity, and improving balance.

All participants' injuries were classed as moderate to severe, in line with the service's eligibility criteria. Common challenges experienced by participants were cognitive difficulties including memory, attention, and executive functioning, in addition to psycho-social challenges such as increased psychological distress. Some participants had physical difficulties including fatigue, dizziness, and balance impairments, which were accommodated for using adaptive surf equipment and extra staff support.

6.5.6. Inclusion criteria for the service

In accordance with the eligibility criteria for the service participants were 18 years of age or older, had a confirmed diagnosis of an acquired brain injury, lived in the community and in the health board catchment area. They were able to take part meaningfully and safely in the intervention.

6.5.7. Exclusion criteria

patients who had any medical, physical, cognitive or psychosocial difficulties which would prevent them engaging with neurorehabilitation or the surf therapy intervention (as assessed by their treating clinician) were excluded. For example, if a patient had uncontrollable epilepsy and were deemed not medically fit to take part. Risk assessments were carried out by clinicians and all staff involved were made aware of individual participants' needs and requirements. Patients who were unable to give informed consent were excluded from the evaluation. Patients who dropped out of the intervention due to ill health and travel difficulties (before completing at least 4 out of 5 sessions) were excluded.

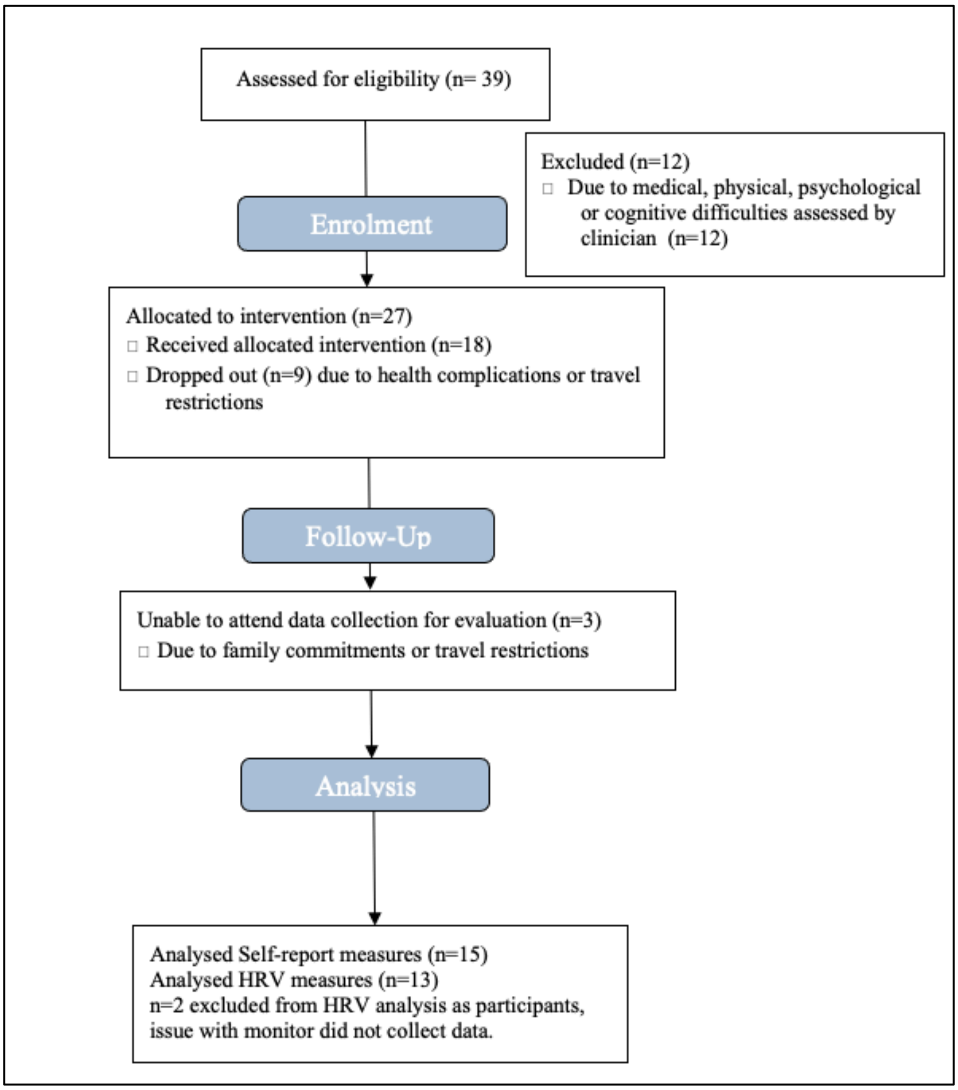

Figure 10 Quantitative Data CONSORT Flow Diagram

Note: Image created by Lowri Wilkie using Microsoft Word.

6.5.8. Intervention

The intervention took place between 2019 and 2021 during the Summer/Autumn months, with a new cohort participating each year. The intervention was provided as part of a collaborative relationship between a NHS neurorehabilitation service based at a major hospital in South Wales and a local, community-based third sector organisation. Surf-Ability is a Community Interest Group who provide adapted surf lessons for individuals with additional needs. Surfability UK is located at Caswell Bay on the Gower Peninsula of South Wales and their mission is to make surfing accessible for everyone.

The intervention took place over 5 weeks, and included a two-hour session, once per week in a small group of no more than 5 participants. In each session, two members of the neurorehabilitation team were present to assist participants with their rehabilitation goals during the session. At least two qualified adaptive surf instructors were present, along with enough volunteers to support participants 1:1.

Surfability staff assessed individual participants' needs during the first session and provided appropriate equipment based on these needs. For example, if a participant had a physical disability and required a seated surfboard. A seated surfboard is an extra-large surfboard with a seat attached to the top (see figure 11), which allows the surf instructor to paddle out to sea with the participant seated on the board, so they are still able to experience catching the waves. All participants were given a demonstration on shore on how to safely manage the board in the water, how to safely stand up, fall, call for assistance and recognise safety signals. In each session, staff helped participants guide or paddle their board out into the sea and ride the wave into shore. They chose to either lie down, kneel, or attempt to stand up on the board.

Clinicians from the neurorehabilitation service encouraged participants to set goals for themselves at the start of every session based on their rehabilitation. Sometimes these might be surfing related, such as building confidence to stand on the board, or these goals might be psychosocial, such as engaging with more conversations with peers, or related to physical needs such as managing fatigue. Clinicians also aimed to bring therapeutic concepts into the water, for example by encouraging participants to practice mindfulness by staying present and aware during

Figure 11 Photographs of participants at Surf-ability with example of a seated surfboard

Note: Written informed consent was obtained and permission granted from staff and patients to publish photographs. These were anonymised by authors to reduce revealing unnecessary information regarding patient identity.

6.5.9. Quantitative Data Collection

The lead author (LW) collected the data. LW is a part-time assistant psychologist within the Neurorehabilitation service and a PhD candidate. Patients had met LW before because she works in the service and were therefore comfortable meeting her alone. LW arranged to meet participants at the neuropsychology department to collect physiological and questionnaire measures. Following the onset of COVID-19 related social distancing restrictions in the UK in March 2020, participants who attended the intervention during Summer of 2020 were posted a HRV monitor through the mail and were asked to wear the device for 10-minutes at home whilst on a Zoom conferencing call to LW. At the start of the session, the participant was made aware of the purpose of the service evaluation, that their data will be used for service development purposes and that if it were to be written up for publication in future, data would be anonymised. Data collection only continued if the participant understood this, agreed to take part, and signed the consent form. During HRV collection, participants were asked to wear the small device and were then left alone in the room for ten minutes. They were asked not to engage with any activities such as their phone during this time and to simply sit in silence. Once ten minutes had passed, the device was removed and LW re-entered the room to administer the questionnaires. When HRV data was collected via Zoom, the exact same process occurred, however LW gave instructions remotely and turned off their video and audio, retuning after 10 minutes. If the participant was able to, they read through and answered the questionnaire measures themselves, if they required further support, LW read the questions aloud and marked the appropriate answer based on the participants' response. The data was managed by LW who also transcribed scores on to a database on a secure NHS password-protected laptop.

6.5.10. Quantitative Outcome Measures

The following questionnaire measures are routinely administered in the service during patients' first assessments and throughout their treatment, because they provide important information about psychological functioning and whether these changes following different aspects of neurorehabilitation. They also allow us to follow changes in patients' scores across their rehabilitation to track progress. These measures were chosen because they have robust psychometric properties and had been normed in the brain injury or clinical population. Since 2018, Heart Rate Variability (HRV) has also become a routine method of evaluation in the service based on the emerging evidence supporting its link to wellbeing. HRV is potentially a more inclusive way to measure changes in patients' health and wellbeing, given that many patients may face communication or visual impairments which make surveys challenging. HRV has provided clinicians with invaluable insights into patients' lifestyle, health behaviours and stress-activity. Physiological measures are also less vulnerable to social desirability bias.

6.5.11. Primary Outcome Measure

Warwick-Edinburgh Mental Wellbeing Scale - Short Version (SWEMWBS): This survey was developed at the request of NHS Scotland in the UK to measure mental wellbeing and evaluate interventions designed to improve wellbeing (Tennant et al., 2007). It includes seven statements about the participant's thoughts and feelings (mental wellbeing). Participants are asked to respond by choosing one of five responses – ranging from 1= 'none of the time' to 5 = 'all of the time'. The total raw score is then transformed into metric scores using the conversion table. WEMWBS is reported to be valid, reliable and also responsive to meaningful change in clinical populations (Shah et al., 2018; Trousselard et al., 2016). Spearman correlations between SWEMWBS and WEMWBS are above 0.95, demonstrating the effectiveness of the short version (Fat et al., 2017). The WEMWBS also shows high test-retest reliability at one week (0.83) (Tennant et al., 2007).

6.5.12. Secondary Outcome Measures

Hospital Anxiety & Depression Scale (HADS) (Zigmond & Snaith, 1983)*:* The HADS was designed to measure anxiety and depression in the patient population. It focuses on non-physical symptoms in order to diagnose patients who also have physically ill health. The HADS contains seven questions for anxiety and seven for depression. The HADS has been validated in studies on stroke populations and have found good internal consistency and sensitivity and adequate specificity when lowered stroke-specific cut-off scores are used (Sagen et al., 2009; Turner et al., 2012). The HADS is often sensitive to change over time and thus is helpful in tracking changes in mood (Cameron et al., 2008).

Visual Analogue Scale. Visual analogue scales are to measure subjective characteristics or symptoms (Klimek et al., 2017). The VAS used in the present evaluation aimed to gather weekly data on participants' anxiety, happiness, and connection to others across the intervention period. The questionnaire consisted of three horizontal lines, marked at each end to describe the extremes of the feeling. The three questions consisted of: "How anxious/happy/connected to others do you feel in this moment right now?" and participants were asked to mark down the number which best reflected their current state on a scale of 0-10. Participants were asked to complete the VAS at baseline, at the start of each weekly session (before the session took place) and once post-intervention. The aim was to track any fluctuations in relevant characteristics across the intervention period.

Resting Heart Rate Variability (HRV). Collecting HRV is a non-invasive approach, the devices used were commercial products (Firstbeat technologies monitors) available for public use. The data collected on the device contained no personal data that could identify the participants, and was uploaded to secure laptop only accessible to LW, all data was deleted from the device once saved on the laptop. Firstbeat monitors claim to detect the heartbeat at 1 ms accuracy (1000HZ) and calculate RR intervals. Participants were asked to sit for ten minutes without moving or using a phone whilst their HRV was measured at baseline and post-intervention. HRV data was then analysed in Kubios premium (version 3.5.0). Artefact correction threshold was adjusted individually, this is stated by Kubios to be best practice because inter-individual difference in HRV is significant, and therefore a fixed threshold (e.g. 5%) will not work for all participants (Tarvainen et al., 2021). The optimal threshold was identified by choosing the lowest correction level which identifies all artefacts (RR intervals which fall outside of the 600-1200ms range, but does not identify too many normal RR intervals as artefacts (<5% of all beats removed) (Tarvainen et al., 2021). On average, 3 beats were removed from each sample (range = 0-12 single beats, 0-4.23% of beats). Data was then extracted and entered in SPSS. Root Mean Square of Successive Differences (RMSSD) and Normed high frequency were used as an outcome measure because they are thought to reflect parasympathetic activity (Laborde et al., 2017; Shaffer & Ginsberg, 2017).

Relevant Participant Demographics and States. Relevant lifestyle and demographic questions were asked (Fatisson et al., 2016). To accurately interpret HRV data, it is important to know when the participant last exercised, ate, consumed caffeine, alcohol, slept, smoked cigarettes as well as understanding any blood pressure, heart, or respiratory conditions, to ensure these factors are not accounting for a change in HRV (Fatisson et al., 2016).

6.5.13. Statistical Analysis

All primary and secondary quantitative measures will be subjected to tests of significant difference in HRV and survey scores between baseline and post-intervention. Significance will be set at 0.05 and an effect size will be calculated using Cohen's guidelines (0.2 = small, 0.5 = medium, 0.8 = large). Normality will be assessed by examining histograms, pp plots and conducting a Shapiro-Wilk test. Paired t-tests will be used to compare the differences in measures which meet parametric assumptions and the Wilcoxon signed ranks test will be used as a non-parametric alternative if variables violate assumptions.

6.5.14. Qualitative Data Collection

All participants who attended Surf-therapy in the cohort of Summer and Autumn of 2021 were invited to attend a REM session in April 2022. Participants who attended in the cohort of 2019 and 2020 (whose quantitative measures were included in the evaluation) were not invited to the REM session because they had been discharged from the service by April 2022, when the session took place. Of eight potential participants, four accepted and attended the session, and four were unable to attend due to work, family or travel commitments. A three-hour session took place at the local hospital in which the neuropsychology service is based. Written consent was obtained at the start of the session. The session was facilitated by lead author (LW), the written whiteboard content and voice recording of the entire session was captured. At the start of the session, participants begun by interviewing each other as part of the appreciative inquiry process. They were provided with question prompts (see Appendix V) and space to make notes from the conversation, which could later be used in group discussion. A facilitated group discussion then took place whereby participants shared what they had discussed with their partner in their interviews. Key details from each participants' story were mapped out on a large whiteboard and the facilitator used probing questions to encourage rich reflections and narratives (*What happened next? How did that impact you?)*. After each participants' story was told, the group brainstormed possible theme names to capture the most significant impacts which arose during the discussion. Finally, a list of the key themes was written on the whiteboard, which everyone approved of.

6.5.15. Qualitative Data Analysis

The recording of the REM session (which totaled 78 minutes) was transcribed and uploaded to ATLAS.ti for Mac for data management. Data analysis followed the six steps to thematic analysis (Braun & Clarke, 2006). Stage one to four involved lead author (LW) only. Stage one was familiarisation through listening to the audio recording and re-reading the transcript, and stage two involved reviewing the data with the initial generated themes in mind to ensure they were capturing distinct concepts and reflection on whether effects were short or long term. Step three and four was an iterative process whereby the transcripts were coded, and themes were modified to ensure all discussed ideas were reflected in the final themes. In stage five, all authors reviewed the themes until an agreement was made and finally the results were reported in stage six.

6.5.16. Ethical Considerations

Evaluations of service user experiences associated with the delivery of interventions in the healthcare sector are excluded from ethical review in the United Kingdom (GAfREC §2.3.12) because they are considered to contain minimal risk. No randomisation, experimental or control condition was used, and the intervention was not withheld from any eligible participants. Patient care did not deviate from usual care and participants continued to receive usual healthcare treatments in addition to Surf-therapy. All participants were invited to take part in the evaluation, only those who gave informed consent were included and participants understood their rights to withdraw. When the data was transcribed, any identifiable information was removed. All participants included valued the opportunity to participate in evaluation, provide feedback on their experiences and help support service development.

The service described in this evaluation is highly research-driven, interventions are designed based on strong theoretical foundations and are updated using advances in the wellbeing literature. It is acknowledged that service evaluations are often heterogenous and are not generalisable beyond the patient group. However, this work is still vital, as it represents how all service evaluations should use rigorous methodology to assess outcomes in patients, yet this is seldom done. If service evaluations use only sub-par methods, remain unpublished and do not keep up to date with advances in science, then the research-treatment gap and lag will only continue to increase. If we want science and research to be translated to healthcare, and for healthcare to be grounded in a strong evidence base, then more effort needs to be made to design interventions based on emerging evidence, and share novel treatment opportunities through well-designed, rigorous evaluations that can inspire clinicians to trial these within their own services.

6.6. Study Two Results

6.6.1. Quantitative Findings

The participant demographics of the present sample are a good representative on average of the ABI patient population seen in this specific neuro-rehabilitation service.

Table 14 *Quantitative Data Participant Characteristics*

Characteristic	Mean	SD
Age	48.27	13.56
Years Since ABI	2.97	2.16

Characteristic	Category	N
Gender	Male	11
	Female	4
Employment	Unemployed	11
	Employed	2
	Off Sick or Medically Retired due to Injury	2
ABI Type	Traumatic	9
	Non-Traumatic	6
Blood Pressure Condition	NO	11
	YES	4
Heart or Respiratory Condition	NO	14
	YES	1
Current Smoker	NO	11
	YES	4
Taking Medication or Contraceptives	NO	14
	YES	1

All outcome variables were normally distributed except for the VAS anxiety variable. A Wilcoxon signed ranks test was therefore performed for the VAS anxiety variable as a non-parametric alternative to the T-test. The Wilcoxon signed ranks test indicated that the difference between VAS anxiety ratings at pre (M=4.4 SD=1.96) and post (M=2.73 SD=2.2) was statistically significant, $z = -2.367$, $p = .018$. T-test results (see table 16) revealed that there was a significant increase in self-reported wellbeing upon completing the Surf-therapy intervention, and a significant increase in VAS happiness score. Measures of HRV and HADS did not differ significantly. Weekly self-reported mood scores are presented in figure 12.

Table 15 *Paired t-test results*

	N	Mean (before/after)	SD (before/after)	*t*	P value (2-tailed)	*d*	BF_{10}	BF_{01}	Bayes interpretation
Wellbeing	15	19.52/21.11	3.47/2.15	-2.164	.048*	0.56	3.062	0.327	Moderate
HADS Anxiety	15	9.4/7.47	4.1/2.45	2.094	.055	0.54	2.759	0.362	Anecdotal
HADS Depression	15	9/7.93	5.52/3.88	0.913	.377	0.24	0.599	1.669	Anecdotal
VAS Happy	15	6.2/7.47	1.78/1.55	-3.3	.005*	-0.85	9.486	0.105	Moderate
VAS Connection	15	5.13/6.87	3.14/1.6	-2.01	.065	-0.52	1.261	0.792	Anecdotal
RMSDD	13	22.84/22.95	13.37/13.24	-0.04	.969	-0.01	0.287	3.490	Moderate
HR	13	76.69/79.18	11.54/11.26	-0.882	.395	-0.25	0.165	6.051	Moderate
Normed HF	13	28.3/32.78	19.86/25.91	-1.143	.275	-0.32	0.813	1.231	Anecdotal

*Significant change at level of p<.05

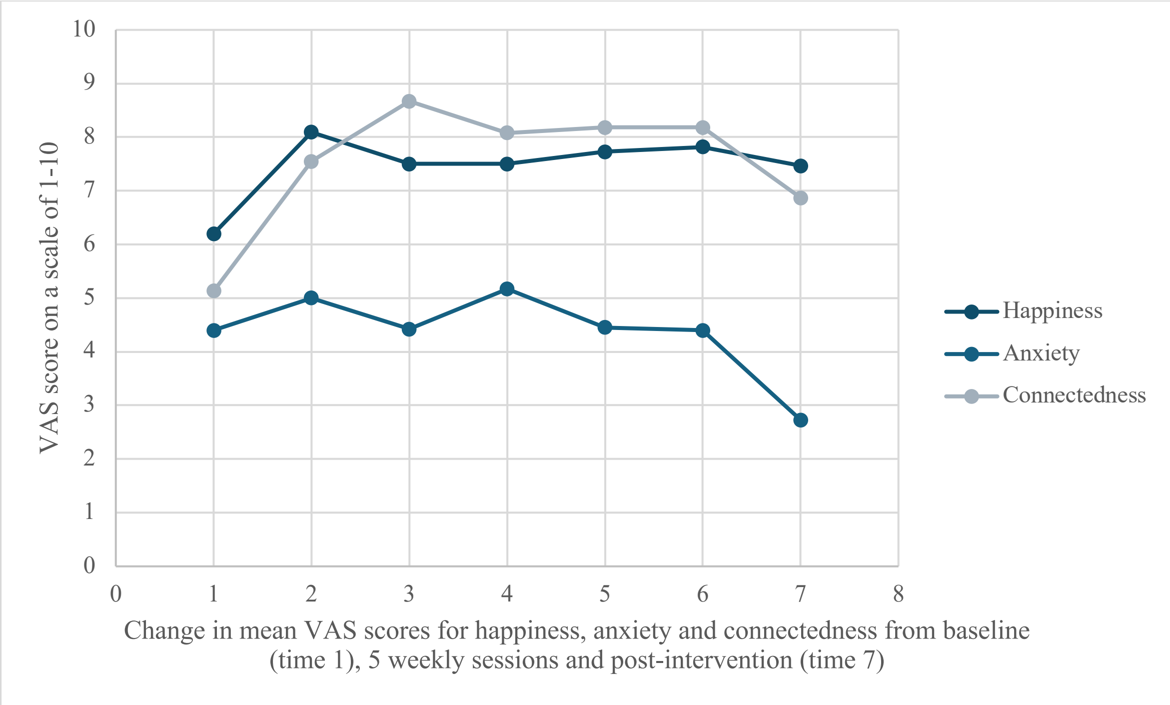

Figure 12 Weekly self-reported mood scores

Note: Image created by Lowri Wilkie using Microsoft Excel

6.6.2. Qualitative Findings

Four participants and two clinicians participated in the REM session. The age range of this sub-sample of participants was 21-60 years old, 50% male, 50% TBI injury type, 75% unemployed. Time since injury range was 2-5 years. The two clinicians attended the intervention with participants but were not involved in the evaluation. In keeping with common practice in REM (Chazdon et al., 2017), the clinicians represented wider stakeholders' views and reflections from the intervention.

Following thematic analysis, three phases (see figure 13) were identified as being significant consequences of attending the intervention. Firstly, participants noted that it was the unique physical and emotional experience of this nature-based challenge (phase 1) which initiated a powerful mindset shift towards empowerment and optimism for their future (phase 2). This mindset shift then led to long-term behaviour change (phase 3) which promoted participants' wellbeing on an individual level, as well as contributing to improving collective and also planetary wellbeing.

Table 16 *Summary of Qualitative Themes Which Arose During Ripple Effects Mapping Session*

Phases Which Themes Occurred	**Themes**
Phase 1: The Physical and Emotional Experience of a Nature-based Challenge	Intense Physical Challenge
	Support to Overcome Fear
	Invigoration and Achievement
	Shared Experience
Phase 2: Experience of a Mindset Shift	Inspiration and Optimism
	Increased Self-Confidence and Empowerment
Phase 3: Long-Term Wellbeing-Promoting Behaviour Change	Increased Mindfulness
	Physical Activity and Movement
	Improved Relationship Quality
	Increased Community Participation & Connections
	Organisational Benefits
	Increased Connection & Appreciation of Nature

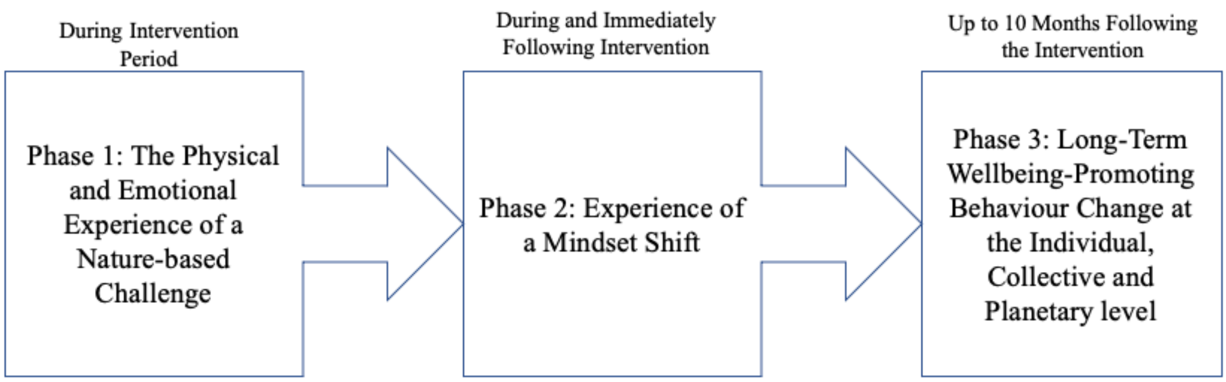

Figure 13 A summary of the 'phases' in which significant change took place for the participants.

Note: Image created by Lowri Wilkie using Microsoft Word.

Phase 1: The Physical and Emotional Experience of a Nature-based Challenge

Participants identified four components of Surf-therapy which significantly contributed to shifting their mindset.

Intense Physical Challenge

The activity of surfing was very physically demanding for participants, especially given that fatigue is one of the most common consequences of ABI. Most reported that even walking down to the beach or getting changed into a wetsuit was tiring. This meant that they pushed themselves to tolerate much more activity than they had done since their injury, and enabled them to recognise their limits and when they should rest.

"It gave me confidence that I could tolerate things that I thought, no way could I tolerate." (P1)

Supported to Overcome Fear

The prospect of attending the intervention evoked a degree of fear and anxiety in all participants, many felt unsure if they were capable of such a strenuous activity following their injury and many had negative preconceptions of the ocean, believing it was a dangerous environment. The intervention gave participants and safe and supported environment to challenge their negative perceptions and fully experience the beauty and benefits of nature and the ocean, whilst trusting that they would not be in danger. This allowed them to confront a substantial fear and overcome it successfully.

"We hear via social media and the news, that the sea is so dangerous, and it's always a negative thing to be, sort of, in a wave and riptides and whatnot. But when you're actually in it, it's, again, euphoric" (P4)

"I remember the two people either side of me, when we were walking…the two helpers, you know. And the surf was really, really rough, and I was, like, going forward like this… But the sense of, actually, I'm battling through this, really big time, was actually huge." (P1)

Invigoration & Achievement

The experience of surfing and being immersed in the ocean and nature was invigorating and energising for participants, several described this feeling as a "buzz". They felt that being so immersed in nature was unique, one describing it as "magical" and another as "euphoric". This was combined with a sense of pride in their achievement, after overcoming challenges and pushing themselves beyond their limits.

"[the days the ocean was rough] was more exhilarating and fulfilling than the days when it was really calm." (P3)

Shared Experience

Participants reported feeling invested in each other's progress. One described their group as being a "temporary family", whereby they felt excitement and pride towards each other's' achievements. One reason for this was because they have empathy for how uniquely tough this challenge was following an ABI. It was this shared experience which subsequently led to feelings of inspiration and optimism described in phase 2.

"Because doing something extreme brings people together but doing something extreme when you're actually living…when you've survived something, and you've, you know, you've got those limitations anyway is…is much greater." (P3)

Phase 2: Experience of a Mindset Shift

Inspiration & Optimism

Participants felt that observing fellow survivors of ABI endure this challenge and achieve their goals, provided them with inspiration and enthusiasm for their own lives. It gave them a sense of hope and optimism for what they also might be able to achieve in their future. One participant described how they watched their fellow participant progress from sitting on the seated board, to swimming completely independently by the final session, and how this had a powerful impact on their own mindset.

"Just to see the progress…to see the progress that somebody can make, that makes you want to do the same? Makes you want to be a better person? If somebody can do…can be that brave, to make that sort of jump. You feel that you can…you can do anything as well." (P3)

"I find that, with the community. I find that sense of inspiration" (P2)

Increased Self-Confidence & Empowerment

This theme reflects a positive change that occurred in participants' perceptions of themselves following the intervention. Participants felt that the achievements they had at Surf-therapy demonstrated that they were capable of being more independent than they previously thought. They reported a new zest for life, and that their experience gave them a sense of "normality" post-ABI. Participants reported feeling empowered to take control of their life in some way.

"There's no way you can get in that water'… Having got in there and survived it, I'm thinking, 'yes I can" (P1)

"[Surf-Ability] has helped me with other things. Because I know that I'm stronger than I thought, because I had that experience." (P3)

Phase 3: Long-Term Wellbeing-Promoting Behaviour Change: Individual Scale.

The long-term benefits of Surf-Ability were reflected in positive behaviour change which endured 6-10 months following the intervention. It was evident that this positive behaviour change did not only improve individual wellbeing, but on a broader scale, also improved collective wellbeing e.g. participants engaged in behaviour which improved the wellbeing of family, friends, their community and even local organisations (see figure 14). The rippling effects of surf-ability also improved planetary wellbeing, whereby participants felt more appreciative of nature and so began engaging with it more consciously and frequently.

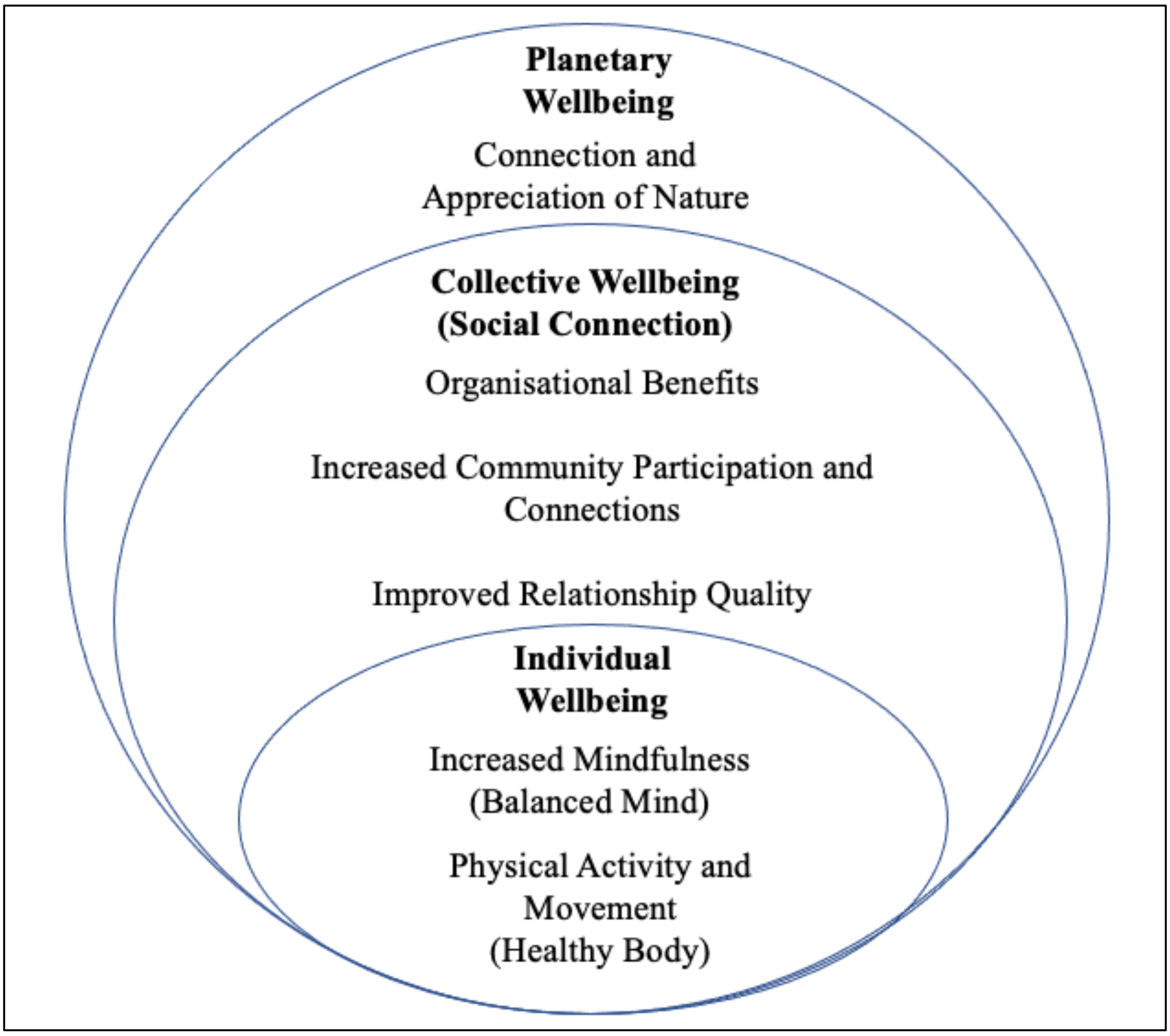

Figure 14 Visual summary of phase 3: Long term behaviour change

Note: A visual representation of the long-term wellbeing promoting behaviour changes (phase 3), grouped according to level of scale (individual, collective or planetary). Image created by Lowri Wilkie using Microsoft Word

Increased Mindfulness

Some participants reported that they felt Surf-Ability initiated an interest in mindfulness. Participants learned how to notice sensations and beauty in their surroundings, especially when spending more time in nature.

"It did give us time to be very mindful. And I realise more and more the importance of that to my wellbeing" (P3)

Physical Activity & Movement

Some participants began participating in more physical activities following the intervention, including paddle boarding, surfing, and cold-water swimming. One participant reported that they stopped taking anti-depressant medication because of attending the intervention, they felt this was because of the confidence they gained, which enabled them to continue cold water swimming, and begin exercising again, giving them a "natural high" (P3). Other participants felt that Surf-therapy empowered them to improve their mobility and their fatigue, which increased their capacity for activity and self-regulation.

"it leads me onto the cold water swimming. I just…I'm just one of those addicts now" (P3)

Phase 3: Long-Term Wellbeing-Promoting Behaviour Change: Collective Scale.

The behaviour changes which followed the intervention, not only positively impacted the participants' individual wellbeing, but also improved wellbeing on a collective scale (see figure 15).

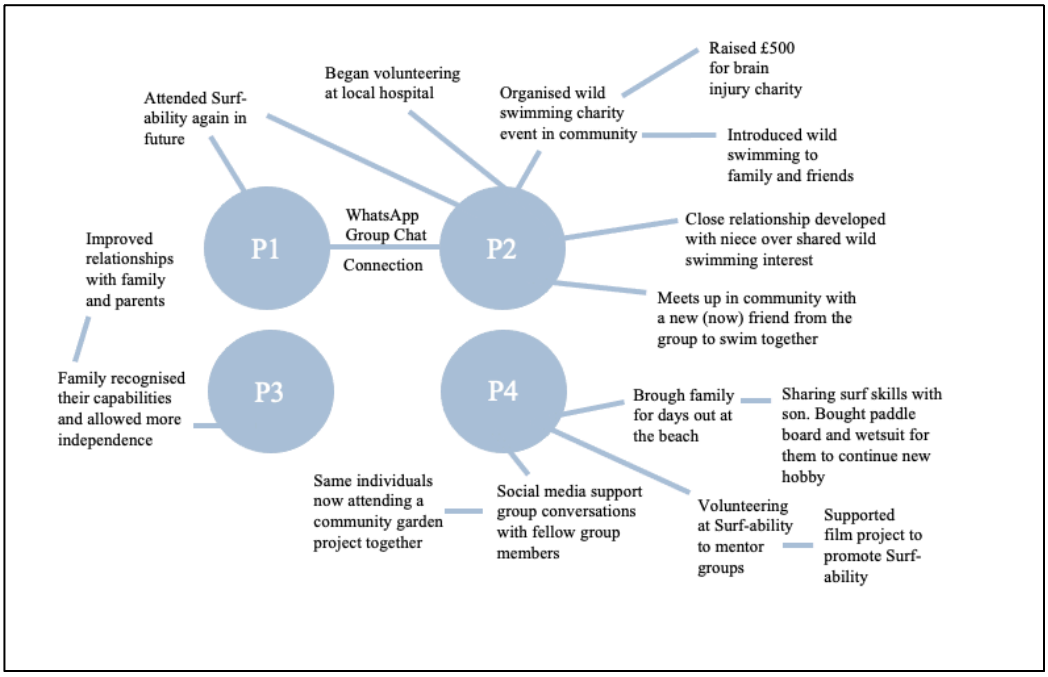

Figure 15 Chain of events which occurred following Surf-Ability which improved collective wellbeing.

Note: Image created by Lowri Wilkie using Microsoft Word.

Improved Relationship Quality

One participant reported that the intervention empowered them to realise their capability for "independence", which improved their mood long-term, made them more accepting of their family's support instead of feeling resentful, thus improving their family dynamic. Other participants felt that they shared the skills and passions they learned at Surf-therapy with family and friends, which improved their connection and bond.

"Yeah I have got to say, again, turn a negative in to a positive, if I hadn't have had the stroke, I wouldn't have spent so much time on the beach with my boy [son]" (P4)

Improved Community Participation & Connections

Some participants made new connections from the intervention which still endured at follow up, for example meeting up in the community to go for cold swims together. Another participant created an online group chat following the intervention, where they keep in contact with the group, and they now attend other community projects together such as a gardening group.

"I've been cold water swimming with my niece, friends, with all sorts of people! Even a friend who's never done it before is going to come with me, because she loves the idea of it." (P3)

Organisational Benefits

On an organisational level, one participant began to organise cold swim fund-raising events following Surf-therapy, their first event raised £500 for an ABI charity. One participant began mentoring at Surf-Ability with other ABI participants and another has begun volunteering on a befriending scheme at a local hospice, because of the confidence they gained from Surf-therapy. Some were involved in filming surfing and swimming content for 1) a documentary promoting the work of Surf-Ability and 2) a short educational video for a brain injury charity.

"When I was offered the chance to mentor within the Surf-Ability group, it gave me the chance to… help others" (P4)

Phase 3: Long-Term Wellbeing-Promoting Behaviour Change: Planetary Scale

Increased Connection & Appreciation of Nature

Most participants reported that since attending Surf-therapy, they now spend significantly more time out in natural environments such as the beach. Participants reported feeling an increased connection to nature and appreciation of its beauty, power and vastness.

"You can feel the joy of [the beach] that you didn't see before" (P3)

"I've never had a negative time on the beach, which has spurred me on to, every chance we get to go to the beach, even if it's tipping down with rain" (P4)

6.7. Study Two Discussion

The aim of study two was to assess whether a surf-therapy intervention promoted wellbeing in patients with Acquired Brain Injury (ABI) according to survey and physiological data. The secondary aim was to explore using Ripple Effects Mapping (REM) qualitative data whether the impact of the intervention endured at approximately one year follow up, thus ensuring it is an efficient use of service resources. Within subjects' analysis revealed significant increases in self-reported wellbeing between baseline and post intervention (upon completing 4-5 weekly sessions). There were also significant increases in self-reported happiness and decreases in anxiety at post intervention versus baseline according to brief visual analogue scale ratings. There were no significant differences between baseline and post-intervention HADS depression and anxiety scores, nor connectedness (visual analogue scale rating) and no significant change in HRV measures. The improvement in participants' self-reported wellbeing is coherent with previous qualitative findings on Surf-Ability, in which participants reported holistic improvements across a range of inter-connected wellbeing-promoting factors (Gibbs et al., 2022). In addition, a REM session was conducted with a small sub-sample of participants at 6-10 months follow up. Thematic analysis identified four key components of the nature-based intervention which were unique in initiating a mindset shift in participants: the intense physical challenge, support to overcome fear, invigoration & achievement, and a shared experience. These factors contributed to an increase in 1) inspiration and optimism and 2) self-confidence and empowerment, and ultimately led to long-term wellbeing-promoting behaviour change. On an individual level, participants increased their mindfulness practice and their physical activity and movement, a change which persisted at the time of follow up. On a collective level, the participants used the intervention to improve the quality of their relationships, increase community participation and engage in activities beneficial for local third sector organisations in the months following the intervention. Finally, on a planetary level, participants now felt more connected to, and appreciative of nature, a trait associated with pro-environmental (Martin et al., 2020).

The present evaluation highlights the unique opportunity that blue spaces offer to improve wellbeing. Several previous theoretical frameworks have proposed explanations for the relationship between nature and health, of most relevance might be the attention restoration hypothesis (Kaplan, 1995) which claims that scenes of nature require only effortless attention, allowing cognitive resources to rest and recover. Given that cognitive fatigue and heightened sensory stimulation are common challenging symptoms following ABI (Alwis et al., 2013; Belmont et al., 2006; Cantor et al., 2008; Ziino & Ponsford, 2006) it is likely that spending time in nature might be particularly helpful for this population and thus neurorehabilitation services should consider ways to merge nature opportunities with clinical interventions. Moreover, given that surfing involves complete immersion into the (often tumultuous and cold) ocean, it is proposed that this experience offers a unique opportunity to be fully absorbed in nature beyond what one might experience from simply observing a nature scene. Whilst surfing might not be accessible to all neurorehabilitation services, there is a growing body of literature which promotes the more general use of water-based activities for improving wellbeing. For example a systematic review of 33 studies (Britton et al., 2020) proposed that psycho-social wellbeing can be improved via blue space interventions, specifically designed with a therapeutic purpose (examples included; ocean therapy, surf therapy, kayaking, scuba diving, sailing and others). Theoretically it is therefore possible that other water-based activities which are possible to practice in other blue spaces such as lakes or rivers (e.g., 'wild' swimming, kayaking or paddle boarding) might also be beneficial for individuals with ABI, however the evidence-base for these is scarce and requires future investigation.

The present evaluation also illuminates the role in which physical activity plays in promoting wellbeing. The mind-body dualism approach to health has been found to be inadequate, given the noteworthy role health behaviours including exercise have on psychological wellbeing. For example, one study found that individuals with ABI who exercised more than 90 minutes per week experienced a reduction in depression scores and higher perceived quality of life and mental health (Wise et al., 2012). Moreover, a meta-analysis on 157 studies found a positive relationship (d = 0.360) between physical activity and subjective wellbeing (Buecker et al., 2020). Given that participants in the present evaluation reported that increasing their physical activity was an important contribution to their long-term wellbeing changes, it is proposed that neurorehabilitation services, where possible, provide opportunities for individuals with ABI to safely access group exercise, particularly within their own communities, so they are able to maintain the activity independently.

In addition, the evaluation illuminates the role of behaviour change in promoting health and wellbeing, a concept commonly neglected in previous models of wellbeing (Fredrickson, 2001; Ryff & Keyes, 1995; Seligman, 2011). Whilst in might be difficult for participants to maintain the levels of wellbeing reached during an intervention, unless they learn how to make consistent changes to their behaviour, they risk regressing back to their baseline level of wellbeing. The findings suggest that participants required a change in their sense of identity and perception of their injury to change their behaviour long-term. This is in line with the 'Y-Shaped' model (Gracey et al., 2009) which claims that the process of adaption following ABI requires individuals to resolve discrepancies within one's social identity, interpersonal relationships and personal identity. Forming an updated, adapted and realistic identity is important for positive growth following an ABI, and thus neurorehabilitation services need to provide opportunities which facilitate this process of meaningful personal change. The findings suggest that nature-based interventions, particularly surf-therapy might offer a unique opportunity to facilitate this process of identity change following ABI, by acting as a powerful behavioural experiment to realise their capabilities and subsequently change their behaviour. This change may also be explained by social identity theory, which proposes that experiencing a sense of collective and personal achievement will have positive consequences for one's social and personal identity (Haslam et al., 2018).

Overall, study two provides new quantitative data supporting the use of surf-therapy as a nature-based intervention to promote wellbeing in individuals with ABI. It is proposed that being immersed in nature contributed to a positive change in participants' self-perceptions and identity, which subsequently enabled some participants to maintain wellbeing-promoting behaviours at 6-10 months follow up. This evaluation highlights the need to utilise diverse approaches to measure wellbeing in a holistic way, including physiological data, patient and stakeholder involvement and the capturing of wider collective and planetary impact of interventions. The need for wellbeing science and positive psychology to progress towards a transdisciplinary biopsychosocial ecological model of wellbeing is noted – such as the GENIAL framework - which integrates known determinants of wellbeing including nature-connection and positive health behaviours (Mead et al., 2021). Findings support the need for healthcare providers - including neurorehabilitation services - to enhance interventions for patients by incorporating multiple factors which improve wellbeing including nature-connection. To do this, it is suggested that healthcare services consider forming collaborative partnerships with local third sector organisations in addition to research academics, to identify collaborative funding opportunities and co-deliver innovative interventions which exploit these advances in wellbeing science.

6.8.Overall Chapter Discussion

6.8.1 Limitations and Strengths

Both studies' conclusions are limited to the community neuro-rehabilitation service from which the data was collected, as the interventions were unique to this service. However, findings are interpreted in line with relevant theory and so provides useful understanding for the ways in which neuro-rehabilitation services can adapt and evolve. We propose that the holistic model of neurorehabilitation can be enhanced by drawing on wellbeing theory and advances in wellbeing science in order to offer further insight into the building blocks needed for effective psycho-social interventions.

One particular strength of study two was the use of a multi-method approach to measuring wellbeing. REM as a qualitative method aligns with the need for health research to be population-led and receive input from patients (Mader et al., 2018). REM helps amplify the voices of people who may feel unheard. Adopting this approach may help ensure that wellbeing science evolves to reflect the needs of service users. This approach also helped to dissect the mechanism through which improvements in wellbeing occurred in participants, a discovery which would have been impossible through survey measures alone.

A major constraint however was dealing with applied psychophysiological data outside of a laboratory setting. Participants' lifestyle behaviours which are known to influence HRV were unable to be controlled such as alcohol consumption, caffeine or exercise (Fatisson et al., 2016), which may have caused confounds. Moreover, during the intervention period, the UK faced COVID-19 related lockdown restrictions, meaning one cohort of participants were unable to attend appointments in person at the hospital clinic room, so instead data collection relied on participants fitting their own monitors whilst on a video call. This inevitably caused interference with HRV measurements, given that distractions in participants' home environments were unable to be controlled for. Despite the constraints faced in the process of the evaluation, overall best efforts were made to utilise what resources were available to contribute towards the goal of progressing from single, self-reported measures toward utilising diverse methods, including physiological data, to understand wellbeing in a more holistic and multi-faceted way (Vella-Brodrick et al., 2022). In this instance, coherence was not found between self-reported changes in wellbeing, and improvements in HRV, however there are several potential explanations for this. One reason might be that any change in resting HRV may have occurred following the cascade of events which took place after the intervention. For example, the intervention alone may not have been enough to improve resting HRV, but the subsequent increase in physical activity, mindfulness, improved relationships, community participation and connection to nature which occurred in the months following the intervention may have led to improved vagal functioning long term.

Study one collected qualitative data via interviews post-intervention, relying on participants to retrospectively reflect on the intervention. Whilst this is common practice in qualitative research evaluating interventions, utilising a mixed methods approach and incorporating quantitative data (as was done in study two) may have strengthened the conclusions of study one. Moreover, study two was also limited by only two time point measurements (pre-post design) which lacks a control group for comparison and limits the ability to draw causal conclusions. Future research could therefore benefit from incorporating a treatment-as-usual (TAU) group or a wait-list control design to better assess the intervention's specific effects and account for potential confounding factors. Specifically for the surf-ability intervention it would also have been beneficial to measure changes in resting HRV across all five weeks of the intervention, as well as in the months following to assess the 'rippling' long term effects physiologically. Future studies with sufficient funding may utilise advances in smart devices, which can monitor HRV continuously for longer periods of time with greater ease such as via a watch or ring. The monitors used in the present evaluation were not waterproof but given the association between nature and parasympathetic activity (Kobayashi et al., 2015, 2018; Lee et al., 2014; Park et al., 2009), future research might consider tracking changes in HRV across the individual surf sessions and in the recovery period to assess whether surf therapy initiates moment to moment changes in nervous system activity. However, the evaluation took place as part of routine appraisal within an NHS public healthcare service and so lacked the required time and resources.

Reasons why patients were initially excluded from the interventions via clinician's assessment were most commonly due to medical issues such as uncontrollable epilepsy because the individual was deemed at high risk of a second stroke or because they were employed and thus unable to take time off work. This might also explain why the majority of participants were unemployed or on sick leave from work than employed. Moreover, after discussions with their clinician, some felt their psycho-social challenges were too intense e.g., they were clinically depressed or anxious and so were not yet ready to move beyond 1:1 therapy. This is common within the service, as patients who attend community projects are often further along in their rehabilitation journey. It is common for patients at the start of the patient pathway to have more 1:1 and within service interventions, before gradually progressing to community projects later in the pathway, preparing them for an eventual discharge into the community. This also highlights the utility of an integrated, stepped care approach whereby individuals can receive intensive, individualised therapy to address specific disease mechanisms and symptom reduction when needed, and can progress to holistic wellbeing interventions when they are ready.

A total of 30% of participants dropped out in study two, primarily due to health complications and travel restrictions, which were unrelated to the surf therapy intervention itself. This is common in interventions involving individuals with acquired brain injury (ABI), who often experience co-morbid medical conditions that can prevent participation at short notice. Surfing also carries inherent risks that may have contributed to non-participation. Additionally, many participants were unable to drive following their brain injury, which highlighted travel as a significant barrier. To address this, subsequent iterations of the intervention incorporated car-sharing arrangements and public transport support. Therefore, while dropouts were acknowledged, their exclusion is unlikely to have introduced bias as these factors were logistical rather than reflective of the intervention's impact.

6.8.2. Key Implications and Conclusion

Overall, barriers which prevent individuals with ABI integrating to social groups in the community include fear of stigmatisation (McLellan et al., 2010), cognitive impairment (e.g., impaired executive functioning), behaviour challenges (e.g., disinhibition) and psychosocial challenges including depression and anxiety, lack of motivation and fatigue (Mahar & Fraser, 2011). Whilst it is common for neurorehabilitation to offer group-based therapies and educational interventions within services, it is less common to actively support ABI patients to participate in community-based activities. Yet the present findings from both studies highlight that having trusted, skilled professionals present, provides a 'safety net' from whom they can seek support and increase confidence that their needs will be adapted for. Given the psychosocial impacts of ABI, individuals are more likely to experience fear of rejection, lack of confidence and anxiety (activated 'defence' mode) prior to entering new social groups. However, if they are accompanied by a trusting professional, with whom they feel safe, then they will be more able to socially participate.

The present findings suggest that it is advantageous to incorporate multiple key determinants of wellbeing into neurorehabilitation interventions e.g., social opportunity, natural environment, physical activity, mindfulness techniques etc. It is noted that improving wellbeing is not simply an effort to improve psychological functioning following ABI, but that enhanced wellbeing has important benefits for all domains of the holistic model of neurorehabilitation, given the reciprocal interactions between psychological, cognitive, social and physical health. For example, evidence suggests that positive wellbeing improves performance on cognitive tasks including executive function, memory, and processing speed (Allerhand et al., 2014). In addition, higher levels of wellbeing are associated with physical health benefits such as reduced inflammation, lower heart rate, lower blood pressure and less central obesity (Dockray & Steptoe, 2010; Steptoe et al., 2005, 2012). Providing opportunities for improved wellbeing will likely have simultaneous 'whole health' benefits for cognitive, functional, physical, psychological, social, and vocational skills.

There are an extensive number of third sector and community organisations providing opportunities for people to flourish, but it requires substantial confidence for patients to approach these spontaneously, without support. Whilst it can be practically and financially challenging for neurorehabilitation services to attend community projects with patients, the present evaluation demonstrates that this goal can be achieved via collaborative partnerships between neurorehabilitation services and local community third sector organisations (Gibbs et al., 2022; Wilkie et al., 2021). Bridging the gap between healthcare and community projects can help overcome barriers for individuals with ABI who feel unable to access the community independently and thus are at risk of become marginalised (A. H. Kemp & Fisher, 2022).

Building on these insights, the following Discussion Chapter will integrate and compare the key findings from across the thesis within the context of the GENIAL framework, exploring contradictions and emphasising the need to address inequalities in wellbeing. Chapter Seven synthesises themes from the empirical chapters, evaluates the strengths and limitations of the methodologies used, and proposes future directions to enhance the effectiveness and inclusivity of wellbeing interventions.

Chapter Seven

7. Thesis Discussion and Impact

Abstract

The following chapter integrates and compares key findings from empirical chapters of this thesis within the context of the GENIAL framework of wellbeing. Contradictory findings are explored and key themes from across the thesis are highlighted. The issue of inequality in wellbeing is particularly emphasised, and solutions are proposed based on my research findings, namely, the importance of facilitating wellbeing opportunities in communities and empowering disadvantaged individuals. Strengths and limitations of the methodologies employed in this thesis are acknowledged. The benefits of utilising Randomised Controlled Trials (RCTs) with large sample sizes in Network Meta-Analysis (NMA) are recognised. However, challenges in meeting assumptions inherent in this methodology are also addressed. The complexities of collecting psychophysiological data and its limitations are also examined. Recommendations for future research directions include filling gaps in RCTs, particularly on multi-component wellbeing interventions, further controlled evaluation of community-based approaches as large scale wellbeing strategies and applying co-designed community wellbeing interventions to diverse health services. Lastly, the chapter reflects on the thesis's impact, including dissemination efforts, policy engagement, conference funding acquisition, and knowledge translation in academic and practical settings. It concludes with a call to prioritise holistic wellbeing across society and outlines strategies for individual, community, and healthcare interventions aimed at fostering individual, collective and planetary wellbeing.

7. Discussion

The overall aim of the thesis was to investigate the impact of wellbeing interventions across various contexts - including individual wellbeing interventions for the general population, initiatives for local communities, and interventions within healthcare services - to better understand how wellbeing may be prioritised across society. I achieved this by examining the impact of interventions from across these domains and presenting them within the context of the GENIAL framework of wellbeing.

7.1.Connecting Thesis Discoveries to the GENIAL Framework of Wellbeing

Overall, my findings support the use of the GENIAL model as a framework for both understanding the determinants of wellbeing and to guide the design and implementation of wellbeing interventions and strategies. The GENIAL model is a biopsychosocial, interpretative framework on the published literature on wellbeing (A. Kemp et al., 2017; A. H. Kemp & Fisher, 2022; Mead et al., 2019, 2021, 2023). The framework highlights the core domains of wellbeing as: individual wellbeing (including a balanced mind and a healthy body), collective wellbeing and planetary wellbeing in addition to the influential role of behaviour change and socio-structural factors. GENIAL defines wellbeing is a connection to the self, others and nature. Overall, this is a useful framework to understand the complex construct of wellbeing because – as discussed in chapter one - it integrates a significant previous body of work from various disciplines.

One key insight from my research is the recognition that there are multiple pathways to individual wellbeing. At the core of this lies the importance of self-connection and awareness of individual needs and preferences, challenging the notion of a purely objective list theory. Instead, GENIAL offers a nuanced perspective, recognising that while certain objective determinants may hold intrinsic value and benefit individuals irrespective of their subjective desires, they must also cater to subjective pleasures, needs, or desires. The findings from my thesis particularly highlight the interconnectedness of the domains of wellbeing. For example, opportunities to cultivate individual wellbeing are shaped by inequalities, highlighting the role of socio-structural factors. Also, the depth of one's self-connection directly impacts their ability to establish meaningful connections with others, thus influencing collective wellbeing.

Individuals are inherently embedded within a broader system. Our holistic conception of wellbeing recognises that attaining planetary wellbeing - the highest attainable standard of welfare for both human and non-human entities - cannot be achieved in isolation, but requires integration of connection to self, others, and nature. Designing wellbeing interventions and strategies is imperative, and it requires careful consideration of how different levels of scale interact.

7.2.Individual Wellbeing

The network meta-analysis (NMA) presented in chapter four of this thesis sheds light on the individual domain and underscores the importance of emotional balance and positive health behaviours. In the GENIAL framework, 'Emotional Balance' encompasses positive emotion, regulation of difficult emotions, and finding meaning and purpose. Various psychological interventions that facilitate these aspects, such as Mindfulness, Compassion-Focused Interventions, Acceptance and Commitment Therapy (ACT), and Positive Psychology Interventions (PPIs), significantly enhanced wellbeing according to the NMA, a finding which echoes previous research (Agteren et al., 2021; Bolier et al., 2013; Carr et al., 2021; Lomas et al., 2019; White et al., 2019). My NMA contributes to advancing the field by additionally illuminating new pathways for advancing wellbeing via positive health behaviours. By highlighting the synergistic combination of psychological interventions with physical activity, my findings underscore the underutilised potential of holistic approaches to wellbeing, reinforced also by the consistent high ranking of yoga. This calls for future RCTs to investigate the combination of psychological and movement-based interventions and explore which combinations may be most effective.

Moreover, whilst my NMA findings cannot be generalised to clinical populations due to the exclusion of clinical data, the evaluations of Local Area Coordination (LAC) and neurorehabilitation interventions also underscore the role of self-connection in wellbeing. Participants engaged in interventions that promoted both emotional balance and positive health behaviours, which enhanced their overall wellbeing. For example, the COVID-adapted intervention in Chapter Six included activities such as surfing, psychoeducation, positive psychology practices, and cycling (Wilkie et al., 2021). Similarly, LAC participants reported involvement in community yoga, walking groups, and nutrition and cooking classes. Together, these findings highlight the value of individual physical health behaviours and psychological interventions, and the importance of mind and body approaches to wellbeing.

The persistence of dualistic thinking in healthcare, where mental and physical health are often treated separately, can sometimes limit the scope of care and the potential benefits of a more integrated approach (Switankowsky, 2000; Latoo et al., 2021). While this separation is common, there is growing recognition of the benefits of therapies that blend psychological and physical interventions, as seen in areas like PTSD treatment, where trauma-informed yoga, or somatic therapies are increasingly used together to address both mind and body (Kim et al, 2013; van der Kolk et al, 2014). These integrative approaches suggest that more holistic intervention options which facilitate both emotional balance and positive health behaviours may enhance treatment effectiveness, though accessibility remains a challenge, and more work is needed to make these options widely available.

7.3.Collective Wellbeing

Many of the groups in which both LAC community members and acquired brain injury patients engaged with had a significant social component, such as coffee clubs, quiz nights, peer support groups, and games groups. Across qualitative interviews, increased social support was consistently the most frequently highlighted positive experience and, in the LAC quantitative survey, community integration significantly predicted wellbeing in a structural equation model. However, in my NMA, the inclusion of social interventions as a node was not feasible due to the heterogeneity and scarcity of RCTs focusing on social interventions, despite initial plans outlined in the protocol. This highlights an urgent need for further research on this topic. Previous meta-analyses have highlighted the substantial effectiveness (g = 0.66) of social identification-building interventions on wellbeing (Steffens et al., 2021). However, many studies included in this meta-analysis focused on participants with mental or physical health disorders (Steffens et al., 2021). As my NMA focused on the general population, the search identified some social interventions, but these social groups involved discussions on heterogenous topics such as politics, current events, emotional support, or parenting stressors. Comparisons also consistently revealed a higher average participant age in these interventions, primarily due to the high number of ‘reminiscence’ social groups for the elderly, adversely impacting the assumption of transitivity. Thus, social identify building interventions were excluded from analysis. Surprisingly, subgroup analysis within the NMA revealed no significant difference between interventions conducted on an individual versus group basis. The likely reason for this discrepancy lies in the oversimplification of equating group-based activities with social connection. Not all group interventions inherently foster social bonding; some may simply involve individuals learning a skill together, such as in a gym class where participants purely engage in exercises before dispersing. In contrast, activities like CrossFit for example are explicitly designed to cultivate a sense of community through organised social opportunities and fostering a culture of participation (Woolf & Lawrence, 2017). Furthermore, the nature of group activities varies widely. Some are open-ended, allowing participants to attend sporadically, while others are closed, with the same consistent group of people attending each session. Effective facilitation plays a pivotal role in maximising social connection within group interventions. Facilitators employ deliberate strategies, such as structured breaks, introductions, and post-session socialising, to nurture a sense of community and belonging among participants. Therefore, the absence of a significant difference between individual and group interventions underscores the importance of considering the quality and intentionality of fostering social connection within group settings.

7.4.Planetary Wellbeing

In the NMA, nature-based interventions did not demonstrate significantly greater efficacy compared to control conditions. As discussed in chapter four, this is likely attributed to limitations in the quality and size of the RCTs included. A significant body of work highlights the relationship between nature connection and wellbeing (Hughes et al., 2018; Martin et al., 2020; Pritchard et al., 2020; Richardson et al., 2016; Twohig-Bennett & Jones, 2018), however these methods are often correlational, and the literature is lacking large, robust RCTs. I did not have sufficient studies to create a node specifically addressing combined "physical activity AND in nature interventions." Consequently, I was unable to directly compare the effects of physical activity in a natural environment with passive nature exposure. Nevertheless, it is possible that the combination of physical activity and nature immersion may have a synergistic effect, like that which was observed in the "combined psychological intervention and movement" node within the NMA. Previous research suggests that exercising outdoors is associated with greater feelings of positive engagement, and decreased negative emotions compared to indoor exercise (Coon et al., 2011) however often studies on indoor versus outdoor exercise do not specifically in natural green/blue spaces (may be urban outdoor spaces) and are commonly non-randomised trials. My NMA has highlighted the lack of quantitative evidence supporting the psychological advantage of green exercise over non-green exercise. Therefore, a valuable avenue for future research would be a direct comparison RCT examining the distinct effects of exercise in nature versus mere exposure to natural environments, to provide insights into the relative contributions of physical activity and nature immersion to wellbeing outcomes. The overall dearth of RCTs focusing on nature interventions in my NMA may explain why the expected findings were not observed.

In my exploration of the Surfability intervention however, patients frequently emphasised the centrality of nature connection to their positive experience of the intervention. It is worth noting that the patients were actively engaged in physical activity in a natural setting which raises the possibility that physical activity in nature played a synergistic role in the observed benefits. Substantial disparities persist in access to high-quality green spaces, particularly affecting residents of deprived areas and individuals with chronic health conditions or physical limitations (Berg et al., 2015; Corazon et al., 2019; Mitchell and Popham, 2008). Notably, acquired brain injury is more common among individuals from disadvantaged backgrounds (Dunn et al., 2003) and is associated with significant levels of disability both in terms of mental and physical health. Research indicates that individuals from lower socio-economic backgrounds typically derive more significant mental health benefits from urban green spaces compared to their more affluent counterparts (Ward Thompson et al., 2016; Marselle et al., 2020). Additionally, those with lower baseline levels of wellbeing, which are often prevalent in these populations, tend to exhibit greater improvements in wellbeing following engagement with nature (Rogerson et al., 2020). Therefore, it is plausible that baseline characteristics, such as socio-economic status and lack of access to green space previously also influenced participants' experience in nature.

7.5. Addressing Inequalities in Wellbeing

My NMA findings demonstrate that there are numerous avenues for promoting individual wellbeing via a range of interventions. This highlights the pivotal role individuals play in fostering their own wellbeing through proactive engagement in interventions, self-care and positive health behaviours in their communities and daily lives. Nevertheless, a critical consideration is that individuals from healthier or more privileged backgrounds typically possess greater autonomy in accessing various interventions or behaviours conducive to wellbeing compared to individuals with chronic physical or mental health conditions, disabilities, or low socioeconomic status (Marmot, 2005). Throughout multiple studies included in this thesis, including my work on LAC and neurorehabilitation, a consistent finding emerged regarding socio-structural barriers to wellbeing, which was illuminated through qualitative interviews with service users. In the LAC research, the theme of "social equality" reflected how community members had to surmount barriers related to visual impairment, learning disabilities, and mental illness that had previously hindered their access to the local community. Similarly, in the COVID-19 neurorehabilitation interventions discussed in chapter Six, the theme of "barriers to efficacy" underscored the barriers to social participation raised by participants, and included anxiety about attending groups, lack of confidence or ability to use technology to access interventions, and feelings of alienation or exclusion in the initial stages of group participation (Wilkie et al., 2021). The synthesis of my research findings reveals two fundamental findings crucial for addressing inequalities in wellbeing. Firstly, it underscores the necessity of creating opportunities for behaviours that promote wellbeing, particularly by utilising community resources. Secondly, providing additional support to empower those facing greater disadvantages, enabling them to take proactive control of their own wellbeing.

7.6. Opportunity: Utilising Community Assets for Wellbeing Interventions

Promoting wellbeing through local communities is becoming increasingly recognised as a more sustainable approach to healthcare and is becoming embedded across long-term health strategies. For example, "A Healthier Wales" is a vision and strategy for health and social care developed by the Welsh Government to improve the health and wellbeing of people in Wales (Welsh Government, 2021). A key component of this strategy is to shift services out of hospital to communities to encourage people to remain active and independent in their locality, highlighting a needed shift in thinking towards promoting wellbeing and preventing illness, and recognising this approach is more cost effective and sustainable than reactively treating illness after it occurs.

For this approach to be effective, it is essential that opportunities for wellbeing promotion are available within communities. Governments play a pivotal role in supporting local groups, businesses, and organisations who provide opportunities or spaces for interventions aimed at promoting wellbeing such as psychological therapies, exercise groups, nature-based activities, and support groups. Grants facilitating these opportunities and partnerships are crucial components of a top-down strategy aimed at promoting a bottom-up community asset approach. Urban planning must also prioritise green spaces, parks, and recreational facilities in cities and towns which are essential for encouraging physical activity, social interaction, and outdoor leisure (Luca et al., 2021; Navarrete-Hernandez & Laffan, 2019; Richardson et al., 2020).

In addition, we must develop new healthcare models which break silos between different sectors, so health services can communicate and collaborate with community-based organisations (Gibbs et al., 2022). The neurorehabilitation interventions presented in chapters six and seven of this thesis demonstrate the efficacy of projects developed in collaboration with community providers, fostering sustainable wellbeing post-discharge by bridging the gap between healthcare services and local communities. "Surfability" and "Bikeability" for example are organisation dedicated to providing accessible wellbeing opportunities for individuals facing health-related access barriers. In the evaluation of Surf-ability in chapter seven, ripple effect mapping at a one-year follow-up post-intervention revealed that the initial intervention served as a catalyst for a 'ripple' of positive change. For instance, participants began engaging in activities such as spending more time in blue spaces, wild swimming with friends, and paddle boarding with family, behaviours that were not part of their repertoire before the intervention. According to Theory of Planned Behaviour (TPB), behaviour change is influenced by 1) attitude toward the behaviour, 2) subjective norms, and 3) perceived behavioural control (Ajzen, 1991). In the context of Surfability, the initial intervention likely influenced participants' attitudes towards surfing by providing them with a positive experience and exposure to a new activity. Additionally, the supportive social environment may have influenced norms, making these behaviours more socially acceptable and desirable. Furthermore, the intervention may have increased participants perceived behavioural control by providing them with the skills and confidence to engage in these activities independently. Actively exposing patients to community settings, rather than confining interventions to healthcare settings, is likely to enhance their confidence in independently accessing similar resources post-intervention. The solution isn't solely about surfing or other individual approaches; it's about establishing a network of community providers collaborating with health boards to create sustainable community wellbeing opportunities beyond discharge. These partnerships not only support individuals but benefit whole communities and promote collective wellbeing.

7.7.Empowerment: Embedding People into their Communities

To reduce inequalities in wellbeing, not only is it essential to provide the opportunities for people to engage in wellbeing promoting interventions and behaviours in their own local communities, but it's essential to provide additional support and empowerment to those facing barriers to community participation. Empowerment ensures people are confident and motivated to engage in positive behaviour change. This concept aligns with the need for 'competence' as highlighted by Self-Determination Theory (SDT) (Deci & Ryan, 2008) whereby individuals need to experience effectiveness or mastery in their behaviours to retain intrinsic motivation and behaviour change. This also supports Carol Ryff's work on the dimension of environmental mastery, one of six components in her model of psychological wellbeing which assesses individuals' competence and their sense of control over their surroundings (Ryff & Keyes, 1995). Individuals from disadvantaged backgrounds, such as those with ABI or other disabilities, may either refrain from attending community activities altogether due to anxiety or find themselves in an anxiety-provoking situation without anyone on hand to support them, which prevents them returning. Further barriers which also prevent individuals with ABI participating in social groups include fear of stigmatisation (McLellan et al., 2010), cognitive impairment, depression, lack of motivation and fatigue (Mahar & Fraser, 2011). While group-based therapies and educational interventions are commonly offered within healthcare services, and signposting to community projects occurs, actively attending and supporting patients to engage in community activities is less common. My findings underscore the imperative of bridging these gaps to facilitate community integration. In the neurorehabilitation interventions, the physical presence of practitioners in fostering a secure and supportive atmosphere proved instrumental. Similarly, in LAC, coordinators played a crucial role in offering a 'safety net', aiding individuals to overcome financial, physical, or mental barriers, and initially attending community groups with them to build initial confidence, thereby facilitating sustained independent engagement. This line of reasoning is aligned with Polyvagal theory, which highlights that a perceived safe environment activates vagal pathways which inhibit fight or flight responses and allows for social connection (Porges, 2007, 2011). Moreover, according to broaden-and-build theory, increased vagal functioning predicts enhanced positive emotions and social connectedness (Fredrickson, 2004). Thus, according to this perspective, once individuals feel safe in an environment, this will allow for a positive spiral of increased wellbeing, and self-confidence for future social participation, even after the professional 'safety net' is removed.

The interventions outlined in this thesis represent a departure from traditional community-based approaches like social prescribing. Rather than merely suggesting activities, there is active collaboration with service providers to develop initiatives and address service gaps, often facilitated through staffing arrangements to ensure seamless support. A significant challenge in social prescribing is high attrition rates (Grayer et al., 2008), but these approaches aim to counter this by fostering a sense of safety and belonging. Through the concept of 'bridging,' clients are supported in attending prescribed activities and integrating them for sustained engagement.

My research indicates that the presence of a trusted individual who can establish rapport, provide companionship, and cultivate a sense of security is pivotal in supporting vulnerable populations to independently engage with community activities, social groups and positive health behaviours. Advancing collective wellbeing is integral to achieving the objectives of the United Nations Sustainable Development Goal 10 to reduce inequalities (United Nations, 2015). By prioritising wellbeing promotion, particularly among marginalised groups, interventions can reduce disparities, ensuring all individuals have the opportunity and empowerment to pursue wellbeing.

7.8.Strengths and Limitations of Heart Rate Variability Data

While collecting and analysing HRV psychophysiological data across multiple studies in my thesis, several critical insights surfaced. In the LAC study, while in-phase synchrony was observed, it did not correlate with subjective ratings of relationship quality, suggesting that HRV-based synchrony may capture a different layer of physiological interaction that does not necessarily reflect perceived relationship. Future research should consider refining these measures to assess whether certain synchrony dimensions may more accurately reflect relationship quality or other interactional aspects. Also, no significant changes in HRV were found in ABI patients following the surf therapy intervention. Findings across multiple studies highlight inconsistencies in the association between vagal function and wellbeing. This is also reflected in the wider literature, while there is substantial evidence linking vagal function to various aspects of wellbeing (see Wilkie et al., 2022a), several studies have also reported no direct associations between vagal function and wellbeing (Behnke et al., 2022; Sloan et al., 2017; Tegegne et al., 2018). This raises questions regarding vagal tone's function as an upstream mediator—potentially influencing pathways to wellbeing rather than serving as a direct measure of subjective wellbeing. The variability may also reflect limitations in HRV generalisability, especially within heterogeneous populations such as individuals with chronic health conditions (Kemp & Quintana, 2013).

In both the LAC participants and ABI patients, the diverse array of medical conditions, medication usage, and comorbidities markedly influenced HRV, necessitating rigorous participant screening to identify potential factors affecting the data. Looking ahead, it is critical to standardise participants' physiological state pre-data collection by issuing instructions to abstain from alcohol, strenuous exercise, and caffeine, all of which impact HRV (Laborde et al., 2017; Tarvainen et al., 2021; Tegegne et al., 2018). Additionally, ensuring a consistent time of day for data collection and issuing instructional videos for participants about sensor placement, could further bolster data reliability. However, based on my experience, HRV data acquisition demands significant time and resources due to various logistical intricacies. Therefore, the balance between the potential benefits and logistical challenges warrants evaluation in future larger studies. It will be crucial for the project lead to possess extensive knowledge of HRV data collection, and securing funding to support in-person logistics will be essential. Overall, though substantial evidence links the vagus nerve to wellbeing, methodological challenges persist and interpreting vagal tone as a wellbeing marker requires caution, and more rigorous studies are needed, especially in complex health populations.

7.9. Recommendations for Future Directions

Addressing Gaps in RCTs in Wellbeing Science: NMA is strong method for intervention evaluation, my study leveraged 183 RCTs with a substantial sample size of 22,811 adults. NMA has gained endorsement as a robust methodology from esteemed organisations like the

Cochrane Collaboration and National Institute for Health and Care Excellence (NICE), facilitating informed decision-making processes. However, NMA is only as robust as the evidence available. The findings indicated that only 33% of included RCTs implemented an intention-to-treat analysis, which raises concerns regarding the integrity of the reported outcomes in wellbeing intervention RCTs more broadly. This limitation, alongside a generally high risk of bias in the literature, highlights the need for more rigorous methodological approaches in future RCTs. To enhance the reliability of findings in wellbeing science, future research should prioritise intention-to-treat analyses and the inclusion of appropriate control groups. These steps are essential to establish a more robust evidence base, ultimately advancing the field of wellbeing interventions. There are also significant gaps in the current literature regarding wellbeing interventions, particularly in areas where RCTs are lacking. There is an opportunity to explore the synergistic effects of multi-component wellbeing interventions drawn from various domains as outlined in the GENIAL framework. Combining psychological interventions with movement, as indicated by the findings of my NMA, holds considerable promise. Furthermore, investigating the combined effects of nature and movement, or exploring the efficacy of integrating psychological interventions with movement in natural settings, would be valuable avenues for future research. Such combined interventions have the potential to enhance effectiveness while requiring fewer resources. In addition, given that my NMA focused only on data from the general population, future research should consider replicating the study methodology with specific clinical populations to guide specific clinical decisions on interventions. Overall, however, by implementing specific criteria in my NMA such as only including peer reviewed literature, using multiple sensitivity analyses and valid measurement scales only, I increased the robustness of the conclusions drawn, even when considering these broader methodological challenges.

Community-Based Approaches to Wellbeing: The Welsh Government and Public Health Wales have recently initiated a consultation period for their new 'Health and Wellbeing' strategy. Additionally, seven Regional Partnership Boards across Wales, established under the Social Services and Wellbeing Act, have formulated 'Emotional Wellbeing Strategies' – comprehensive regional plans operating across health boards, social services, and the third sector. LAC plays a central role in the vision of enhancing societal wellbeing and my study is the first of its kind to specifically examine wellbeing outcomes in LAC. It underscores the significance of further exploration in this area and highlights the necessity of conducting a larger-scale study. This might involve recruiting an area planning to implement LAC and pairing it with a socio-structurally similar area for comparison. This approach would enable tracking population changes over time, drawing potential causal conclusions. Based on my findings on the key mechanisms underpinning LAC, it would be advantageous to include measures of wellbeing, relationship quality (therapeutic alliance), community integration duration and frequency of contact in future evaluations.

My findings particularly highlight the importance of the relationship and therapeutic alliance between coordinators and the community members they engage with. This also holds significant implications for other community approaches, as the extent to which rapport building is prioritised can vary significantly depending on factors such as resource availability, time constraints, the organisation implementing the approach, and the skills, professional supervision, or training of the coordinator. Findings also suggest that flexibility is important and efforts to 'standardise' or 'prescribe' activities should be avoided as participants specifically highlighted the utility of a personalised approach. Co-designing community interventions is likely a more helpful strategy for ensuring that services are genuinely responsive to the needs and preferences of those they aim to support, aligning with the ethos of LAC. By involving individuals in the design process, we can create and allow them to choose personalised interventions that are not only relevant but also more effective in promoting wellbeing. Fostering a sense of ownership and empowerment, may make communities and individuals more likely to engage with interventions and assets offered. Furthermore, co-design ensures that interventions are culturally sensitive and tailored to the specific contexts and challenges faced by different communities.

I recommend that LAC could be strengthened further by bolstering the therapeutic role of coordinators through additional training in positive psychology and wellbeing coaching. LAC's ethos of leveraging strengths, self-efficacy, and personal growth closely aligns with positive psychology, yet most coordinators I have met showed limited familiarity with positive psychology, indicating a potential area for future integration. An example of how this may be implemented at scale can be seen at Swansea Bay Health Board, which has recently funded seven community psychology positions to be employed in general practices. One component of their role will involve supervising and upskilling local area coordinators.

Expanding Application Beyond Neurorehabilitation - Potential Implications for NCDs:

While this thesis has focused on neurorehabilitation, the principles of co-designed, community-integrated wellbeing interventions may also offer value for mental health services and the management of other chronic conditions. With the rising prevalence of Non-Communicable Diseases (NCDs) such as diabetes, cardiovascular disease, and chronic respiratory conditions, healthcare systems face increasing pressure and a need for reform. While specialised medical care remains essential for the treatment of symptoms, there is a pressing need for a stepped care model that supports patients with chronic conditions in adopting healthier lifestyles within their communities, reducing the risk of co-morbidities and minimising long-term reliance on healthcare services. My research overall suggests that integrating multiple wellbeing determinants into interventions, for example physical activity conducted in a group setting or outdoors in nature, and combined with psychological therapeutic intervention could help patients manage chronic conditions by encouraging overall healthier lifestyles and community participation which simultaneously supports individual and collective wellbeing. Importantly, the involvement of a trusted healthcare professional is key, not simply to prescribe these activities, but to actively facilitate and support patients' engagement in them. By having healthcare providers play an active role in bridging clinical care and community resources, these interventions become a core part of rehabilitation, rather than an add-on, helping patients feel safe and supported as they integrate these behaviours into their daily lives.

Evaluating wellbeing interventions within health services however necessitates a critical reflection on methodological approaches. The quantitative findings presented in chapter six were based on pre-post designs, which provided valuable insights on the impact of the interventions on wellbeing, especially when combined with data from a mixed methodological approach. However, pre-post designs are inherently limited in that they are unable to establish causality as they lack randomisation and control of external variables. Future research might consider designs such as wait-list controls or cluster-randomised trials, which offer a more rigorous comparison, but accommodate some of the ethical constraints with treatment randomisation inherent in healthcare settings. Cost-effectiveness studies are also crucial to evaluate the financial viability and resource efficiency of these community-based interventions, particularly within stretched healthcare systems. Longitudinal studies would be especially valuable for measuring the lasting impact of such interventions on patients' health, wellbeing, social cohesion, and social capital, providing insights into how these programmes might reduce the prevalence and impact of NCDs on a systemic level. Importantly, to reiterate, the NMA presented in this thesis also revealed significant methodological limitations in existing wellbeing RCTs more broadly. This highlights a broader issue regarding the robustness of intervention research in this field, which isn't necessarily addressed simply by using RCT designs but requires the careful design of robust RCTs. Moreover, conducting controlled studies in clinical settings is often challenging due to bureaucratic hurdles, limited funding, and time constraints for clinicians, meaning that research is frequently only feasible if it can be seamlessly embedded into existing practice, as was the case with our service evaluations.

7.10. Impact of Thesis

In the realm of neurorehabilitation and healthcare, I have presented my research findings at both local conferences like The South West Wales Brain injury Group Conference (2021, 2022 and 2023) and International conferences such as the European Positive Psychology Conference 2022 in Reykjavik, Iceland. Through this, I have facilitated knowledge dissemination and dialogue among professionals in the field. Similarly, my work LAC has left a notable impact on both practice and policy. I presented findings last year at the LAC network national conference in Sheffield, UK in 2023 to a significant number of coordinators and stakeholders involved in LAC. Additionally, I presented my work to psychologists from across mental health and chronic condition services in Swansea Bay Health Board. Through these opportunities, I have advocated for the adoption of community-based approaches to support vulnerable populations and promote independence and wellbeing. Furthermore, my involvement in policy discussions, such as the 'A Healthier Wales' steering group, led by the Welsh Government, has highlighted to decision makers the importance of relationship-building and safety in community-based interventions, influencing decision-making processes and future healthcare strategies. My supervisors have recently been invited to contribute to the ongoing development of the Welsh Government's mental health and wellbeing strategy draft, with a specific focus on integrating it with our GENIAL model. These efforts will be based on existing work, including the ideas and research presented in this thesis.

Through a £10,000 grant from the Morgan Advanced Studies Institute, myself and two fellow PhD students (Jessica Mead and Katie Gibbs) organised the 'Summer of Hope' conference. This two-day online event brought together emerging researchers to share innovative and interdisciplinary perspectives on improving wellbeing. Notable speakers included Professor Jose Luis Marti from Pompeu Fabra University of Barcelona, who discussed planetary wellbeing, and Vanessa King from Action for Happiness, who explored the role of positive psychology following the COVID-19 pandemic. The conference also provided a platform for early career researchers worldwide to present their research, fostering knowledge exchange.

In parallel to my academic pursuits, I have undergone training to become a registered mindfulness practitioner and a yoga teacher and have established a business focused on leading wellbeing interventions in the community [see lowriwilkie.com]. Through training programs, mindfulness workshops, and retreats, I have fostered resilience, wellbeing, and community support, aligning with my commitment to promoting mental health and holistic wellbeing beyond academic settings. The GENIAL Roadmap to wellbeing, which I developed (see Appendix W), will soon be published in a book chapter (Fisher et al, in press) and has been a cornerstone tool in my training repertoire. It's been a privilege to facilitate self-connection and reflection to individuals across a diverse spectrum of sectors, including educational institutions, charities, various organisations, and universities. This tool has been a guide for individuals to reflect on the key domains of wellbeing as they pertain to their own lives and has encouraged the setting of targeted goals to enhance wellbeing. My dual role as a researcher and practitioner has allowed me to bridge the gap between theory and practice, empowering individuals to cultivate mindfulness and enhance their wellbeing.

7.11. Conclusion

To cultivate a flourishing society, individuals need the education and skills to effectively manage their individual wellbeing through emotional balance and positive health behaviours. Interventions such as mindfulness, compassion, ACT, yoga, and physical activity offer evidence-based pathways to enhance wellbeing, and there is flexibility for the choice of interventions and delivery formats to align with personal preferences and needs. However, whilst individuals are indeed responsible for self-care, promoting wellbeing cannot solely depend on individual efforts.

Addressing barriers to collective wellbeing within communities is also crucial. Approaches like Local Area Coordination empower vulnerable individuals to engage in wellbeing-promoting behaviours, fostering healthier and more equal communities. Additionally, in healthcare, addressing non-communicable diseases requires a shift towards incorporating community asset led, holistic care, integrating interventions which aid emotional balance, physical health behaviours, social connection, connection to nature, behaviour change and overcoming socio-structural barriers (A. Kemp et al., 2017; A. H. Kemp & Fisher, 2022; Mead et al., 2019, 2021, 2023). Policy decisions play a vital role in supporting wellbeing, creating conditions conducive to flourishing at both the individual and societal levels (Marmot, 2020). We must create communities to be inclusive spaces where everyone has access to resources and support for wellbeing in their daily lives. This requires collaborative efforts across various sectors to create a culture of wellbeing. Education about wellbeing may be further integrated into schools to teach children skills of self-reflection and self-care (Patton et al., 2016). Public health strategies and workplace initiatives can also promote healthy lifestyles. Fabian & Pykett, 2022 propose the use of psychological boosting, a strengths-based approach to promoting population wellbeing. Unlike 'psychological nudging' policies which aim to steer decisions, psychological boosts aim to empower individuals through education and skill-building, enhancing capacity for self-regulation and decision-making. Governments should also ensure accessibility by supporting funding for local groups and organisations providing wellbeing services (Jones et al., 2015). Urban planning can also contribute by designing environments that encourage social connection, access to green space and physical activity (Hartig et al., 2014; Helbich et al., 2018; Navarrete-Hernandez & Laffan, 2019; Shen et al., 2017).

Overall, this thesis serves as a call to action to prioritise whole health and wellbeing across various sectors of society. It outlines various approaches to achieve this goal, ranging from individual interventions for the general population to community-based initiatives and restructuring healthcare models. Through fostering collaborative efforts and collective action, we have the potential to nurture connected individuals and communities that prioritise the wellbeing of all beings and the planet.

8. References

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9. Appendices

Appendix A. Search strategy

Note: this Appendix Refers Chapter 4 A Systematic Review and Network Meta-Analysis Comparing Wellbeing-Focused Interventions

Medline (Via Ebsco)

1. TI (Well-being OR Wellbeing OR Positive affect OR Positive Emotion OR Wellness OR happy OR happiness or flourish* OR resilienc*) OR AB (Well-being OR Wellbeing OR Positive affect OR Positive Emotion OR Wellness OR happy OR happiness or flourish* OR resilienc*)
2. TI (life N1 satisfaction) OR AB (life N1 satisfaction)
3. #1 OR #2
4. TI ("Randomized controlled trial*" OR "Randomised controlled trial*" OR RCT OR "Clinical trial*" OR "Controlled clinical trial*") OR AB ("Randomized controlled trial*" OR "Randomised controlled trial*" OR RCT OR "Clinical trial*" OR "Controlled clinical trial*")
5. MH "Randomized Controlled Trials as Topic"
6. MH "Controlled Clinical Trials as Topic"

7. #4 OR #5 OR #6
8. TI (Mindfulness OR “Mindfulness based intervention*” OR “Mindfulness based stress reduction” OR MBSR OR MBI OR Compassion OR Meditation OR “Acceptance and Commitment Therapy” OR ACT) OR AB (Mindfulness OR “Mindfulness based intervention*” OR “Mindfulness based stress reduction” OR MBSR OR MBI OR Compassion OR Meditation OR “Acceptance and Commitment Therapy” OR ACT)
9. MH “Mindfulness+”
10. MH “Empathy”
11. MH “Meditation”
12. MH “Acceptance and Commitment Therapy”
13. TI (“Positive psychology” OR “Positive psychotherapy” OR PPI OR Strength* OR Gratitude OR Optimism OR Meaning OR Savouring OR Hope) OR AB (“Positive psychology” OR “Positive psychotherapy” OR PPI OR Strength* OR Gratitude OR Optimis* OR Meaning OR Savouring OR Hope)
14. MH “Psychology, Positive”
15. MH “Optimism”
16. MH “Hope”
17. TI (intervention* N1 (Nature OR outdoor*)) OR AB (intervention* N1 (Nature OR outdoor*))
18. TI (Ecotherap* OR Greenspace* OR “green space*” OR “blue space*” OR bluespace* OR “Green therap*” OR “natural environment” OR “Forest bathing” OR “forest therap*” OR “Shinrin Yoku” OR Horticultur* OR Garden* OR Conservation OR Allotment OR Beach* OR Countryside) OR AB (Ecotherap* OR Greenspace* OR “green space*” OR “blue space*” OR bluespace* OR “Green therap*” OR “natural environment” OR “Forest bathing” OR “forest therap*” OR “Shinrin Yoku” OR Horticultur* OR Garden* OR Conservation OR Allotment OR Beach* OR Countryside)
19. MH “Relaxation therapy”
20. MH “Parks, Recreational”
21. MH “Horticulture+”
22. TI (“Physical activit*” OR “Health promotion” OR “Health education” OR “Healthy Lifestyle” OR “Isometric training” OR “isometric program” OR “isometric conditioning” OR “isometric exercise*” OR “strength training” OR “strength conditioning” OR “strength program” OR “aerobic training” OR “aerobic exercise” OR “aerobic conditioning” OR “physical exercise” OR “stretching” OR “movement program” OR workout) OR AB (“Physical activit*” OR “Health promotion” OR “Health education” OR “Healthy Lifestyle” OR “Isometric training” OR “isometric program” OR “isometric conditioning” OR “isometric exercise*” OR “strength training” OR “strength conditioning” OR “strength program” OR “aerobic training” OR “aerobic exercise” OR “aerobic conditioning” OR “physical exercise” OR “stretching” OR “movement program” OR workout)
23. MH “Exercise”
24. MH “Health promotion”
25. MH “Health education”
26. MH “Healthy lifestyle”
27. TI ((Intervention OR Group* OR Club*) N1 (Support OR Social or self-help OR “self help”)) OR AB ((Group* OR Club*) N1 (Support OR Social OR “self-help”))

28. TI (“Social identity” OR “group identi*” OR “team identi*” OR “club identi*” OR “work identi*”) OR AB (“Social identity” OR “group identi*” OR “team identi*” OR “club identi*” OR “work identi*”)
29. MH “social identity+”
30. S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28 OR S29
31. S3 AND S7 AND S30

Search results March 2023 = 3776

PsycINFO (Via Ebsco)

1. TI (Well-being OR Wellbeing OR Positive affect OR Positive Emotion OR Wellness OR happy OR happiness or flourish* OR resilienc*) OR AB (Well-being OR Wellbeing OR Positive affect OR Positive Emotion OR Wellness OR happy OR happiness or flourish* OR resilienc*)
2. TI (life N1 satisfaction) OR AB (life N1 satisfaction)
3. #1 OR #2
4. TI (“Randomized controlled trial*” OR “Randomised controlled trial*” OR RCT OR “Clinical trial*” OR “Controlled clinical trial*”) OR AB (“Randomized controlled trial*” OR “Randomised controlled trial*” OR RCT OR “Clinical trial*” OR “Controlled clinical trial*”)
5. TI (Mindfulness OR “Mindfulness based intervention*” OR “Mindfulness based stress reduction” OR MBSR OR MBI OR Compassion OR Meditation OR “Acceptance and Commitment Therapy” OR ACT) OR AB (Mindfulness OR “Mindfulness based intervention*” OR “Mindfulness based stress reduction” OR MBSR OR MBI OR Compassion OR Meditation OR “Acceptance and Commitment Therapy” OR ACT)
6. DE “Mindfulness”
7. DE “Empathy”
8. DE “Meditation”
9. DE “Acceptance and Commitment Therapy”
10. TI (“Positive psychology” OR “Positive psychotherapy” OR PPI OR Strength* OR Gratitude OR Optimism OR Meaning OR Savouring OR Hope) OR AB (“Positive psychology” OR “Positive psychotherapy” OR PPI OR Strength* OR Gratitude OR Optimis* OR Meaning OR Savouring OR Hope)
11. DE “Positive Psychology”
12. DE “Optimism”
13. DE “Hope”
14. TI (intervention* N1 (Nature OR outdoor*)) OR AB (intervention* N1 (Nature OR outdoor*))
15. TI (Ecotherap* OR Greenspace*OR “green space*” OR “blue space*” OR bluespace* OR “Green therap*” OR “natural environment” OR “Forest bathing” OR “forest therap*” OR “Shinrin Yoku” OR Horticultur* OR Garden* OR Conservation OR Allotment OR Beach* OR Countryside) OR AB (Ecotherap* OR Greenspace* OR “green space*” OR “blue space*” OR bluespace* OR “Green therap*” OR “natural environment” OR “Forest bathing” OR “forest therap*” OR “Shinrin Yoku” OR Horticultur* OR Garden* OR Conservation OR Allotment OR Beach* OR Countryside)

16. DE “Relaxation therapy”
17. DE “Horticulture Therapy”
18. TI (“Physical activit*” OR “Health promotion” OR “Health education” OR “Healthy Lifestyle” OR “Isometric training” OR “isometric program” OR “isometric conditioning” OR “isometric exercise*” OR “strength training” OR “strength conditioning” OR “strength program” OR “aerobic training” OR “aerobic exercise” OR “aerobic conditioning” OR “physical exercise” OR “stretching” OR “movement program” OR workout) OR AB (“Physical activit*” OR “Health promotion” OR “Health education” OR “Healthy Lifestyle” OR “Isometric training” OR “isometric program” OR “isometric conditioning” OR “isometric exercise*” OR “strength training” OR “strength conditioning” OR “strength program” OR “aerobic training” OR “aerobic exercise” OR “aerobic conditioning” OR “physical exercise” OR “stretching” OR “movement program” OR workout)
19. DE “Exercise”
20. DE “Health promotion”
21. DE “Health education”
22. TI ((Intervention OR Group* OR Club*) N1 (Support OR Social or self-help OR “self help”)) OR AB ((Group* OR Club*) N1 (Support OR Social or self-help OR “self help”))
23. TI (“Social identity” OR “group identi*” OR “team identi*” OR “club identi*” OR “work identi*”) OR AB (“Social identity” OR “group identi*” OR “team identi*” OR “club identi*” OR “work identi*”)
24. DE “social identity”
25. S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24
26. S3 AND S4 AND S25

Results March 2023 = 1608

Scopus (Via Elsevier)

1. TITLE-ABS-KEY (Well-being OR Wellbeing OR Positive affect OR Positive Emotion OR Wellness OR happy OR happiness or flourish* OR resilienc*)
2. TITLE-ABS-KEY (life W/1 satisfaction)
3. #1 OR #2
4. TITLE-ABS-KEY (“Randomized controlled trial*” OR “Randomised controlled trial*” OR RCT OR “Clinical trial*” OR “Controlled clinical trial*”)
5. TITLE-ABS-KEY (Mindfulness OR “Mindfulness based intervention*” OR “Mindfulness based stress reduction” OR MBSR OR MBI OR Compassion OR Meditation OR “Acceptance and Commitment Therapy” OR ACT)
6. TITLE-ABS-KEY (“Positive psychology” OR “Positive psychotherapy” OR PPI OR Strength* OR Gratitude OR Optimism OR Meaning OR Savouring OR Hope)
7. TITLE-ABS-KEY (intervention* W/1 (Nature OR outdoor*))
8. TITLE-ABS-KEY (Ecotherap* OR Greenspace* OR “green space*” OR “blue space*” OR bluespace* OR “Green therap*” OR “natural environment” OR “Forest bathing” OR “forest therap*” OR “Shinrin Yoku” OR Horticultur* OR Garden* OR Conservation OR Allotment OR Beach* OR Countryside)
9. TITLE-ABS-KEY (“Physical activit*” OR “Health promotion” OR “Health education” OR “Healthy Lifestyle” OR “Isometric training” OR “isometric program” OR “isometric conditioning” OR “isometric exercise*” OR “strength training” OR

“strength conditioning” OR “strength program” OR “aerobic training” OR “aerobic exercise” OR “aerobic conditioning” OR “physical exercise” OR “stretching” OR “movement program” OR workout)

10. TITLE-ABS-KEY ((Intervention OR Group* OR Club*) W/1 (Support OR Social or self-help OR “self help”))
11. TITLE-ABS-KEY (“Social identity” OR “group identi*” OR “team identi*” OR “club identi*” OR “work identi*”)
12. S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11
13. S3 AND S4 AND S12

Results March 2023 = 2100

CENTRAL (Via Cochrane)

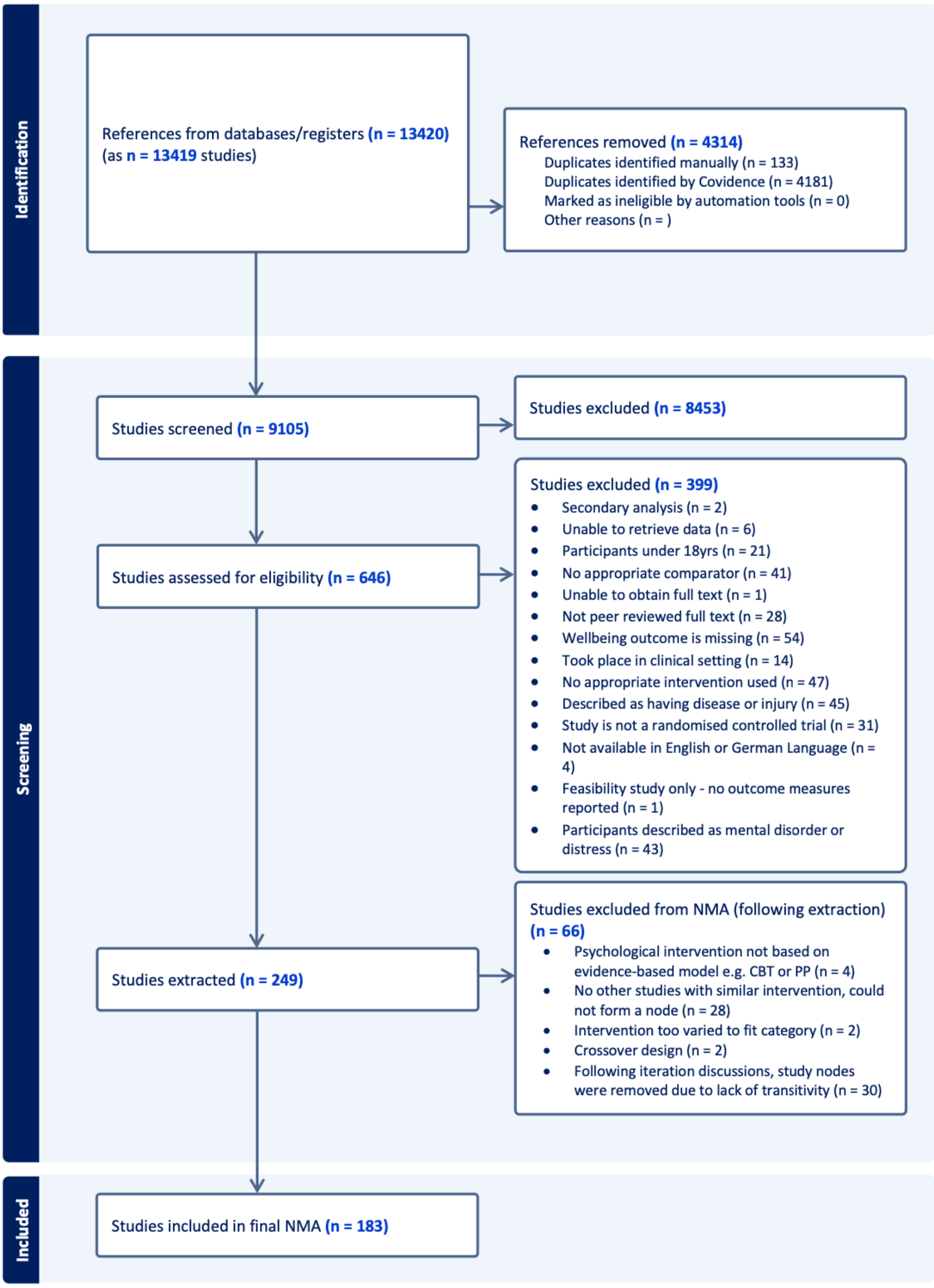
1. (Well-being OR Wellbeing OR Positive affect OR Positive Emotion OR Wellness OR happy OR happiness or flourish* OR resilienc*):ti,ab,kw
2. (life NEAR/1 satisfaction):ti,ab,kw
3. #1 OR #2
4. (“Randomized controlled trial*” OR “Randomised controlled trial*” OR RCT OR “Clinical trial*” OR “Controlled clinical trial*”):ti,ab,kw
5. MeSH descriptor [Randomized Controlled Trial] this term only
6. MeSH descriptor [Controlled Clinical Trial] this term only
7. #4 OR #5 OR #6
8. (Mindfulness OR “Mindfulness based intervention*” OR “Mindfulness based stress reduction” OR MBSR OR MBI OR Compassion OR Meditation OR “Acceptance and Commitment Therapy” OR ACT):ti,ab,kw
9. MeSH descriptor [Mindfulness] this term only
10. MeSH descriptor [Empathy] this term only
11. MeSH descriptor [Meditation] this term only
12. MeSH descriptor [Acceptance and Commitment Therapy] this term only
13. (“Positive psychology” OR “Positive psychotherapy” OR PPI OR Strength* OR Gratitude OR Optimism OR Meaning OR Savouring OR Hope):ti,ab,kw
14. MeSH descriptor [Psychology, Positive] this term only
15. MeSH descriptor [Optimism] this term only
16. MeSH descriptor [Hope] this term only
17. (intervention* NEAR/1 (Nature OR outdoor*)):ti,ab,kw
18. (Ecotherap* OR Greenspace* OR “green space*” OR “blue space*” OR bluespace* OR “Green therap*” OR “natural environment” OR “Forest bathing” OR “forest therap*” OR “Shinrin Yoku” OR Horticultur* OR Garden* OR Conservation OR Allotment OR Beach* OR Countryside):ti,ab,kw
19. MeSH descriptor [Relaxation Therapy] this term only
20. MeSH descriptor [Parks, Recreational] this term only
21. MeSH descriptor [Horticultural] explode all trees
22. (“Physical activit*” OR “Health promotion” OR “Health education” OR “Healthy Lifestyle” OR “Isometric training” OR “isometric program” OR “isometric conditioning” OR “isometric exercise*” OR “strength training” OR “strength conditioning” OR “strength program” OR “aerobic training” OR “aerobic exercise” OR “aerobic conditioning” OR “physical exercise” OR “stretching” OR “movement program” OR workout):ti,ab,kw
23. MeSH descriptor [Exercise] this term only

24. MeSH descriptor [Health Promotion] this term only
25. MeSH descriptor [Healthy Lifestyle] this term only
26. ((Intervention OR Group* OR Club*) NEAR/1 (Support OR Social or self-help OR "self help")):ti,ab,kw
27. ("Social identity" OR "group identi*" OR "team identi*" OR "club identi*" OR "work identi*"):ti,ab,kw
28. MeSH descriptor [Social identity] this term only
29. #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26 OR #27 OR #28
30. #3 AND #7 AND #29

Results March 2023 = 5757

Appendix B. PRISMA flow chart for studies included in NMA

Note: this Appendix Refers Chapter 4 A Systematic Review and Network Meta-Analysis Comparing Wellbeing-Focused Interventions



Note: Image created by Lowri Wilkie using Microsoft Word.

Appendix C. Characteristics of included studies in NMA

Note: this Appendix Refers Chapter 4 A Systematic Review and Network Meta-Analysis Comparing Wellbeing-Focused Interventions

Author	Country	Mean Age	Setting	Outcomes	Intervention 1	Intervention 2	Intervention 3	Intervention 4
Aeschbach, 2022	Germany	31.02	Workplace (Hospital)	FS, SCS	Theoretical information book on mindfulness	An 8-week mindfulness-based program		
Ahmad, 2020	Canada	24.8	University	16-item Quality of Life Scale (QOLS), FFMQ-SF	Wait list control	Mindfulness and CBT intervention		
Aikens, 2014	USA	Not reported	Workplace - (Corporation)	CD-RISC, FFMQ - Non Reactivity Scale	Wait list control	Mindfulness Programme		
Ajilchi, 2019	Iran	23.47	University	Mental Toughness Questionnaire (49 item)	No intervention	Mindfulness group		
Alexander, 2015	USA	46.38	Workplace (Hospital)	FMI	No intervention	Yoga		
Allexandre, 2016	USA	39.6	Workplace (Call Centre)	SF-36 Vitality	Wait list control	Mindfulness Program		
Amutio, 2015	Spain	47.31	Workplace (Healthcare)	FFMQ, SRSI3	Wait list control	MBSR mindfulness		

Ardi, 2021	Israel	30.91	Community and University	SWLS, CD-RISC	Wait list control	MBSR mindfulness	
Asuero, 2014	Spain	47.85	Workplace (Healthcare)	FFMQ, POMS Vigor	Wait list control	MBSR mindfulness	
Baker, 2008	Scotland	49.2	Community	PANAS-PA	No intervention	Walking program	
Basso, 2022	USA	30.72	Community	PANAS-PA	No intervention (maintain current exercise levels)	Exercise: Increase exercise regimen	
Bita, 2021	Iran	21.55	University	PWB, The Sports Mental Toughness Questionnaire (SMTQ)	No intervention - received usual sports coaching	Mindfulness Acceptance intervention	
Blasche, 2013	Austria	40.1	Workplaces (Various organisations)	Emotional well-being was assessed with a standardized German questionnaire (EBF)	Wait-List Control	Nordic walking	
Bohlmeijer, 2021	Netherlands	48.6	Community	MHC-SF, GQ-6	Wait list control	Gratitude based writing exercises	Self acts of kindness
Bonde, 2022	Denmark	45.2	Workplace (School)	WHO-5, FFMQ	Wait list control	Mindfulness-based Stress Reduction (MSR)	

Borchardt, 2018	USA	18.94	University	PANAS-PA	Control - Sat quietly	Meditation Intervention
Bowden, 2011	Not reported	Not reported	University	The Subjective Vitality Scale	Mindfulness classes	Iyengar Yoga Procedure
Brinkmann, 2020	Germany	43.27	Workplace	FMI-SF, SCS	Wait list control	Mindfulness based intervention
Brito-Pons, 2018	Chille	36.165	Community	SWLS, SHS	Wait list control	Compassion Training
Cerna, 2020	Chile	30.9	Community	The Mental Health Questionnaire (MHC)	Wait list control	MBSR mindfulness
Champion, 2018	UK	39.13	Online	SWLS, The Wagnild Resilience Scale (WRS)	Wait list control	Headspace mindfulness introductory program
Chesak, 2015	USA	28.2	Workplace	CD-RISC	Educational lecture	Resilience Intervention
Christopher, 2018	USA	43.98	Workplace (Law enforcement)	FFMQ-SF, SCS-SF	No intervention control	Mindfulness training
Connolly, 2020	UK	40	Community	WEMWBS	No intervention	12 week exercise training DVD
Crain, 2017	Canada and USA	46.9	Workplace (School)	FFMQ	Wait list control	Mindfulness Training Program
Cruz-Ferreira, 2011	Portugal	40.7	University	SWLS	Wait list control	Pilates
Cruz-Ferreira, 2015	Portugal	71.95	Health centre	SWLS	No intervention control	Creative Dance Exercise program

Danitz, 2014	United States	21.13	University	Philadelphia Mindfulness Scale	Wait list control	Acceptance based Workshop		
deVibe, 2018	Norway	23.8	University	FFMQ	Control - studies as usual	Mindfulness		
Devillers-Réolon, 2022	France	22.13	University	WEMWBS	No intervention control	Mindfulness: daily online mindfulness		
Díaz-Benito, 2022	Spain	34.31	Workplace	SF-36 Vitality	No intervention control	Exercise: aerobic and strength training		
Duan, 2019	China	18.22	University	Brief Inventory of Thriving (BIT)	No intervention control	Character strengths intervention		
Dvořáková, 2017	USA	18.2	University	SWLS, SCS	No intervention control	Mindfulness program students		
Economides, 2018	Not reported	No mean reported	Online	SPANE	Audio mindfulness content	Headspace mindfulness app		
Edney, 2020	Australia	41	Online	PP	Wait list control	Increase daily step count		
Edwards, 2019	USA	21.43	University	Exercise Induced Feelings Inventory: positive engagement	Control - sit in lab	Walking	Meditation Group	Meditation then Walk
Engel, 2019	Germany	36.2	University (Laboratory)	WHOQOL-BREF	Control - maintained their standard	Functional high-intensity training		

					exercise training	
EnriqueRoig, 2020	Ireland	26	University	Pemberton Happiness Index (PHI), CD-RISC	Wait list control	Space for resilience intervention
Erogul, 2014	USA	23.5	University	SCS, The Resilience Scale (RS)	No intervention control	MBSR mindfulness
Fernández-Portero, 2021	Spain	52.08	Community	SWLS, CD-RISC	Physical activity training	Mindfulness and acceptance-based intervention
Fisher, 2004	USA	73.99	Community	SWLS	Education booklet control	Walking (outdoor)
Flook, 2013	USA	43.06	Workplace (School)	FFMQ-Non Reactivity Sub-Scale, SCS - Shared Humanity	Wait list control	MBSR Mindfulness
Galante, 2016	UK/USA	Not reported	Online	WEMWBS	Light Exercise (Video based)	Loving kindness meditation
Gerodimos, 2022	Greece	44.44	Workplace - hospital	Subjective Vitality Scale	No intervention	Chair based exercise group
Goldberg, 2020	United States	41.74	Online based	FFMQ	Waitlist Control	Awareness and Insight
Green, 2006	Austrailia	42.68	Community	SWLS	Waitlist Control	Life coaching group programme
Green, 2022	Pakistan	23.26	University	PP	Waitlist Control	Character strengths intervention

Gregoire, 2017	Canada	31.72	University	Well-Being Manifestations Measure Scale (WBMMS), FFMQ-SF	Waitlist Control	Four workshops based on ACT	
Hajatnia, 2021	Iran	Not reported - all over 65	Elderly home	CD-RISC	No intervention control	Acceptance and commitment therapy	
Harris, 2016	USA	43	Workplace (School)	FFMQ-Non Reactivity Sub-Scale, PANAS-PA	Wait list control	Community Approach to Learning Mindfully (CALM) program for educators	
Heintzelman, 2019	USA	45.36	University	SWLS, SPANE	Waitlist Control	Enduring Happiness and Continued Self-Enhancement (ENHANCE)	
Hendriks, 2020	Suriname, Caribbean	36.3	Workplace	MHC-SF, PANAS-PA	Waitlist Control	Multi-component positive psychology intervention	
Hilcove, 2021	USA	42.45	Workplace (Healthcare)	SF-36 Vitality	No intervention control	Group yoga sessions	
Hirshberg, 2018	USA	19.29	University	PANAS-PA	Gratitude practice	Breath awareness	Loving-kindness meditation
Hirshberg, 2022	USA	42.5	Online (App)	WHO-5, SCS-SF	Waitlist Control	Healthy Minds Program	

Ho, 2022	Hong Kong, China	34.76	University	SWLS, Chinese Affect Scale (CAS-PA)	Waitlist Control	Nature Contact	
Hollingsworth, 2022	USA	44.6	Online	GQ-6, Adult Hope Scale	Inactive Control	Tiny habits for gratitude	
Hu, 2017	China	53.38	Community	SWLS	Waitlist Control	Exercise intervention: health education and walking	
Huang, 2021	China	20.55	University/College	SCS	Waitlist Control	Self-compassion Intervention	
Hunsinger, 2018	USA	43.98	Workplace (Law enforcement)	CD-RISC, SCS-SF	No intervention control	Mindfulness-based resilience training (MBRT)	
Hunt, 2018	USA	19.3	University	PANAS-PA	No intervention control	Mindfulness Training	Yoga
Hwang, 2019	Austrailia	42.34	Workplace (School)	FFMQ-SF, SCS-SF	Waitlist Control	Reconnected - A mindfulness-based training program	
Ivtzan, 2016	UK, USA, Canada, Austrailia	40.82	Online	The Pemberton Happiness Index (PHI), GQ6	Waitlist Control	The Positive Mindfulness Program	
Ivtzan, 2018	Hong Kong and UK	31.5	Online	FMI	Waitlist Control	The Mindfulness Based Flourishing program	
Janssen, 2022	The Netherlands	49	Workplace (School)	FFMQ	Waitlist Control	Mindfulness-Based Stress Reduction (MBSR)	

Janzarik, 2022	Germany	46.95	Workplace (Healthcare)	SWLS, WHO-5	Waitlist Control	Psychodynamic and CBT based therapy group
Jarukasemthawee, 2019	Thailand	20.5	University	The Eudemonic Well-Being Scale, FMI	Waitlist Control	Insight-Based Mindfulness Program
Jazaieri, 2013	USA	43.33	Community	SCS	Waitlist Control	Compassion Cultivation Training
Jazaieri, 2014	USA	43.08	Community	SHS, Kentucky Inventory of Mindfulness Scale (KIMS)	Waitlist Control	Compassion cultivation training (CCT)
Jennings, 2019	USA	Median age reported: 40	Workplace (School)	FFMQ	Waitlist Control	CARE program
Jones, 2019	USA	18.97	University	FFMQ, Coping Flexibility Scale	Waitlist Control	Mindfulness Meditation Intervention
Josefsson, 2014	Sweden		Workplace	PWB-SF, FFMQ	No intervention	Mindfulness Meditation: Standard sitting
Juul, 2021	Denmark	26.35	University	WHO-5, BRS	Waitlist Control	Mindfulness-Based Stress Reduction (MBSR)
Kadian, 2022	India	19.31	University/College	Brief Resilient Coping Scale	Resilience self-help booklet group	Brief resilience intervention program

Kaemmerer, 2022	France	39.24	University	SCS	Waitlist Control	Mindfulness
Kam, 2022	USA	29.9	Online	PANAS-PA	Waitlist Control	Mindfulness Training - Headspace
Kamegaya, 2014	Japan	74.9	Community centre	The Satisfaction in Daily Life	Waitlist Control	Group Physical Activity Programme
Kang, 2022	China	36.96	Online	WHO-5, PANAS-PS	Waitlist Control	Short-term audio-based mindfulness
Karing, 2021	Germany	22.68	University	FFMQ	Waitlist Control	Mindfulness training
Kariyawasam, 2022	UK & Sri Lanka	Not reported	Online	WEMWBS	Wait list control	Compassionate Mind Training
Khazaee-Pool, 2015	Iran	71	Community	OHI	No intervention	Exercise intervention
Kimura, 2010	Japan	74	University	SF-36-Mental Health, SF-36 Vitality	Health education group control	Exercise intervention
Kloos, 2022	Netherlands	53.2	Online (App)	MHC-SF	Wait-list control	Gratitude Intervention App
Ko, 2018	USA	19.78	University	SCS	Wait-list control	Compassion Seminar
Kosugi, 2021	Japan	46.8	University	SWLS, FS	Wait-list control	MBCT
Krekel, 2021	UK	Not reported	Community	Santa Clara Brief Compassion Scale	Wait-list control	Exploring what matters course
Kuhlthau, 2020	USA	45	communtiy	Current Experience	Wait-list control	Mind body intervention

				Scale (CES), PANAS-PA		
Kwon, 2015	South Korea	71.35	Community	SF-8 TM - Mental Component Scale	No intervention	Wheel of Wellness counseling
LeBlanc, 2017	UK	36.68	University	SWLS	No intervention	Workshops focussed on emotion regulation, expressive writing, mindfulness, and self-talk and cue-controlled progressive muscle relaxation.
Lee, 2016	UK	33	Community	Adapted General Well-Being Index (AGWBI)	The control group received	Education and Walking Group
Lee, 2019	Taiwan	61	Community	CHI 20-item version	Walking Exercise	Walking exercise + positive psych coaching
Lee, 2021	China	71.55	Community	SWEMWBS, SCS	Waitlist Control	Mindfulness-based Stress Reduction
Li, 2001	USA	73.2	Community	SWLS, PANAS-PA	Waitlist Control	Exercise intervention : Tai Chi
Li, 2015	China	20.78	University	WHOQOL-BREF	Control - usual physical activity	Baduanjin Exercise -

Liu, 2020	China	29.26	Workplace (Airline)	SWLS, State Mindfulness Scale (SMS)	No intervention control	Loving kindness meditation
Liu, 2022 A	China	38.83	Workplace	PANAS-PA	Waitlist Control	Loving-Kindness Meditation
Liu, 2022 b	China	25.26	University	SWLS, SPANE	Health education	Moderate physical activity
Loewenthal, 2021	USA	29.23	Workplace (Hospital)	FFMQ, RS-14	Wait list control	Yoga
Lorenz, 2022	Germany	23.95	University	BRS, PANAS-PA	Wait list control	Self guided positive psychology
Ly, 2017	Sweden	23.25	Online	SWLS, FS	Wait list control	Chatbot Intervention: Positive Psychology
Maatouk, 2018	Germany	52.11	Workplace (Hospital)	WHOQOL-BREF	Wait list control	Intervention: Successful Ageing
Mackenzie, 2006	Canada	46.7	Workplace (Hospital)	SWLS	Wait list control	Shortened Version of MBSR
Mak, 2015	China	22.8	University	WHO-5, SWLS	Waitlist Control	Health Action Process Approach
Manotas, 2014	Colombia	39.05	Workplace (Hospital)	FFMQ	No intervention	Mindfulness-based Stress Reduction (MBSR)
Mascaro, 2021	USA	Not reported	Workplace	CD-RISC	Waitlist Control	Compassion-Centered Spiritual Health
Matos, 2022	Portugal	51.35	Workplace (School)	Types of Positive Affect Scale - Safe PA,	Waitlist Control	The Compassionate Mind Training

				Compassionate Engagement and Action Scales		
Matvienko-Sikar, 2017	Ireland	33.87	Communtiy	SWLS	No intervention	Gratitude & Mindfulness Intervention
Maurer, 2020	Germany	24.19	University	PANAS-PA	No intervention - usual lifestyle	Endurance Exercise Intervention
McConachie, 2014	UK	Not reported	Workplace	WEMWBS	Waitlist Control	Acceptance and mindfulness workshop
McGonagle, 2020	USA	42.62	Workplace (Healthcare)	24-item Psychological Capital Questionnaire	Waitlist Control	Positive psychology coaching
Miller, 2015	UK	36.46	University	SWLS, OHQ	Wellbeing articles	Gratitude
Mirabito, 2022	USA	21.39	Online	PWB, PANAS	Waitlist Control	Mindfulness Intervention
Montaner, 2022	Spain	41.1	Workplace (Hospital)	SWLS	Waitlist Control	Acceptance and Commitment Therapy
Morledge, 2013	USA	Not reported	Online	PWB-Self Acceptance Sub-Scale, Subjective Vitality Scale	Waitlist Control	Internet-Based Stress Management Program
Mountain, 2017	UK	72.1	Community	SF-36 Mental Health, BRS	No intervention	Lifestyle Matters Intervention

Muller, 2016	Germany	39.9	Workplace (Hospital)	WHO-5	Waitlist Control	Intervention: Selection, optimisation, and compensation (SOC)	
Murray, 2021	USA	40.62	Community	WHO-5	Waitlist Control	Education and physical activity	
Myers, 2017	USA	41.76	Workplace (University)	I COPE	Control - wellbeing info website access	Online wellness intervention	
Nadler, 2020	USA	Not reported	Workplace	FFMQ, PANAS-PA	Waitlist Control	Online Workplace-Based Mindfulness Training:	
Nedeljkovic, 2012	Switzerla nd	35.48	Unreported	Self-Compassion Scale (SCS)	Waitlist Control	Taiji classes	
Neff, 2013	USA	50	Communtiy	SCS, SWLS	Waitlist Control	Mindful Self compassion	
Neumeier, 2017	Austraili a	41.16	Community	SHS & PANAS	Waitlist Control	Self administered PERMA program	Gratitude
Ng, 2016	Singapor e	67.01	Community	PWB	Waitlist Control	Horticultural Therapy	
Nguyen, 2018	Taiwan	22	University	The 4 items assessing user happiness were adapted from Lyubomirsky and Lepper (1999)	No intervention control	Exergames	
Nielsen, 2021	Canada	46	Workplace	BRS, PANAS-PA	Waitlist Control	The Anxious Lawyer: Book	

Noradechanunt, 2017	Australia	66.66	Communities	SF-36 Mental Health, Vitality	Control Group - received	Thai Yoga	
Norman, 2010	Australia	29.7	Hospital	PABS	Control: Physical education only	Intervention: Exercise and Education	
O'Leary, 2015	Ireland	28.35	Home/Online	4-item Subjective Happiness Scale	Waitlist Control	Gratitude Intervention	Mindfulness Intervention
Odou, 2013	Australia	34	Online	WEMWBS, PANAS-PA	No intervention control	Three Good Things	
Oken, 2006	USA	72.1	University	SF-36 Mental Composite	Waitlist Control	Hatha Yoga Class	Walking Exercise
Oliver, 2018	United Kingdom	Not reported	Workplace	SWLS, FS	Wait-List Control	Online Goal-Setting and Planning	
Pacanowski, 2020	USA	19.63	University/College	PANAS-PA, FFMQ	Control Group	Yoga Group	
Page, 2013	Australia	39.7	Workplace	SWLS & PANAS	Inactive control group	Working for Wellness Program	
Pan, 2019	Taiwan	32.8	Hospital	FFMQ	Education only control	Mindfulness-based childbirth and parenting	
Pang, 2019	Switzerland	44.2	Workplace	WHO-5	Waitlist Control	Mindfulness-based strengths	Mindfulness-based stress reduction
Passmore, 2022	Canada	46.75	Community	SWLS, PANAS-PA	Waitlist Control	Nature intervention	

Payne, 2020	Australia	31.2	University	SWLS	Waitlist Control	Nature Intervention group
Perez-Blasco, 2016	Spain	63.56	Community	BRCS	No intervention control	Mindfulness
Proyer, 2016	Switzerland	45.66	University	AHI, Orientations to Happiness Questionnaire	Waitlist Control	Positive Psychology
Rababah, 2022	Jordan	20.1	University	FFMQ	Wait list control	Modified version of motivational interviewing
Read, 2016	Australia	52.8	Community	WEMWBS	Waitlist Control	Single-session Behavioural Activation
Recabarren, 2019	Switzerland	21.34	University	WHOQOL-BREF, SCS-SF	Control	Stress Prevention Intervention
Rich, 2021	UK	Not reported	University	FFMQ-SF	Waitlist Control	Headspace mindfulness-based meditation training
Rodríguez-Jiménez, 2022	Spain	43.3	Workplace (University)	SWLS, WHO-5	Waitlist Control	Hatha Yoga
Roeser, 2013	Canada and USA	46.9	Workplace (School)	FFMQ	Waitlist Control	Mindfulness Training Program
Santos, 2022	Portugal	44.43	Workplace (Care Home)	SCS, CS	Control	Compassionate Mind Training program
Schulte-Frankenfeld, 2022	The Netherlands	24.75	University	Questionnaire for the Assessment of Happiness, FMI-14	Waitlist Control	Balloon Meditation App

Seear, 2013	Australia	33.15	Online	WEMWBS, PANAS-PA	No-activity control group	Three good things	
Senf, 2013	Malaysia	20.3	University	Steen Happiness Index	Control Group	Strength-based intervention	
Seppälä, 2020	USA	19.67	University	PWB - Purpose Scale, SWLS	Inactive Control	SKY Campus Happiness	Mindfulness-Based Stress Reduction
Shapiro, 2011	USA	18.73	University	SWLS & PANAS, SCS	Waitlist Control	Mindfulness-based Stress Reduction (MBSR):	
Sommers-Spijkerman, 2018	The Netherlands	52.87	Online	MHC-SF, PANAS-PA	Waitlist Control	Compassion-Focused Therapy	
Sood, 2014	USA	47.75	Workplace	CD-RISC	Waitlist Control	Stress Management and Resiliency	
Spence, 2007	Australia	38.59	Community	SWLS, PWB-Purpose	Waitlist control group	Professional Coaching	
Spence, 2019	Australia	42.47	University	PWB, SWLS	No intervention	Mindfulness meditation	
Steinhardt, 2008	USA	22.7	University	CD-RISC, PANAS-PA	Waitlist Control	Resilience intervention	
Strauss, 2021	UK	43.93	Workplace (Healthcare)	SWEMWBS, FFMQ-SF	Waitlist Control Group	Mindfulness + CBT Intervention	
Sturm, 2022	USA	Median age: 75	Community	SWLS	Active Control - Walking	Awe Walk	
Taylor, 2014	UK	28.61	University	SWLS, FFMQ	wait list control	Mindfulness book self help	

Taylor, 2022	UK	40.53	Workplace (Healthcare)	SWEMWBS, SCS-SF	Psychoeducation platform	Headspace
Terblanche, 2022	UK	22	University (Business School)	WEMWBS, BRS	Control group	AI coach (Vici)
Timlin, 2017	Northern Ireland, UK	28.19	Community Centre	PANAS-PA	Waitlist Control	Dru Yoga Programme
Trombka, 2021	Brazil	42.26	Workplace (Law enforcement)	WHOQOL-BREF	Waitlist Control	Mindfulness-based health promotion (MBHP)
Tsang, 2021	China	39.54	Workplace (School)	SWLS, PANAS-PA	Waitlist Control	A school-based mindfulness training
Van Roie, 2017	Belgium	82.12	Community	Marcoen Scale	No intervention	Structured ergometer-cycling training program
vanDijk, 2017	The Netherlands	23.5	University	MHC-SF, Life Satisfaction Questionnaire (LiSat-9)	No intervention	Mindfulness-Based Stress Reduction
vanEmmerik, 2018	The Netherlands	44.7	Online (App)	WHOQOL-BREF, FFMQ	Waitlist Control	The VGZ Mindfulness Coach
Verweij, 2018	The Netherlands	31.2	University	SCS-SF, MHC-SF	Waitlist control	MBSR Intervention
Viskovich, 2020	Australia	26.85	University	MHC-SF, SWLS	Waitlist Control	Web based ACT intervention
Wadhen, 2021	UK	42.45	Workplace	WEMWBS, Coping Self-	Waitlist Control	Yoga

				Efficacy Scale (CSES-26)			
Waelde, 2017	USA	59.6	Workplace	SWLS	Psychoeducation and telephone support	Inner Resources for Stress	
Wang, 2020	Hungary	24.96	University	SWLS	Control - maintain a sedentary lifestyle	Walking intervention	
Welford, 2022	Sweden	72.5	Community	SWLS	Waitlist Control	Yoga	Aerobic Exercise - participants
Weytens, 2014	Belgium	22.29	University	SWLS, SHS	Waitlist Control	Positive Emotion Regulation (PER)	Loving-Kindness Meditation Program
Wilke, 2022	Argentina, Austria, Brazil, Chile, Germany, Italy, Ireland, South Africa and Spain	32.8	Home	WHO-5	Inactive control group	Tele-exercise: moderate intensity livestreamed	
Wingert, 2022	USA	18.95	University	PP	Waitlist Control	Mindfulness-based strengths practice	

Xiong, 2022	USA	25.58	University	PP, FFMQ	Waitlist Control Group	Mindfulness-based well-being group
Xu, 2021	Australia	Not reported	Workplace (Hospital)	WEMWBS	Waitlist Control	Headspace App
Yang, 2018	USA	25.11	University	General Well-Being Schedule (GWBS), FFMQ	Waitlist Control	Mindfulness Mobile Phone Application
Yıldırım, 2022	Turkey	28.33	University Hospital	PWB	Relaxation control group	Mindfulness-based breathing and music
Zeng, 2019	China	27.55	University	SWLS, Appreciative Joy Scale (AJS)	Waitlist Control	Appreciative Joy Meditation Intervention
Zhang, 2019	China	22.5	University	FMI, PANAS-PA	Waitlist Control	Mindfulness Training and Homework
Zheng, 2022	China	27.29	University and Community	SWLS	Waitlist Control	Mindfulness-based positive Intervention
Zilcha-Mano, 2016	Israel	28.71	Online	SWLS, PANAS-PA	No intervention	Mindfulness Intervention

Appendix D. References of included studies in NMA

Note: this Appendix Refers Chapter 4 A Systematic Review and Network Meta-Analysis Comparing Wellbeing-Focused Interventions

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Appendix E. Cochrane risk of bias for individual studies using RoB 2

Note: this Appendix Refers Chapter 4 A Systematic Review and Network Meta-Analysis Comparing Wellbeing-Focused Interventions

Study Name	1.0 Algorithm Result	2.0 Algorithm result	3.0 Algorithm Result	4.0 Algortithim Result	5.0 Algorithim Result	Overall
Aeschbach 2022	Low Risk	Low Risk	Low Risk	Low Risk	Some Concerns	Some Concerns
Ahmad 2020	Low Risk	Low Risk	Low Risk	Low Risk	Some Concerns	Some Concerns
Aikens 2014	Low Risk	Some Concerns	Low Risk	Low Risk	Some Concerns	Some Concerns
Ajilchi 2019	Low Risk	Some Concerns	Low Risk	Low Risk	Some Concerns	Some Concerns
Alexander 2015	Some Concerns	Some Concerns	Low Risk	Low Risk	Some Concerns	High Risk
Allexandre 2016	Low Risk	Some Concerns	Low Risk	Low Risk	Low Risk	Some Concerns
Amutio 2015	Low Risk	Some Concerns	Low Risk	Low Risk	Some Concerns	Some Concerns
Ardi 2021	Low Risk	Some Concerns	Low Risk	Low Risk	Some Concerns	Some Concerns
Asuero 2014	Low Risk	Some Concerns	Low Risk	Low Risk	Some Concerns	Some Concerns
Baker 2008	Low Risk	Some Concerns	Low Risk	Low Risk	Some Concerns	Some Concerns
Basso 2022	Low Risk	Some Concerns	Low Risk	Low Risk	Some Concerns	Some Concerns
Bita 2021	Low Risk	Some Concerns	Low Risk	Low Risk	Some Concerns	Some Concerns
Blasche 2013	Low Risk	High Risk	Low Risk	Low Risk	Some Concerns	High Risk
Bohlmeijer 2021	Low Risk	High Risk	Low Risk	Low Risk	Low Risk	High Risk
Bonde 2022	Low Risk	Some Concerns	Low Risk	Low Risk	Some Concerns	Some Concerns
Borchardt 2018	Low Risk	High Risk	Low Risk	Low Risk	Some Concerns	High Risk
Bowden 2011	Low Risk	High Risk	High Risk	Low Risk	Some Concerns	High Risk
Brinkmann 2020	Low Risk	High Risk	Some Concerns	Low Risk	Some Concerns	High Risk
Brito-Pons 2018	Low Risk	Some Concerns	Low Risk	Low Risk	Some Concerns	Some Concerns
Cerna 2020	Low Risk	High Risk	High Risk	Low Risk	Some Concerns	High Risk

Study Name	1.0 Algorithm Result	2.0 Algorithm result	3.0 Algorithm Result	4.0 Algortithim Result	5.0 Algorithim Result	Overall
Champion et al 2018	High Risk	High Risk	High Risk	Low Risk	Some Concerns	High Risk
Chesak 2015	Some Concerns	High Risk	High Risk	Low Risk	Some Concerns	High Risk
Christopher 2018	Some Concerns	High Risk	Low Risk	Low Risk	Some Concerns	High Risk
Connolly 2020	Low Risk	Some Concerns	Low Risk	Low Risk	Some Concerns	Some Concerns
Crain 2017	Some Concerns	High Risk	High Risk	Low Risk	Some Concerns	High Risk
Cruz-Ferreira 2011	Low Risk	High Risk	Low Risk	Low Risk	Some Concerns	High Risk
Cruz-Ferreira 2015	Low Risk	Some Concerns	Low Risk	Low Risk	Some Concerns	Some Concerns
Danitz 2014	Some Concerns	Some Concerns	High Risk	Low Risk	Some Concerns	High Risk
deVibe 2018	Some Concerns	Low Risk	Low Risk	Low Risk	Some Concerns	Some Concerns
Devillers-Réolon 2022	Some Concerns	High Risk	High Risk	Low Risk	Some Concerns	High Risk
Díaz-Benito 2022	Low Risk	Low Risk	Low Risk	Low Risk	Some Concerns	Some Concerns
Duan 2019	Some Concerns	High Risk	Low Risk	Low Risk	Some Concerns	High Risk
Dvořáková 2017	Some Concerns	Some Concerns	Low Risk	Low Risk	Some Concerns	High Risk
Economides et al 2018	Some Concerns	Some Concerns	Low Risk	Low Risk	Some Concerns	High Risk
Edney 2020	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk
Edwards 2019	Some Concerns	High Risk	High Risk	Low Risk	Some Concerns	High Risk
Engel 2019	Some Concerns	Some Concerns	Low Risk	Low Risk	Some Concerns	High Risk
EnriqueRoig 2020	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk
Erogul 2014	Low Risk	Some Concerns	Low Risk	Low Risk	Some Concerns	Some Concerns
Fernández-Portero 2021	Low Risk	Some Concerns	Low Risk	Low Risk	Some Concerns	Some Concerns
Fisher 2004	Some Concerns	Some Concerns	Low Risk	Low Risk	Some Concerns	High Risk
Flook 2013	Some Concerns	High Risk	High Risk	Low Risk	Some Concerns	High Risk
Galante 2016	Low Risk	High Risk	High Risk	Low Risk	Some Concerns	High Risk
Gerodimos 2022	Low Risk	Some Concerns	Low Risk	Low Risk	Some Concerns	Some Concerns

Study Name	1.0 Algorithm Result	2.0 Algorithm result	3.0 Algorithm Result	4.0 Algortithim Result	5.0 Algorithim Result	Overall
Goldberg et al 2020	Low Risk	Low Risk	Low Risk	Low Risk	Some Concerns	Some Concerns
Green 2006	Some Concerns	Some Concerns	Low Risk	Low Risk	Some Concerns	High Risk
Green 2022	Some Concerns	Some Concerns	Low Risk	Low Risk	Some Concerns	High Risk
Gregoire 2017	Low Risk	Some Concerns	Low Risk	Low Risk	Some Concerns	Some Concerns
Hajatnia 2021	Some Concerns	High Risk	High Risk	Low Risk	Some Concerns	High Risk
Harris 2016	Low Risk	Some Concerns	Low Risk	Low Risk	Some Concerns	Some Concerns
Heintzelman 2019	Some Concerns	Low Risk	Low Risk	Low Risk	Some Concerns	Some Concerns
Hendriks 2020	Low Risk	Some Concerns	Low Risk	Low Risk	Some Concerns	Some Concerns
Hilcove 2021	Low Risk	Some Concerns	Low Risk	Low Risk	Some Concerns	Some Concerns
Hirshberg 2018	Low Risk	Some Concerns	Low Risk	Low Risk	Some Concerns	Some Concerns
Hirshberg et al 2022	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk
Ho 2022	Low Risk	Low Risk	Low Risk	Low Risk	Some Concerns	Some Concerns
Hollingsworth 2022	Some Concerns	High Risk	High Risk	Low Risk	Some Concerns	High Risk
Howells et al 2016	Low Risk	High Risk	Low Risk	Low Risk	Low Risk	High Risk
Hu 2017	Low Risk	High Risk	Some Concerns	Some Concerns	Some Concerns	High Risk
Huang 2021	Low Risk	Some Concerns	Low Risk	Some Concerns	Some Concerns	High Risk
Hunsinger 2018	Low Risk	High Risk	Some Concerns	Some Concerns	Some Concerns	High Risk
Hunt 2018	Low Risk	High Risk	Some Concerns	Some Concerns	Some Concerns	High Risk
Hwang 2019	Low Risk	High Risk	Some Concerns	Some Concerns	Some Concerns	High Risk
Ivtzan 2016	Low Risk	High Risk	Some Concerns	Some Concerns	Some Concerns	High Risk
Ivtzan 2018	Low Risk	Low Risk	Low Risk	Some Concerns	Some Concerns	Some Concerns
Janssen 2022	Low Risk	High Risk	Some Concerns	Some Concerns	Some Concerns	High Risk
Janzarik 2022	Low Risk	High Risk	Some Concerns	Some Concerns	Some Concerns	High Risk
Jarukasemthawee 2019	Some Concerns	High Risk	Some Concerns	Some Concerns	Some Concerns	High Risk

Study Name	1.0 Algorithm Result	2.0 Algorithm result	3.0 Algorithm Result	4.0 Algortithim Result	5.0 Algorithim Result	Overall
Jazaieri 2013	Low Risk	High Risk	Some Concerns	Some Concerns	Some Concerns	High Risk
Jazaieri 2014	Low Risk	High Risk	Low Risk	Some Concerns	Some Concerns	High Risk
Jennings 2019	Low Risk	High Risk	Low Risk	Some Concerns	Some Concerns	High Risk
Jones 2019	Some Concerns	High Risk	Low Risk	Some Concerns	Some Concerns	High Risk
Josefsson 2014	Low Risk	High Risk	Some Concerns	Some Concerns	Some Concerns	High Risk
Juul 2021	Low Risk	Low Risk	Low Risk	Some Concerns	Low Risk	Some Concerns
Kadian 2022	Low Risk	Low Risk	Low Risk	Some Concerns	Low Risk	Some Concerns
Kaemmerer 2022	Low Risk	High Risk	Some Concerns	Some Concerns	Some Concerns	High Risk
Kam 2022	Low Risk	Some Concerns	Low Risk	Some Concerns	Some Concerns	High Risk
Kamegaya 2014	Low Risk	High Risk	Some Concerns	Some Concerns	Some Concerns	High Risk
Kang 2022	Low Risk	Some Concerns	Low Risk	Some Concerns	Low Risk	Some Concerns
Karing 2021	Low Risk	Low Risk	Low Risk	Some Concerns	Some Concerns	Some Concerns
Kariyawasam 2022	Some Concerns	Low Risk	Low Risk	Some Concerns	Some Concerns	High Risk
Khazaee-Pool 2015	Low Risk	Some Concerns	Low Risk	Some Concerns	Some Concerns	High Risk
Kimura 2010	Low Risk	High Risk	Some Concerns	Some Concerns	Some Concerns	High Risk
Kloos 2022	High Risk	High Risk	Some Concerns	Some Concerns	Low Risk	High Risk
Ko 2018	Low Risk	High Risk	Some Concerns	Some Concerns	Some Concerns	High Risk
Kosugi 2021	Low Risk	Low Risk	Low Risk	Some Concerns	Low Risk	Some Concerns
Krekel 2021	Low Risk	Some Concerns	Low Risk	Some Concerns	Some Concerns	High Risk
Kuhlthau 2020	Low Risk	High Risk	Some Concerns	Some Concerns	Some Concerns	High Risk
Kwon 2015	Some Concerns	Some Concerns	Low Risk	Some Concerns	Some Concerns	High Risk
LeBlanc 2017	Some Concerns	Low Risk	Low Risk	Some Concerns	Some Concerns	High Risk
Lee 2016	Low Risk	High Risk	Some Concerns	Some Concerns	Some Concerns	High Risk

Study Name	1.0 Algorithm Result	2.0 Algorithm result	3.0 Algorithm Result	4.0 Algortithim Result	5.0 Algorithim Result	Overall
Lee 2019	Low Risk	Low Risk	Low Risk	Some Concerns	Low Risk	Some Concerns
Lee 2021	Low Risk	Low Risk	Low Risk	Some Concerns	Some Concerns	Some Concerns
Li 2001	Low Risk	High Risk	Low Risk	Some Concerns	Some Concerns	High Risk
Li 2015	Low Risk	Low Risk	Low Risk	Some Concerns	Low Risk	Some Concerns
Liu 2020	Low Risk	Some Concerns	Low Risk	Some Concerns	Some Concerns	High Risk
Liu 2022 A (LK)	Low Risk	High Risk	Some Concerns	Some Concerns	Some Concerns	High Risk
Liu 2022 B (Exercise)	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk
Loewenthal 2021	Low Risk	High Risk	Some Concerns	Some Concerns	Low Risk	High Risk
Lorenz 2022	Low Risk	High Risk	Low Risk	Some Concerns	Some Concerns	High Risk
Ly 2017	Low Risk	Low Risk	Low Risk	Some Concerns	Some Concerns	Some Concerns
Maatouk 2018	Low Risk	Low Risk	Low Risk	Some Concerns	Low Risk	Some Concerns
Mackenzie 2006	Some Concerns	Some Concerns	Low Risk	Some Concerns	Some Concerns	High Risk
Mak 2015	Low Risk	Low Risk	Low Risk	Some Concerns	Low Risk	Some Concerns
Manotas 2014	Low Risk	High Risk	Some Concerns	Some Concerns	Some Concerns	High Risk
Mascaro 2021	Low Risk	High Risk	Some Concerns	Some Concerns	Low Risk	High Risk
Matos 2022	Some Concerns	High Risk	Some Concerns	Some Concerns	Low Risk	High Risk
Matvienko-Sikar 2017	Low Risk	High Risk	Some Concerns	Some Concerns	Some Concerns	High Risk
Maurer 2020	Low Risk	High Risk	Some Concerns	Some Concerns	Some Concerns	High Risk
McConachie 2014	Low Risk	High Risk	Low Risk	Some Concerns	Some Concerns	High Risk
McGonagle 2020	Some Concerns	High Risk	Low Risk	Some Concerns	Some Concerns	High Risk
Miller 2015	Low Risk	High Risk	Some Concerns	Some Concerns	Some Concerns	High Risk
Mirabito 2022	Low Risk	High Risk	Some Concerns	Some Concerns	Some Concerns	High Risk
Montaner 2022	Low Risk	Low Risk	Low Risk	Some Concerns	Some Concerns	Some Concerns

Study Name	1.0 Algorithm Result	2.0 Algorithm result	3.0 Algorithm Result	4.0 Algortithim Result	5.0 Algorithim Result	Overall
Morledge 2013	Low Risk	High Risk	Some Concerns	Some Concerns	Low Risk	High Risk
Mountain 2017	Low Risk	Low Risk	Low Risk	Some Concerns	Low Risk	Some Concerns
Muller 2016	Low Risk	Low Risk	Low Risk	Some Concerns	Some Concerns	Some Concerns
Murray 2021	Low Risk	Some Concerns	Low Risk	Some Concerns	Some Concerns	High Risk
Myers 2017	Low Risk	Low Risk	Low Risk	Low Risk	Some Concerns	Some Concerns
Nadler 2020	Low Risk	High Risk	Some Concerns	Some Concerns	Some Concerns	High Risk
Nedeljkovic 2012	Some Concerns	High Risk	Some Concerns	Some Concerns	Some Concerns	High Risk
Neff 2013	Low Risk	High Risk	Some Concerns	Some Concerns	Some Concerns	High Risk
Neumeier 2017	Low Risk	High Risk	Some Concerns	Some Concerns	Some Concerns	High Risk
Ng 2016	Low Risk	Some Concerns	Low Risk	Some Concerns	Low Risk	Some Concerns
Nguyen 2018	Low Risk	Some Concerns	Low Risk	Some Concerns	Some Concerns	High Risk
Nielsen 2021	Low Risk	High Risk	Some Concerns	Some Concerns	Low Risk	High Risk
Noradechanunt 2017	Low Risk	Low Risk	Low Risk	Low Risk	Some Concerns	Some Concerns
Norman 2010	Low Risk	Some Concerns	Low Risk	Some Concerns	Some Concerns	High Risk
O'Leary 2015	Low Risk	Some Concerns	Low Risk	Some Concerns	Low	High Risk
Oken 2006	Low Risk	Some Concerns	Low Risk	Low Risk	Low	Some Concerns
Oliver, 2018	Low Risk	Low Risk	Low Risk	Some Concerns	Low	Some Concerns
Pacanowski 2020	Low Risk	Low Risk	Low Risk	Some Concerns	Some Concerns	High Risk
Page 2013	Low Risk	Some Concerns	Low Risk	Some Concerns	Some Concerns	High Risk
Pan 2019	Low Risk	Some Concerns	Low Risk	Low Risk	Some Concerns	High Risk
Pang 2019	Low Risk	Low Risk	Low Risk	Some Concerns	Some Concerns	High Risk
Passmore 2022	Low Risk	Some Concerns	Low Risk	Low Risk	High Risk	High Risk
Payne 2020	Low Risk	Some Concerns	Some Concerns	Some Concerns	Some Concerns	High Risk

Study Name	1.0 Algorithm Result	2.0 Algorithm result	3.0 Algorithm Result	4.0 Algortithim Result	5.0 Algorithim Result	Overall
Perez-Blasco 2016	Low Risk	Some Concerns	Low Risk	Some Concerns	Some Concerns	High Risk
Proyer 2016	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk
Rababah 2022	Low Risk	Some Concerns	Low Risk	Some Concerns	Some Concerns	High Risk
Read 2016	Some Concerns	Some Concerns	Low Risk	Some Concerns	Low Risk	High Risk
Recabarren 2019	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk
Rich 2021	Low Risk	Some Concerns	Low Risk	Some Concerns	Low Risk	High Risk
Rodriguez-Jimnez 2022	Low Risk	Some Concerns	Low Risk	Low Risk	Low Risk	Some Concerns
Roeser 2013	Low Risk	Some Concerns	Low Risk	High Risk	High Risk	High Risk
Santos 2022	Low Risk	Some Concerns	Low Risk	Some Concerns	Some Concerns	High Risk
Schulte-Frankenfeld 2022	Low Risk	Some Concerns	Low Risk	Low Risk	Low Risk	Some Concerns
Seear 2013	Low Risk	Some Concerns	Some Concerns	Some Concerns	Some Concerns	High Risk
Senf 2013	Low Risk	Some Concerns	Low Risk	Some Concerns	High Risk	High Risk
Seppälä, 2020	Low Risk	Some Concerns	Low Risk	Low Risk	Low Risk	Some Concerns
Shapiro 2011	Low Risk	Some Concerns	Low Risk	Low Risk	Low Risk	Some Concerns
Sommers-Spijkerman 2018	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk
Sood 2014	Low Risk	Some Concerns	Low Risk	Some Concerns	High Risk	High Risk
Spence 2007	Low Risk	Some Concerns	Low Risk	Some Concerns	Some Concerns	High Risk
Spence 2019	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk
Steinhardt 2008	Low Risk	Some Concerns	Low Risk	Some Concerns	Some Concerns	High Risk
Strauss 2021	Low Risk	Some Concerns	Low Risk	Low Risk	Low Risk	Some Concerns
Sturm 2022	Low Risk	Some Concerns	Low Risk	Some Concerns	Low Risk	High Risk
Taylor 2014	Low Risk	Low Risk	Low Risk	Some Concerns	Low Risk	Some Concerns
Taylor 2022	Low Risk	Some Concerns	Low Risk	Some Concerns	Low Risk	Some Concerns
Terblanche 2022	Low Risk	Some Concerns	Low Risk	High Risk	Low Risk	High Risk

Study Name	1.0 Algorithm Result	2.0 Algorithm result	3.0 Algorithm Result	4.0 Algortithim Result	5.0 Algorithim Result	Overall
Timlin 2017	Low Risk	Some Concerns	Low Risk	Some Concerns	Low Risk	High Risk
Trombka 2021	Low Risk	Some Concerns	Low Risk	Low Risk	Low Risk	Some Concerns
Tsang 2021	Low Risk	Some Concerns	Low Risk	Low Risk	Low Risk	Some Concerns
Van Roie 2017	Low Risk	Some Concerns	Low Risk	Some Concerns	Low Risk	High Risk
vanDijk 2017	Low Risk	Low Risk	Low Risk	Some Concerns	Low Risk	Some Concerns
vanEmmerik 2018	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk
Verweij 2018	Low Risk	Some Concerns	Low Risk	Some Concerns	Low Risk	High Risk
Viskovich 2020	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk
Wadhen 2021	Low Risk	Some Concerns	Low Risk	Some Concerns	Low Risk	High Risk
Waelde 2017	Low Risk	Low Risk	Low Risk	Some Concerns	Some Concerns	High Risk
Wang 2020	Low Risk	Some Concerns	Low Risk	Some Concerns	Low Risk	High Risk
Welford 2022	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk
Weytens 2014	Low Risk	Some Concerns	Low Risk	Some Concerns	Some Concerns	High Risk
Wilke 2022	Low Risk	Some Concerns	Low Risk	Low Risk	Low Risk	Some Concerns
Wingert 2022	Low Risk	Some Concerns	Low Risk	Some Concerns	Low Risk	Some Concerns
Xiong 2022	High Risk	Some Concerns	Low Risk	Some Concerns	Low Risk	High Risk
Xu 2021	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk
Yang 2018	Low Risk	High Risk	Low Risk	Low Risk	Low Risk	High Risk
Yıldırım	Low Risk	Low Risk	Low Risk	Some Concerns	Some Concerns	High Risk
Zeng 2019	Low Risk	Low Risk	Low Risk	Some Concerns	Some Concerns	High Risk
Zhang 2019	Low Risk	Some Concerns	Low Risk	Some Concerns	Low Risk	High Risk
Zheng 2022	Low Risk	Low Risk	Low Risk	Some Concerns	Low Risk	Some Concerns
Zilcha-Mano 2016	Low Risk	Some Concerns	Low Risk	Some Concerns	Low Risk	High Risk

Appendix F. Node labels and brief descriptions

Note: this Appendix Refers Chapter 4 A Systematic Review and Network Meta-Analysis Comparing Wellbeing-Focused Interventions

Node Label	Intervention Brief Description
C	No Intervention Control - includes passive control (e.g., sit still), no intervention and wait list and TAU
MIND	Mindfulness-based approaches
EX	Exercise
COMB	Multi-Component Psychological intervention (e.g. combined CBT, PPI and Mindfulness). Clear psychological paradigms combined into one.
PPI	Single component PPI e.g. Three good things exercise, character strengths, best possible self or goal setting
ACT	Acceptance and commitment therapy
NAT	Nature Interventions
EXPSY	Physical movement with a psychological intervention (excludes yoga)
COMPAS	Compassion focused therapy
YOGA	Yoga
MPPI	Multi-Component PPI
MEMS	**Early Memories / Reminiscence**
PE	**Psychoeducation**
ACTIVE	**Active Control – includes listening to audiobook, writing down neutral events, daily activities, self-monitoring**
GOAL	**Goal Setting Interventions**
STRENGTH	**Character Strengths**
SOCIAL	**Social Groups e.g., discussions, peer support, sharing stressors**
HE	**Physical health or lifestyle Education**
CBT	**Cognitive Behavioural Therapy**
GRAT	**Gratitude**
BPS	**Best Possible Self**
EXNAT	**Exercise in nature**
WRITE	**Expressive Writing**

*Nodes highlighted in bold were adapted, merged, or removed (additional information in appendix 2.2.3

Appendix G. Initial analysis and node adaptions

Note: this Appendix Refers Chapter 4 A Systematic Review and Network Meta-Analysis Comparing Wellbeing-Focused Interventions

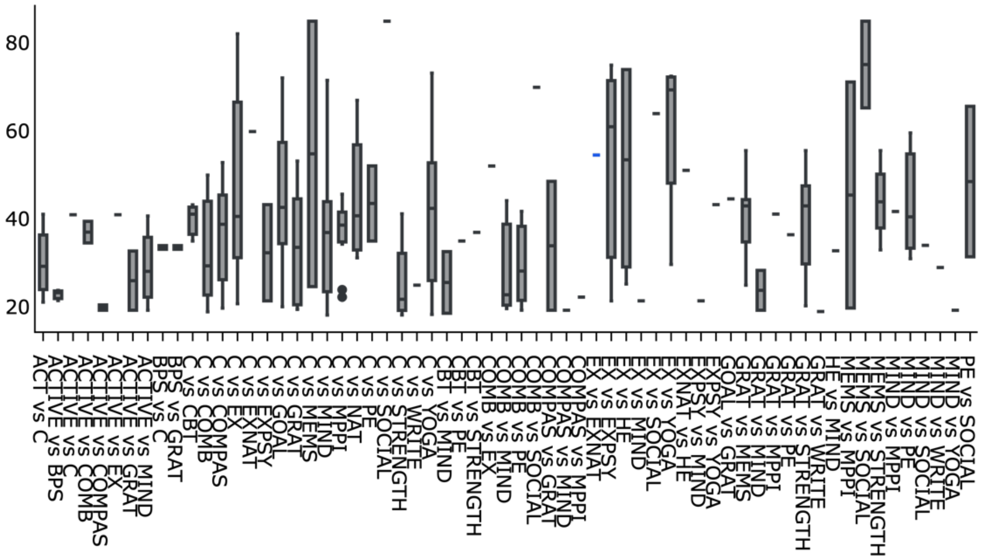


Figure G1 Initial assessment of transitivity prior to node exclusion (box plot distribution of potential effect modifier: age)

Note: Image created by Lowri Wilkie using NMA Studio

Table G1: Initial assessment of local inconsistency prior to node exclusion

Comparison	direct	indirect	p-value
ACTIVE vs BPS	0.9035	0.7412	0.6036
ACTIVE vs C	0.9299	1.3136	0.3457
ACTIVE vs COMB	0.6904	0.8857	0.4019
ACTIVE vs COMPAS	0.9048	0.7866	0.6684
ACTIVE vs EX	0.804	0.8674	0.8397
ACTIVE vs GRAT	0.8596	0.9145	0.8389
ACTIVE vs MIND	0.9366	0.7726	0.451
BPS vs C	1.8254	1.3295	0.4227
BPS vs GRAT	1.0764	1.0707	0.9897
C vs CBT	0.9645	0.6066	0.1017

C vs COMB	0.6687	0.6248	0.7032
C vs COMPAS	0.6283	0.721	0.5401
C vs EX	0.6882	0.6558	0.7871
C vs EXNAT	0.5073	0.55	0.8893
C vs EXPSY	0.4153	0.5112	0.6338
C vs GOAL	0.6499	1.4103	0.3032
C vs GRAT	0.7083	0.7197	0.9296
C vs MEMS	0.4954	0.9112	0.0978
C vs MIND	0.6518	0.6829	0.719
C vs MPPI	0.6202	0.3658	0.0609
C vs PE	0.9806	0.7337	0.3227
C vs SOCIAL	0.5654	1.275	0.0566
C vs STRENGTH	0.6887	0.7004	0.9488
C vs WRITE	0.8281	0.7536	0.8527
C vs YOGA	0.8778	0.5679	0.123
COMB vs EX	0.8611	1.0508	0.6108
COMB vs MIND	1.0917	0.9837	0.6737
COMB vs PE	1.112	1.2203	0.7257
COMB vs SOCIAL	1.172	1.7471	0.4396
COMPAS vs EX	1.0691	1.0501	0.9627
COMPAS vs GRAT	0.8407	1.1864	0.2504
COMPAS vs MIND	1.0735	1.0111	0.884
COMPAS vs MPPI	0.9218	0.8764	0.9056
EX vs EXNAT	0.3477	1.029	0.0827
EX vs EXPSY	0.7242	0.6295	0.7638
EX vs HE	1.2534	0.8036	0.2345
EX vs MIND	0.8762	0.9686	0.8243
EX vs SOCIAL	1.532	1.6143	0.9094
EX vs YOGA	0.9228	1.3254	0.1856
EXNAT vs HE	0.9518	2.2905	0.1037
EXPSY vs MIND	1.1796	1.4485	0.6836
EXPSY vs YOGA	1.9144	1.6634	0.816
GOAL vs GRAT	0.9354	1.0982	0.7132
GRAT vs MEMS	1.0826	1.4915	0.2196
GRAT vs MIND	0.8568	0.9267	0.8115
GRAT vs MPPI	1.1941	0.7519	0.2273
GRAT vs PE	1.0061	1.0982	0.8556
GRAT vs STRENGTH	0.9677	0.9822	0.9555
GRAT vs WRITE	1.4641	0.912	0.3409
HE vs MIND	0.8863	0.8578	0.9414
MEMS vs MPPI	0.2932	0.877	0.0019
MEMS vs SOCIAL	1.1998	1.3296	0.8179
MEMS vs STRENGTH	0.8738	0.7727	0.6787
MIND vs CBT	0.85	1.3873	0.1064
MIND vs MPPI	0.974	0.8572	0.7291
MIND vs PE	1.0899	1.2461	0.5816
MIND vs SOCIAL	17.6293	1.2886	0
MIND vs WRITE	0.8253	1.4418	0.2592
MIND vs YOGA	1.0371	1.2614	0.5939

PE vs CBT	1.1214	0.9584	0.7056
PE vs SOCIAL	1.2018	1.5616	0.4699
STRENGTH vs CBT	1.115	1.1093	0.9906

Appendix H. Rationale for node adaptions made based on transitivity and consistency assessments.

Note: this Appendix Refers Chapter 4 A Systematic Review and Network Meta-Analysis Comparing Wellbeing-Focused Interventions

SOCIAL

Multiple comparisons with the node SOCIAL (social identity building interventions) consistently had an average age of participants higher than other comparisons. For example, the comparison MEMS v SOCIAL had a median age of 75.5yrs old (see appendix 2.1.1). In addition, during SIDE splitting checks, two comparisons containing SOCIAL (MIND v SOCIAL, C v SOCIAL) were found to be inconsistent (direct and indirect estimates were statistically significantly different). Following a discussion concerning the clinical and statistical heterogeneity of the interventions classed as SOCIAL, the decision was made to exclude the intervention node SOCIAL from the NMA.

GRAT

This node originally contained the classic gratitude intervention 'three good things' in addition to savouring interventions and one 'gratitude visit' intervention. Upon discussion, it was decided that these intervention types were too distinct to be classed as one node. Since there were not enough arms to create a new node, gratitude visit (n = 1) and savouring intervention arms (n = 2) were removed from NMA.

MEMS

This node originally contained both reminiscence discission groups and early memories interventions. From clinical discussion, it was decided that discussion groups should be re-categorised as SOCIAL (a node which was later removed) and early memories intervention arms should be characterised in the ACTIVE control node.

MPPI

MPPI was re-defined to include interventions which explicitly contained positive psychology interventions such as acts of kindness, gratitude, mindfulness, resilience, goal setting, strengths building. Treatment arms which described themselves as positive psychology but whose content had been significantly adapted to a niche client group were removed (e.g. positive psychology for couples therapy or tailored to manage older aging). The aim of this re-definition was to reduce the heterogeneity of interventions defined as MPPI and ensure they made clinical sense to categorise as one node. 3 arms in total were removed.

CBT

Arms defined as CBT were checked to ensure they fitted a description of CBT. We found only n=2 arms truly fitted the definition of CBT; the others were more broadly related to challenging thought patterns but did not explicitly fit the CBT model. In addition, during discussion amongst the research group, concerns were raised that CBT is not a wellbeing focused psychological intervention, given that its emphasis is on reducing ill being (via eliminating unhelpful thoughts and behaviours) as opposed to building positive wellbeing. The decision was therefore made to remove the studies within the node CBT.

EXNAT

Note that EXNAT was inconsistent because of an error during data extraction. This node only contains direct evidence from one study (Li 2020). The wrong outcome measure had been extracted and so this was changed to the outcome PANAS (positive affect) which was a more standardised and frequently used measure across other studies. Upon correction, the consistency was no longer significant ($p = 0.843$).

PPI

Following discussion, the decision was made to merge the single PPIs to one node, given that their effect size estimates were similar, to increase the number of arms in a node and increase the confidence of the estimate. Therefore GOAL, GRAT, STRENGTH and BPS were all changed to PPI. Where one study compared two PPIs versus a control in multiple arms, the PPI which was most like the other interventions in the node were chosen for inclusion.

PE/HE

Psychoeducation and health education were merged to create one node called ED to increase the number of studies in the node.

ACTIVE/WRITE

It was decided that it did not make clinical sense to cluster the interventions in the active control condition together as they were heterogeneous in practice e.g. listening to an audiobook versus writing about your typical day, versus reflecting on memories, verses reflective journaling. When the active controls were further split into separate nodes, the n of arms became very small and had large confidence intervals. It was decided eventually to remove active controls from the overall NMA

Appendix I. Characteristics of Included Studies Across the Different Comparisons

Note: this Appendix Refers Chapter 4 A Systematic Review and Network Meta-Analysis Comparing Wellbeing-Focused Interventions

Comparison	Setting: Community (%)	Setting: Online (%)	Setting: University (%)	Setting: Workplace (%)	Intensity: Brief (%)	Intensity: Short (%)	Intensity: Medium (%)	Intensity: Long (%)	Delivery: In-person (%)	Delivery: Online platform (%)	Delivery: Instructions (%)	Delivery: Live video (%)	Format: Group (%)	Format: Individual (%)	Western (%)
COMB-MIND	0%	0%	50%	50%	0%	0%	100%	0%	100%	0%	0%	0%	100%	0%	100%
COMPAS-PPI	0%	0%	100%	0%	100%	0%	0%	0%	100%	0%	0%	0%	0%	100%	100%
C-ACT	0%	0%	60%	40%	20%	40%	20%	20%	80%	20%	0%	0%	80%	20%	80%
C-COMB	15%	15%	50%	20%	0%	20%	75%	6.7%	57.9%	36.8%	5.3%	0%	65%	35%	85%
C-COMPAS	26.7%	13.3%	26.7%	33.3%	0%	20%	60%	25%	78.6%	14.3%	0%	7.1%	71.4%	28.6%	64.3%
C-ED	0%	0%	0%	100%	0%	0%	100%	0%	100%	0%	0%	0%	100%	0%	100%
C-EX	45.5%	9.1%	36.4%	13.6%	5%	12.5%	16.7%	62.5%	81%	9.5%	4.8%	4.8%	68.2%	31.8%	77.3%
C-EXPSY	0%	0%	100%	0%	100%	0%	0%	0%	100%	0%	0%	0%	0%	100%	100%
C-MIND	5.4%	18%	45%	45%	11.7%	25%	63.3%	6.7%	66.2%	29.2%	3.1%	0%	68.8%	31.2%	82.8%
C-MPPI	25%	0%	37.5%	37.5%	12.5%	12.5%	62.5%	12.5%	75%	0%	0%	25%	62.5%	37.5%	87.5%
C-NAT	50%	0%	50%	0%	25%	50%	0%	25%	75%	0%	0%	25%	50%	50%	50%
C-PPI	33.3%	22.2%	27.8%	11.1%	30%	20%	20%	20%	47.1%	17.6%	0%	35.3%	33.3%	66.7%	72.2%
C-YOGA	27.3%	0%	27.3%	45.5%	0%	16.7%	41.7%	41.7%	91.7%	0%	8.3%	0%	100%	0%	100%
ED-COMB	0%	0%	33.3%	66.7%	0%	100%	0%	0%	66.7%	33.3%	0%	0%	66.7%	33.3%	66.7%

Comparison	Setting: Community (%)	Setting: Online (%)	Setting: University (%)	Setting: Workplace (%)	Intensity: Brief (%)	Intensity: Short (%)	Intensity: Medium (%)	Intensity: Long (%)	Delivery: In-person (%)	Delivery: Online platform (%)	Delivery: Instructions (%)	Delivery: Live video (%)	Format: Group (%)	Format: Individual (%)	Western (%)
ED-EX	60%	0%	40%	0%	0%	0%	0%	100%	100%	0%	0%	0%	80%	20%	60%
ED-MIND	20%	20%	0%	60%	40%	0%	40%	20%	60%	40%	0%	0%	60%	40%	75%
ED-PPI	0%	0%	100%	0%	0%	100%	0%	0%	0%	0%	0%	100%	0%	100%	100%
EX-COMB	100%	0%	0%	0%	0%	0%	0%	100%	100%	0%	0%	0%	100%	0%	100%
EX-COMPAS	0%	100%	0%	0%	0%	100%	0%	0%	0%	100%	0%	0%	0%	100%	100%
EX-EXPSY	66.7%	0%	33.3%	0%	33.3%	0%	33.3%	33.3%	66.7%	33.3%	0%	0%	0%	100%	66.7%
EX-MIND	0%	0%	100%	0%	100%	0%	0%	0%	100%	0%	0%	0%	0%	100%	100%
EX-YOGA	100%	0%	0%	0%	0%	0%	0%	100%	100%	0%	0%	0%	100%	0%	100%
MIND-COMPAS	0%	0%	100%	0%	100%	0%	0%	0%	100%	0%	0%	0%	0%	100%	100%
MIND-C	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
MIND-EXPSY	0%	0%	100%	0%	100%	0%	0%	0%	100%	0%	0%	0%	0%	100%	100%
MIND-PPI	0%	0%	100%	0%	100%	0%	0%	0%	100%	0%	0%	0%	0%	100%	100%
MIND-YOGA	0%	0%	100%	0%	0%	50%	50%	0%	100%	0%	0%	0%	100%	0%	100%
MPPI-COMPAS	0%	0%	100%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	100%
MPPI-PPI	100%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	100%	0%	100%	100%

Comparison	Setting: Community (%)	Setting: Online (%)	Setting: University (%)	Setting: Workplace (%)	Intensity: Brief (%)	Intensity: Short (%)	Intensity: Medium (%)	Intensity: Long (%)	Delivery: In-person (%)	Delivery: Online platform (%)	Delivery: Instructions (%)	Delivery: Live video (%)	Format: Group (%)	Format: Individual (%)	Western (%)
PPI-COMPAS	100%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	100%	0%	100%	100%
PPI-MIND	0%	100%	0%	0%	0%	100%	0%	0%	0%	100%	0%	0%	0%	100%	100%
YOGA-EX	50%	0%	50%	0%	0%	0%	0%	100%	100%	0%	0%	0%	100%	0%	100%

Appendix J. Final NMA Model results including final SIDE assessment of local consistency (coherence)

Note: this Appendix Refers Chapter 4 A Systematic Review and Network Meta-Analysis Comparing Wellbeing-Focused Interventions

Comparison	N of studies direct evidence	Network meta-analysis	Direct estimate	Indirect estimate	Difference	Incoherence (p value)
ACT:COMB	0	-0.0061	.	-0.0061	.	.
ACT:COMPAS	0	-0.0542	.	-0.0542	.	.
ACT:C	5	0.3920	0.3920	.	.	.
ACT:ED	0	0.1348	.	0.1348	.	.
ACT:EX	0	-0.0263	.	-0.0263	.	.
ACT:EXPSY	0	-0.3430	.	-0.3430	.	.
ACT:MIND	0	-0.0518	.	-0.0518	.	.
ACT:MPPI	0	0.0821	.	0.0821	.	.
ACT:NAT	0	0.3447	.	0.3447	.	.
ACT:PPI	0	-0.0146	.	-0.0146	.	.
ACT:YOGA	0	-0.1025	.	-0.1025	.	.
COMB:COMPAS	0	-0.0481	.	-0.0481	.	.
COMB:C	21	0.3981	0.4031	0.3733	0.0298	0.8935
COMB:ED	3	0.1409	0.1107	0.1549	-0.0442	0.8693
COMB:EX	1	-0.0202	-0.1496	-0.0090	-0.1405	0.7280
COMB:EXPSY	0	-0.3369	.	-0.3369	.	.
COMB:MIND	2	-0.0457	0.0254	-0.0529	0.0783	0.8101
COMB:MPPI	0	0.0882	.	0.0882	.	.
COMB:NAT	0	0.3509	.	0.3509	.	.
COMB:PPI	0	-0.0084	.	-0.0084	.	.

COMB:YOGA	0	-0.0964	.	-0.0964	.	.
COMPAS:C	15	0.4462	0.4661	0.3475	0.1186	0.6451
COMPAS:ED	0	0.1890	.	0.1890	.	.
COMPAS:EX	1	0.0279	0.0668	0.0234	0.0434	0.9132
COMPAS:EXPSY	0	-0.2888	.	-0.2888	.	.
COMPAS:MIND	1	0.0024	0.0702	-0.0026	0.0728	0.8636
COMPAS:MPPI	1	0.1363	-0.0815	0.1764	-0.2578	0.5660
COMPAS:NAT	0	0.3989	.	0.3989	.	.
COMPAS:PPI	2	0.0397	-0.1727	0.0959	-0.2686	0.3851
COMPAS:YOGA	0	-0.0483	.	-0.0483	.	.
ED:C	1	0.2572	0.1085	0.2703	-0.1618	0.6902
EX:C	23	0.4183	0.3780	0.5394	-0.1613	0.3735
EXPSY:C	1	0.7350	0.8257	0.7018	0.1238	0.8166
MIND:C	65	0.4438	0.4463	0.4178	0.0285	0.8697
MPPI:C	8	0.3099	0.3111	0.2947	0.0163	0.9752
NAT:C	4	0.0472	0.0472	.	.	.
PPI:C	18	0.4065	0.4048	0.4171	-0.0123	0.9618
YOGA:C	12	0.4945	0.4410	0.7745	-0.3335	0.3074
ED:EX	5	-0.1611	-0.2717	-0.0829	-0.1888	0.4329
ED:EXPSY	0	-0.4778	.	-0.4778	.	.
ED:MIND	5	-0.1866	-0.0922	-0.2500	0.1578	0.4934
ED:MPPI	0	-0.0527	.	-0.0527	.	.
ED:NAT	0	0.2099	.	0.2099	.	.
ED:PPI	1	-0.1493	-0.0061	-0.1631	0.1570	0.7488
ED:YOGA	0	-0.2373	.	-0.2373	.	.
EX:EXPSY	3	-0.3167	-0.3197	-0.2943	-0.0254	0.9715
EX:MIND	1	-0.0255	-0.1321	-0.0211	-0.1110	0.8101
EX:MPPI	0	0.1084	.	0.1084	.	.
EX:NAT	0	0.3710	.	0.3710	.	.
EX:PPI	0	0.0118	.	0.0118	.	.
EX:YOGA	3	-0.0762	-0.1698	-0.0411	-0.1287	0.6742
EXPSY:MIND	1	0.2912	0.1651	0.3400	-0.1749	0.7430

EXPSY:MPPI	0	0.4251	.	0.4251	.	.
EXPSY:NAT	0	0.6877	.	0.6877	.	.
EXPSY:PPI	0	0.3285	.	0.3285	.	.
EXPSY:YOGA	0	0.2405	.	0.2405	.	.
MIND:MPPI	0	0.1339	.	0.1339	.	.
MIND:NAT	0	0.3965	.	0.3965	.	.
MIND:PPI	2	0.0373	0.1590	0.0241	0.1349	0.6889
MIND:YOGA	2	-0.0507	0.0355	-0.0637	0.0992	0.7930
MPPI:NAT	0	0.2626	.	0.2626	.	.
MPPI:PPI	1	-0.0966	-0.1774	-0.0785	-0.0988	0.8093
MPPI:YOGA	0	-0.1846	.	-0.1846	.	.
NAT:PPI	0	-0.3593	.	-0.3593	.	.
NAT:YOGA	0	-0.4472	.	-0.4472	.	.
PPI:YOGA	0	-0.0880	.	-0.0880	.	.

Appendix K. Sub-group Analyses

Note: this Appendix Refers Chapter 4 A Systematic Review and Network Meta-Analysis Comparing Wellbeing-Focused Interventions

Table K1: Sub-Group Delivery

Pairwise meta-analysis of all active interventions v control, sub-grouped by delivery mode of treatment

	g	95% CI	*p*	I^2	***p* Subgroup difference**
					0.452
In-person Intervention	-0.445	-0.544; -0.345	< 0.001	75.8%	
Self-Guided Online Platform	-0.446	-0.608; -0.283	< 0.001	82.9%	
Self-Guided Instructions	-0.321	-0.496; -0.147	< 0.001	55.3%	
Live Online Video-Conferencing	-0.224	-0.590; 0.142	0.231	71.0%	

Table K2: Sub-Group Intervention Format

Pairwise meta-analysis of all active interventions v control, sub-grouped by format (individual v group-based)

	g	95% CI	*p*	I^2	***p* Subgroup difference**
					0.263
Individual	-0.371	-0.471; -0.272	< 0.001	73.3%	
Group	-0.455	-0.561; -0.348	< 0.001	78.0%	

Table K3: Sub-Group Intensity of Intervention

Pairwise meta-analysis of all active interventions v control, sub-grouped by intensity of treatment

	g	95% CI	*p*	I^2	***p* Subgroup difference**

					<0.001*
Brief (< 2 weeks	-0.413	-0.614; -0.212	< 0.001	66.0%	
Short (2-4 weeks)	-0.212	-0.325; -0.100	< 0.001	62.2%	
Medium (5-8 weeks)	-0.569	-0.690; -0.449	< 0.001	81.9%	
Long (>8 weeks)	-0.316	-0.475; -0.157	< 0.001	67.5 %	

*Statistically significant (<0.05)

Table K4: Sub-Group Intervention Setting

Pairwise meta-analysis of all active interventions v control, sub-grouped by setting of intervention

	g	**95% CI**	***p***	I^2	***p* Subgroup difference**
					0.267
University	-0.336	-0.453; -0.219	< 0.001	72.2%	
Workplace	-0.513	-0.657; -0.370	< 0.001	73.8%	
Community	-0.392	-0.564; -0.220	< 0.001	73.6%	
Online	-0.481	-0.699; -0.262	< 0.001	87.4%	

Table K5: Sub-Group Western v Non-Western

Pairwise meta-analysis of all active interventions v control, sub-grouped by whether study took place in Western or non-Western Country

	g	**95% CI**	***p***	I^2	***p* Subgroup difference**
					0.294
Western Country	-0.392	-0.472; -0.311	< 0.001	73.4%	
Non-Western	-0.487	-0.647; -0.328	< 0.001	77.4%	

Table K6: Sub-Group Age

Pairwise meta-analysis of all active interventions v control, sub-grouped by age (split by older or younger than mean age = 37.58)

	g	**95% CI**	***p***	I^2	***p* Subgroup difference**
					0.598
Younger PS (<38)	-0.403	-0.520; -0.286	<0.001	76.2%	
Older PS (>38)	-0.446	-0.558; -0.335	<0.001	78.6%	

Appendix L. Sensitivity Analyses

Note: this Appendix Refers Chapter 4 A Systematic Review and Network Meta-Analysis Comparing Wellbeing-Focused Interventions

Table L1: Sensitivity Analysis Outcome Measure

Pairwise meta-analysis of all active interventions v control, sub-grouped by wellbeing outcome measure

	g	**95% CI**	***p***	I^2	***p* Subgroup difference**
					0.312
Subjective Wellbeing	-0.365	-0.448; -0.283	<0.001	74.2%	
Resilience	-0.642	-1.071; -0.213	0.003	77.4%	
Mindfulness	-0.506	-0.695; -0.317	<0.001	80.7%	
Positive affect	-0.489	-0.742; -0.235	<0.001	72.7%	

Table L2: Sensitivity Analysis Waitlist Control

Pairwise meta-analysis of all active interventions v control, sub-grouped by whether a 'waitlist' versus a 'no intervention' control group was used

	g	**95% CI**	***p***	I^2	***p* Subgroup difference**
					0.698
Waitlist	-0.415	-0.486; -0.344	<0.001	69.7%	
No Intervention	-0.458	-0.664; -0.252	<0.001	84.1%	

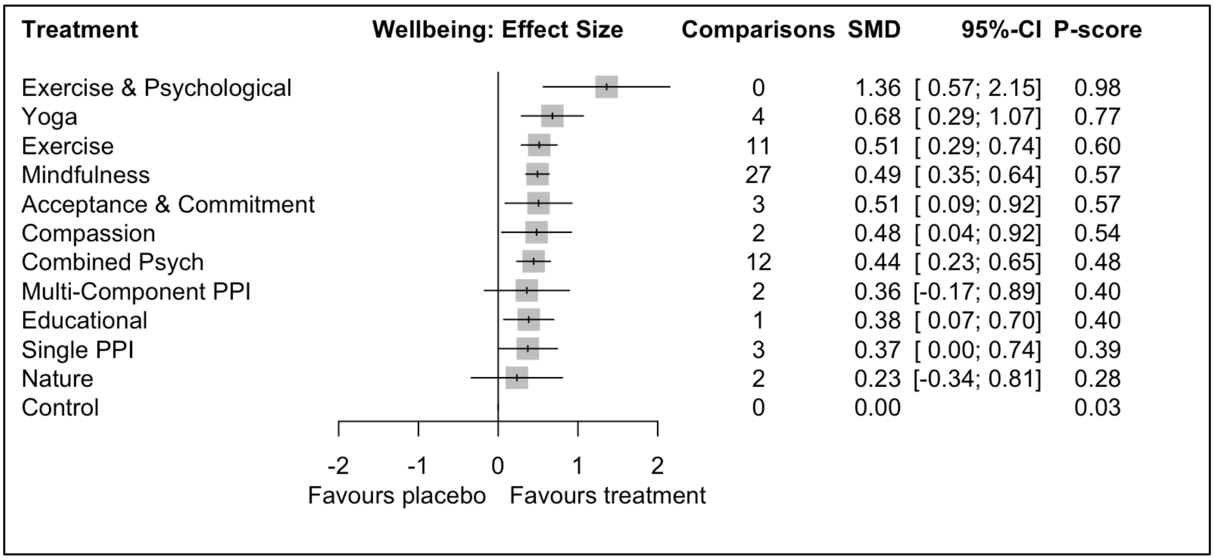
Table L3: Sensitivity Analysis Risk of Bias

Pairwise meta-analysis of all active interventions v control, sub-grouped by risk of bias

	g	**95% CI**	***p***	I^2	***p* Subgroup difference**
					0.146
Low	-0.348	-0.456; -0.240	<0.001	37.1%	
Medium	-0.535	-0.693; -0.378	<0.001	81.9%	
High	-0.382	-0.474; -0.290	<0.001	73.6%	

Figure L1: NMA excluding high risk of bias

Network meta-analysis model results when studies containing high risk of bias are excluded

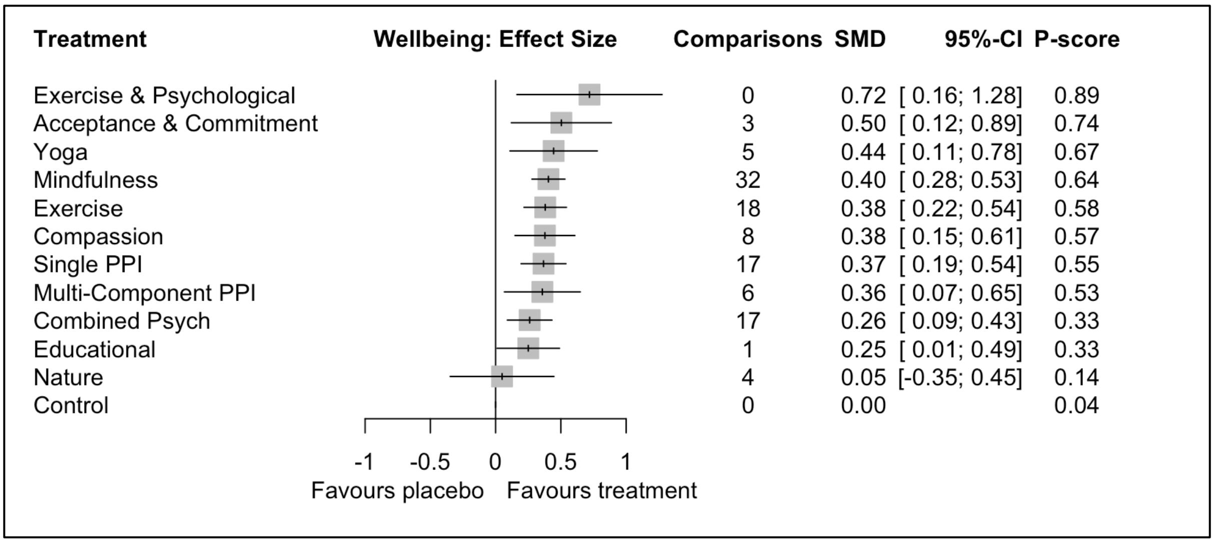


Note: Image created by Lowri Wilkie using R Studio, package 'netmeta'

The network was relatively connected, only one subnetwork was present, however 4/12 interventions only had one direct comparison (not strongly attached). The model contained 73 studies, 12 treatments and 81 pairwise comparisons. The design-by-treatment interaction model suggested global inconsistency in the network (tau^2 = 0.1144; tau = 0.3383; I^2 = 78% [72.4%; 82.5%], p < 0.0001). However, under the assumption of a full design-by-treatment interaction random effects model, Q decreased considerably, and between-design inconsistency was no longer significant (Q = 14.10, p = 0.228).

In the low-medium risk of bias model, four out of five of the top ranked treatments remained the same as the main model. The one modification was that ACT now ranked higher in the top five. In addition, single positive psychology interventions (PPIs) fell significantly in ranking when high risk of bias studies were removed, however remained significantly more effective than control condition (p = 0.049). Multi-component PPIs had a larger confidence interval and was no longer significant compared to controls (p = 0.186).

Figure L2: NMA model using only subjective wellbeing as outcome measure



Note: Image created by Lowri Wilkie using R Studio, package 'netmeta'

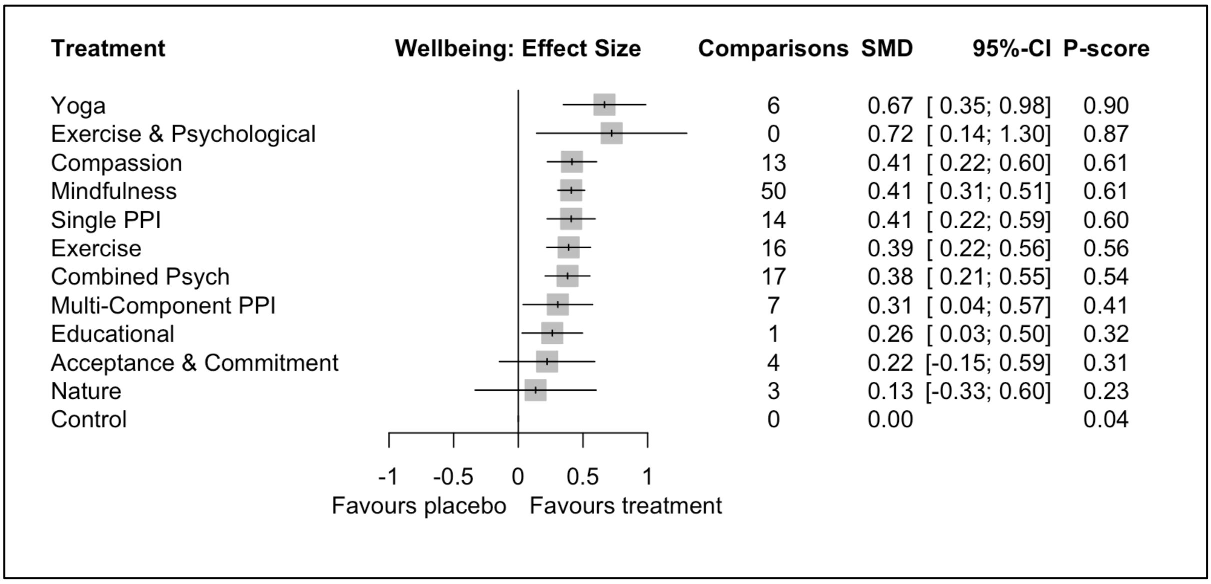
Network was well connected and comparable to main model. It contained 117 studies, 133 pairwise comparisons and 12 treatments. The design-by-treatment interaction model suggested global inconsistency in the network ($tau^2 = 0.0930$; tau = 0.3050; I^2 = 72.9% [67.5%; 77.5%], $p < 0.0001$). Under the assumption of a full design-by-treatment interaction random effects model, Q was no longer significant (Q = 8.76, $p = 0.978$).

Model results were comparable with the main NMA. Again, four out of five of the top ranked treatments remained the same, however ACT increased in effect size (0.39 to 0.50) and rank from eighth to second. Single PPIs and multi-component PPIs ranked more comparably when SWB was used at main outcome measure.

Figure L3: NMA excluding small studies

Network meta-analysis model only containing studies in which studies with small N were excluded.

Studies with N size lower than interquartile range (N=45) defined as small.



Note: Image created by Lowri Wilkie using R Studio, package 'netmeta'

The network was moderately well connected, only one subnetwork was present. 3/12 interventions only had one direct comparison (were not strongly attached). The model contained 140 studies, 12 treatments and 154 pairwise comparisons. The design-by-treatment interaction model suggested global inconsistency in the network $tau^2 = 0.106$; tau = 0.325; I^2 = 76.7% [72.6%; 80.2%]). However, under the assumption of a full design-by-treatment interaction random effects model, Q decreased considerably, and between-design inconsistency was no longer significant (Q = 10.77, p = 0.868).

ACT was no longer significantly more effective than control. The top ranked interventions were consistent with the main NMA, however yoga changed rank to first position, and EXPSY moved down to second, likely due to the large confidence interval.

Appendix M. Confidence in network-meta analysis (CINEMA) judgements

Note: this Appendix Refers Chapter 4 A Systematic Review and Network Meta-Analysis Comparing Wellbeing-Focused Interventions

Comparison	N of studies	Within-study bias	Reporting bias	Indirectness	Imprecision	Heterogeneity	Incoherence	Confidence rating
Acceptance & Commitment:Control	5	Some concerns	Low risk	Major concerns	No concerns	Major concerns	No concerns	Low
Combined Psych:Control	21	Some concerns	Low risk	Major concerns	No concerns	Major concerns	No concerns	Moderate
Combined Psych:Educational	3	Some concerns	Some concerns	Major concerns	Some concerns	Some concerns	No concerns	Moderate
Combined Psych:Exercise	1	Some concerns	Low risk	Major concerns	Some concerns	Some concerns	No concerns	Moderate
Combined Psych:Mindfulness	2	Major concerns	Low risk	Major concerns	Some concerns	Some concerns	No concerns	Moderate
Compassion:Control	15	Major concerns	High risk	Major concerns	No concerns	Major concerns	No concerns	Very low
Compassion:Exercise	1	Major concerns	Low risk	Major concerns	Major concerns	No concerns	No concerns	Low
Compassion:Mindfulness	1	Major concerns	Low risk	Major concerns	Major concerns	No concerns	No concerns	Low
Compassion:Multi-Component PPI	1	Major concerns	Low risk	Major concerns	Some concerns	Some concerns	No concerns	Moderate
Compassion:Single PPI	2	Major concerns	Low risk	Major concerns	Major concerns	No concerns	No concerns	Low

Control:Educational	1	Major concerns	Low risk	Major concerns	No concerns	Major concerns	No concerns	Low
Control:Exercise	23	Major concerns	Some concerns	Some concerns	No concerns	Major concerns	No concerns	Moderate
Control:Exercise & Psychological	1	Major concerns	Low risk	Major concerns	No concerns	Some concerns	No concerns	Moderate
Control:Mindfulness	65	Major concerns	Some concerns	Major concerns	No concerns	Major concerns	No concerns	Low
Control:Multi-Component PPI	8	Major concerns	Low risk	Major concerns	No concerns	Major concerns	No concerns	Low
Control:Nature	4	Some concerns	Low risk	Major concerns	Major concerns	No concerns	No concerns	Moderate
Control:Single PPI	18	Major concerns	High risk	Major concerns	No concerns	Major concerns	No concerns	Very low
Control:Yoga	12	Major concerns	Low risk	Some concerns	No concerns	Major concerns	No concerns	Moderate
Educational:Exercise	5	Major concerns	Low risk	Some concerns	Some concerns	Some concerns	No concerns	Moderate
Educational:Mindfulness	5	Major concerns	Low risk	Major concerns	Some concerns	Some concerns	No concerns	Moderate
Educational:Single PPI	1	Major concerns	Low risk	Major concerns	Some concerns	Some concerns	No concerns	Moderate
Exercise:Exercise & Psychological	3	Major concerns	Low risk	No concerns	Some concerns	Some concerns	No concerns	Moderate
Exercise:Mindfulness	1	Major concerns	Low risk	Major concerns	Some concerns	Some concerns	No concerns	Moderate
Exercise:Yoga	3	Major concerns	Low risk	Some concerns	Some concerns	Some concerns	No concerns	Moderate
Exercise & Psychological:Mindfulness	1	Major concerns	Low risk	Major concerns	Some concerns	Some concerns	No concerns	Moderate
Mindfulness:Single PPI	2	Major concerns	Low risk	Major concerns	Some concerns	Some concerns	No concerns	Moderate

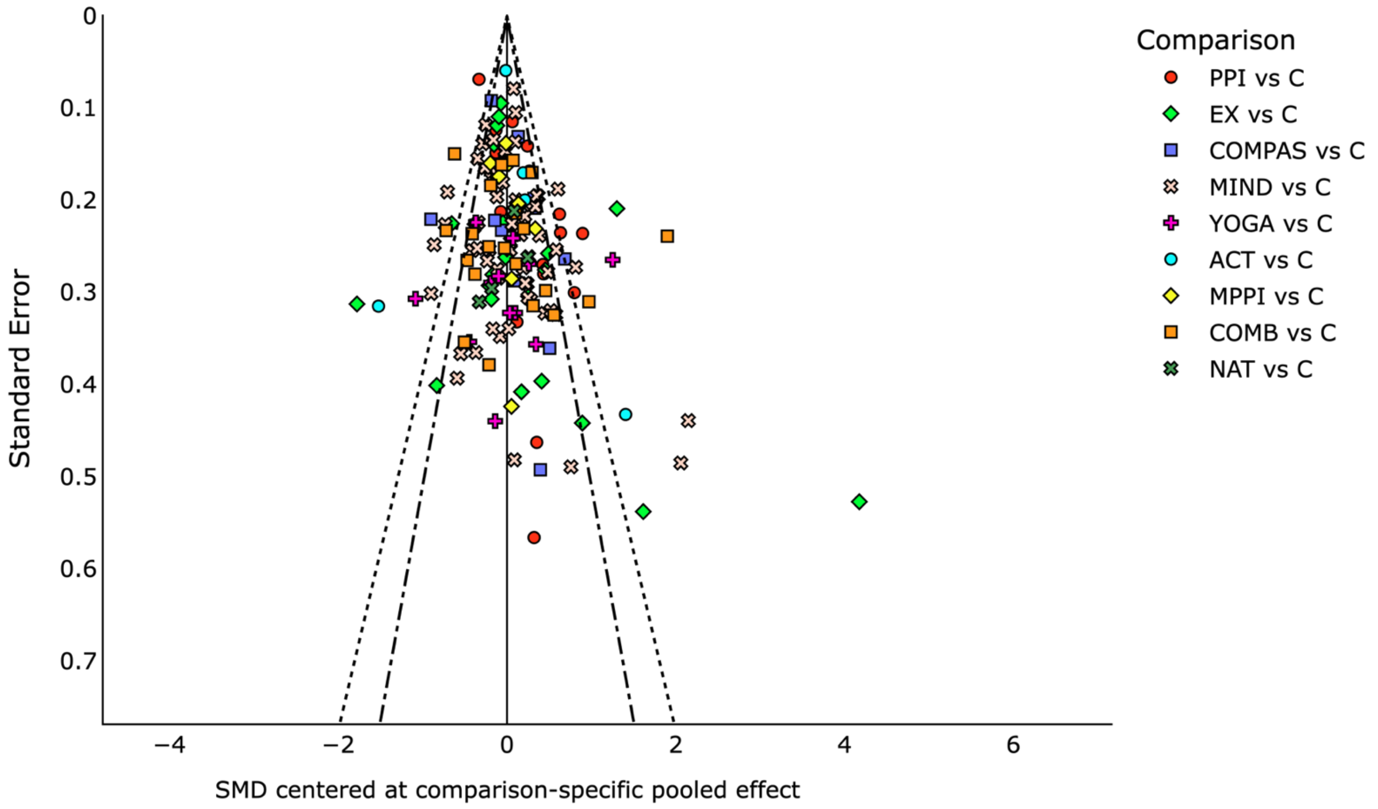
Mindfulness:Yoga	2	Major concerns	Low risk	Some concerns	Some concerns	Some concerns	No concerns	Moderate
Multi-Component PPI:Single PPI	1	Major concerns	Low risk	Major concerns	Major concerns	No concerns	No concerns	Low
Acceptance & Commitment:Combined Psych	0	Some concerns	Low risk	Major concerns	Major concerns	No concerns	No concerns	Moderate
Acceptance & Commitment:Compassion	0	Major concerns	Low risk	Major concerns	Major concerns	No concerns	No concerns	Moderate
Acceptance & Commitment:Educational	0	Some concerns	Low risk	Major concerns	Major concerns	No concerns	No concerns	Moderate
Acceptance & Commitment:Exercise	0	Some concerns	Low risk	Major concerns	Major concerns	No concerns	No concerns	Moderate
Acceptance & Commitment:Mindfulness	0	Major concerns	Low risk	Major concerns	Major concerns	No concerns	No concerns	Moderate
Acceptance & Commitment:Multi-Component PPI	0	Major concerns	Low risk	Major concerns	Major concerns	No concerns	No concerns	Moderate
Acceptance & Commitment:Nature	0	Some concerns	Low risk	Major concerns	Major concerns	No concerns	No concerns	Moderate
Acceptance & Commitment:Single PPI	0	Major concerns	Low risk	Major concerns	Major concerns	No concerns	No concerns	Moderate
Acceptance & Commitment:Yoga	0	Major concerns	Low risk	Major concerns	Major concerns	No concerns	No concerns	Moderate
Combined Psych:Compassion	0	Major concerns	Low risk	Major concerns	Some concerns	Some concerns	No concerns	Moderate
Combined Psych:Exercise & Psychological	0	Major concerns	Low risk	Major concerns	Some concerns	Some concerns	No concerns	Moderate
Combined Psych:Multi-Component PPI	0	Major concerns	Low risk	Major concerns	Major concerns	No concerns	No concerns	Low
Combined Psych:Nature	0	Some concerns	Low risk	Major concerns	Some concerns	Some concerns	No concerns	Moderate

Combined Psych:Single PPI	0	Major concerns	Low risk	Major concerns	Major concerns	No concerns	No concerns	Low
Combined Psych:Yoga	0	Major concerns	Low risk	Some concerns	Some concerns	Some concerns	No concerns	Moderate
Compassion:Educational	0	Major concerns	Low risk	Major concerns	Some concerns	Some concerns	No concerns	Moderate
Compassion:Exercise & Psychological	0	Major concerns	Low risk	Major concerns	Major concerns	No concerns	No concerns	Moderate
Compassion:Nature	0	Major concerns	Low risk	Major concerns	Some concerns	Some concerns	No concerns	Moderate
Compassion:Yoga	0	Major concerns	Low risk	Some concerns	Major concerns	No concerns	No concerns	Low
Educational:Exercise & Psychological	0	Major concerns	Low risk	Major concerns	Some concerns	Some concerns	No concerns	Moderate
Educational:Multi-Component PPI	0	Major concerns	Low risk	Major concerns	Major concerns	No concerns	No concerns	Low
Educational:Nature	0	Major concerns	Low risk	Major concerns	Major concerns	No concerns	No concerns	Low
Educational:Yoga	0	Major concerns	Low risk	Some concerns	Some concerns	Some concerns	No concerns	Moderate
Exercise:Multi-Component PPI	0	Major concerns	Low risk	Major concerns	Major concerns	No concerns	No concerns	Low
Exercise:Nature	0	Major concerns	Low risk	Major concerns	Some concerns	Some concerns	No concerns	Moderate
Exercise:Single PPI	0	Major concerns	Low risk	Major concerns	Major concerns	No concerns	No concerns	Low
Exercise & Psychological:Multi-Component PPI	0	Major concerns	Low risk	Major concerns	Some concerns	Some concerns	No concerns	Moderate
Exercise & Psychological:Nature	0	Major concerns	Low risk	Major concerns	No concerns	Major concerns	No concerns	Low

Exercise & Psychological:Single PPI	0	Major concerns	Low risk	Major concerns	Some concerns	Some concerns	No concerns	Moderate
Exercise & Psychological:Yoga	0	Major concerns	Low risk	Some concerns	Major concerns	No concerns	No concerns	Moderate
Mindfulness:Multi-Component PPI	0	Major concerns	Low risk	Major concerns	Some concerns	Some concerns	No concerns	Moderate
Mindfulness:Nature	0	Major concerns	Low risk	Major concerns	Some concerns	Some concerns	No concerns	Moderate
Multi-Component PPI:Nature	0	Major concerns	Low risk	Major concerns	Major concerns	No concerns	No concerns	Low
Multi-Component PPI:Yoga	0	Major concerns	Low risk	Major concerns	Some concerns	Some concerns	No concerns	Moderate
Nature:Single PPI	0	Major concerns	Low risk	Major concerns	Some concerns	Some concerns	No concerns	Moderate
Nature:Yoga	0	Major concerns	Low risk	Major concerns	Some concerns	Some concerns	No concerns	Moderate
Single PPI:Yoga	0	Major concerns	Low risk	Some concerns	Major concerns	No concerns	No concerns	Moderate

Appendix N. Funnel plot of potential publication bias

Note: this Appendix Refers Chapter 4 A Systematic Review and Network Meta-Analysis Comparing Wellbeing-Focused Interventions



Note: Control is used as reference treatment. Note: Image created by Lowri Wilkie using NMA Studio

Appendix O. Additional Methodological Details for Quantification of Physiological Synchrony (Study One)

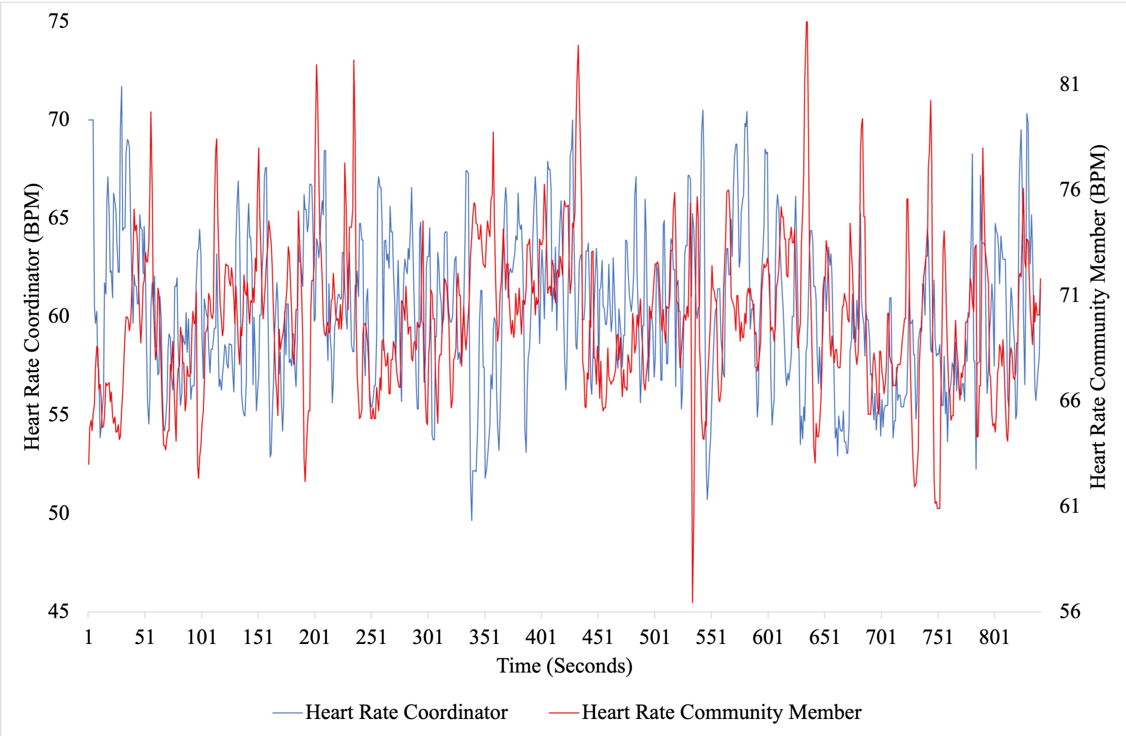
Note: this Appendix Refers to Chapter 5: Improving Wellbeing Through Local Communities: A Mixed Methods Study on the Role of Relationship Building

The statistical software Surrogate Synchrony (SUSY) written in R was used (http://www.embodiment.ch) (Tschacher & Haken, 2019; Tschacher & Meier, 2019). This is a well-established, robust synchrony measure (Coutinho et al., 2021; Nyman-Salonen et al., 2021; Roman-Juan et al., 2020; Tschacher et al., 2021). SUSY uses windowed cross-correlations of the dyadic time series. The time series were cut into segments of 30 seconds and the cross-correlations within each segment were computed up to a maximum lag of 5 seconds. Cross correlations are standardised using Fisher's Z and then averaged in each segment to a mean Z value of synchrony. All mean Z values of all segments are then averaged for the whole session to obtain one value of synchrony for each dyad. SUSY calculates mean Z synchrony using both absolute Z value (Z_{abs}) and non-absolute Z (Zno_{abs}) values. Z_{abs} are calculated by converting negative values into positive ones, whilst Z_{noabs} are calculated using the original positive and negative values of the cross-correlations. Z_{noabs} can thus be used to differentiate between in-phase and antiphase synchrony (where one person's HR is high, the other person's is low) (Coutinho et al., 2021). Both absolute and non-absolute Z values were used in the present study due to inconsistency in previous findings e.g., Coutinho et al (2021) found HRV synchrony using non-absolute values, but not absolute, suggesting anti-phase synchrony. On the other hand, Tschacher and Meier (2020) found HRV synchrony using absolute values only.

The second stage of SUSY involves creating surrogate tests. Surrogate time series constitute the control condition for the Zabs and Z noabs values. SUSY generates surrogates by randomly shuffling the sequence of segments in a dyadic time series. Z values are computed for all surrogates. Z values for each dyad are computed and compared to the numerous surrogate Z values computed in the shuffled time series. This step computes the key measure of synchrony for each dyad, the effect size, for both absolute (ESabs) and non-absolute (ESnoabs) values. Effect sizes are the difference between each dyad's real Z value and the mean Z value of all surrogates divided by standard deviation of all surrogates.

Appendix P. Example of heart rate (variability) synchronisation

Note: this Appendix Refers to Chapter 5: Improving Wellbeing Through Local Communities: A Mixed Methods Study on the Role of Relationship Building



Note: Visually identifiable synchrony is noticeable, particularly in the second half of the experiment within Low Frequency band (6.7 – 25 seconds wavelength). Image created by Lowri Wilkie using Microsoft Excel

Appendix Q. Further details on PLS-SEM Assessment of Measurement and Structural Model for Study 2

Note: this Appendix Refers to Chapter 5: Improving Wellbeing Through Local Communities: A Mixed Methods Study on the Role of Relationship Building

Assessment of Measurement Model

Reflective measurement models are evaluated using (1) indicator loadings (2) internal consistency reliability (3) convergent validity and (4) discriminant validity. Indicator loadings above 0.708 are ideal as this suggests the construct explains more than 50% of the indicator's variance (Hair et al., 2019). Question 2 of the WAI-SR had a loading of 0.563 on the latent variable 'relationship quality'. Advice by Hair et al (p77, 2022) suggests that when indicators are below 0.70, they should be removed from the model only when deleting it leads to an increase in the internal consistency reliability or convergent validity above the suggested threshold value. Given that the removal of WAI-SR Q2 indicator did not considerably alter these values, the indicator was maintained. In addition, the indicator 'frequency' was inversely loaded (-0.869) on the latent construct of 'Contact' and so was removed to form a separate construct in its own name (Frequency of Contact), whilst the construct 'Contact' was changed to 'Duration of Contact' which only contained the one indicator of duration. All other indicators had loadings above 0.708 and so were maintained (see S4 table 1 for factor loadings).

Table Q1: *Factor Loadings for Measurement Model*

	Duration	Relationship	Sense of Community	Time	Wellbeing
Duration	0.869				
Frequency	-0.869*				
WAI-SR 1		0.717			
WAI-SR 2		0.564*			
WAI-SR 3		0.755			
WAI-SR 4		0.87			
WAI-SR 5		0.831			
WAI-SR 6		0.879			
WAI-SR 7		0.824			
WAI-SR 8		0.874			
WAI-SR 9		0.901			
SWEMWBS 1					0.773
SWEMWBS 2					0.81
SWEMWBS 3					0.794
SWEMWBS 4					0.794
SWEMWBS 5					0.855
SWEMWBS 6					0.771
SWEMWBS 7					0.74

Time		1
BSCS 1	0.763	
BSCS 2	0.842	
BSCS 3	0.921	
BSCS 4	0.871	
BSCS 5	0.754	
BSCS 6	0.735	
BSCS 7	0.884	
BSCS 8	0.821	

*Indicates values of less than 0.70

A measurement model is said to have good internal consistency when composite reliability of each construct lies between 0.7 and 0.95 (Hair et al., 2019). The constructs in the present model ranged between 0.901 and 0.945 suggesting satisfactory internal consistency reliability. Average Variance Extracted (AVE) is used to evaluate convergent reliability, whereby an AVE of 0.50 or higher indicates the construct explains at least 50% of variance of its items (Hair et al., 2019). In the present model, all constructs had an AVE between 0.628 and 0.683 (see S4 Table 2)

Table Q2: *Reliability Scores for Measurement Model*

Variables	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Relationship	0.931	0.938	0.943	0.653
Sense of Community	0.933	0.938	0.945	0.683
Wellbeing	0.901	0.906	0.922	0.628

Finally, discriminant validity is assessed using heterotrait-monotrait (HTMT) ratio of the correlations. It is suggested the threshold for HTMT should be below 0.85 (Hair et al., 2019), all scores for the present model met the criteria (see S4 table 3).

Table Q3: *Discriminant Validity (HTMT) Scores for Measurement Model*

Variables	Duration	Frequency	Relationship	Sense of Community	Time
Duration					

Frequency	0.51				
Relationship	0.466	0.453			
Sense of Community	0.123	0.204	0.322		
Time	0.181	0.099	0.127	0.433	
Wellbeing	0.125	0.193	0.324	0.65	0.329

Assessment of Structural Model

Assessment of the structural model included 1) collinearity; 2) R^2 value; 3) Q^2 value; 4) PLSPredict. Variance inflation factor (VIF) is used to measure collinearity. As no formative measures were used in the outer model, only the inner model's VIFs were assessed. Inner model VIFs were all below recommended threshold of 3 (see S4 Table 4).

Table Q4: *Collinearity Scores for Inner Model*

	Duration	Frequency	Relationship	Sense of Community	Time	Wellbeing
Duration			1.352			
Frequency			1.352			
Relationship				1.005		1.097
Sense of Community						1.097
Time				1.005		
Wellbeing						

R^2 values of 0.75, 0.50 and 0.25 commonly reflect strong, moderate and weak correlations, respectively (Hair et al., 2019), however it should always be interpreted within the context of the study. R^2 values ranged between 0.251 and 0.386. Q^2 values assess the path's predictive accuracy. Q^2 values higher than 0, 0.25 and 0.50 reflect small, medium and large predictive accuracy (Hair et al., 2019). Q^2 for the present model fell between 0.050-0.189 which reflects small predictive accuracy (see table 5).

Table Q5: *R^2 and Q^2 Scores*

	R-square	R-square adjusted	Q^2predict
Relationship	0.264	0.234	0.189
Sense of Community	0.251	0.220	0.148
Wellbeing	0.386	0.361	0.050

PLSPredict (Shmueli et al., 2016) is an algorithm in SmartPLS (Ringle et al, 2022) which executes a k-fold cross validation, whereby the dataset is split into a given number of folds and is used to evaluate the model's predictive power. PLSPredict was run on the present model on the recommended setting of $k = 10$ (Hair et al., 2019). Root-mean-square error (RMSE) is most common metric to quantify prediction error. RMSE was used in this case, as prediction error distribution (assessed via histograms) were not deemed to be highly non-symmetric.

Each indictor's RMSE was compared with a naïve linear regression model (LM) benchmark. A higher error in linear regression model and lower error in RMSE suggests high predictive power. LM benchmark values are obtained by running a linear regression between each of the dependant construct indicators and the exogenous construct indicators in the path model. In the present model, most indicators (20/22) in the PLS-SEM analysis yielded smaller prediction errors compared to the LM. This indicates medium predictive power (see S4 table 6 for PLSPredict scores for all manifest variables).

Table Q6: *PLSPredict Output for manifest variables*

	Q^2predict	PLS-SEM_RMSE	LM_RMSE
WAI-SR 3	0.045	1.085	1.167
WAI-SR 4	0.175	1.221	1.251
WAI-SR 5	0.11	1.022	1.045
WAI-SR 6	0.102	1.233	1.294
WAI-SR 7	0.136	1.182*	1.13
WAI-SR 8	0.071	1.139	1.157
WAI-SR 9	0.117	1.122	1.142
WAI-SR 1	0.141	1.068	1.085
WAI-SR 2	0.076	1.156*	1.08
BSCS 1	0.021	0.913	0.968
BSCS 2	0.101	0.955	0.977
BSCS 3	0.057	1.045	1.064
BSCS 4	0.184	0.797	0.816
BSCS 5	0.015	1.003	1.017
BSCS 6	0.042	0.87	0.894
BSCS 7	0.097	1.042	1.078

BSCS 8	0.204	0.821	0.828
SWEMWBS 1	0.084	0.775	0.783
SWEMWBS 2	0.011	0.996	1.025
SWEMWBS 3	-0.024	0.842	0.928
SWEMWBS 4	0.05	0.877	0.913
SWEMWBS 5	-0.036	0.863	0.918
SWEMWBS 6	0.07	0.903	0.926
SWEMWBS 7	-0.039	0.899	0.93

*Indicates PLS-SEM RMSE error is higher than LM RMSE

Appendix R. Study 3 Participant Characteristics

Note: this Appendix Refers to Chapter 5: Improving Wellbeing Through Local Communities: A Mixed Methods Study on the Role of Relationship Building

Identification	Gender	Age	Ethnicity	Time in Coordinator Role (Years)
C1	M	45-54	White	1-2
C2	F	55-64	White	4-5
C3	F	35-44	White	2-3
C4	N	45-54	White	3-4
C5	F	55-64	White	4-5

Identification	Gender	Age	Ethnicity	Time involved with LAC (Years)
P1	F	65+	White	2-3
P2	F	45-54	White	1-2
P3	F	55-64	White	1-2
P4	F	45-54	White	<1
P5	M	35-44	White	3-4
P6	M	25-34	White	1-2
P7	M	18-24	White	<1

‘C’ = Coordinators and ‘P’ = Community Member Participants

**Appendix S.	Mind map of the significant impacts noted during the ripple effects mapping session**

Note: this Appendix Refers to Chapter 5: Improving Wellbeing Through Local Communities: A Mixed Methods Study on the Role of Relationship Building. Image taken by Lowri Wilkie

Appendix T. Topic Guide for participant interviews

Note: this Appendix Refers to Chapter 6: The Impact of Psycho-Social Interventions on the Wellbeing of Individuals with Acquired Brain Injury During the COVID-19 Pandemic.

Topic Guide

This guide is divided in to THREE sections:

1. **Experiences of Injury**
2. **Experiences of Lockdown**
3. **Experiences of Intervention**

1. Experiences of Injury

- **Can you tell me briefly about how your life has changed for you since you've had your injury?**

- **How would you describe your overall wellbeing since your injury? How has this impacted upon how you feel on a daily basis?**

- **Did your injury impact your engagement with any hobbies or interests you enjoy?**

2. Experiences of Lockdown

- **What was your experience of lockdown during the recent COVID-19 pandemic? How did the pandemic affect your daily life?**
  (If difficult) What did you find difficult about it?
  (If OK) What do you think helped you to get through lockdown?

- **How would you describe the quality of your social circle during lockdown?**

- **Did your experience of lockdown impact your engagement with any hobbies or interests you enjoy?**

- **Did you have many opportunities to go outside or spend time in the garden, or at your local park etc?**
  How did this make you feel?

3. Experiences of Intervention

- **Have you attended any interventions with the brain injury service since March 2020? If so, which ones?**

- **How did you feel when you were told that you could attend the intervention after being in lockdown for so long?**

- **What was your experience of being involved in the intervention? How would you describe your experience?**

- **Did you notice anything changed for you after attending the intervention(s)?**
  (Follow up) - Has the intervention affected the way you feel about yourself, or about your diagnosis?
  (Follow up) – Did you notice anything different about yourself?
  (Follow up) - Did you notice any changes in your mood or your emotions?

- **How did you feel about the intervention being in a group format with other people who have had similar experiences?**

- **What did you enjoy most about the sessions?**
  (Follow up) Is there anything that you would change?

- **Do you think you have managed to adjust to your current life circumstances?**
  (If yes, ask: what do you think has helped you to do this?)

- **What do you think keeps you going each day?**

- **Have your priorities changed at all since your injury? Do you think anything has changed for the better?**

Closing Up

Finish with: *"We really appreciate you taking this time to share your experience. Is there anything else that you would like to add, or anything you think I should know to fully understand how you feel about the group?"*

Appendix U. Themes and Sub-Themes Identified from the Transcripts.

Note: this Appendix Refers to Chapter 6: The Impact of Psycho-Social Interventions on the Wellbeing of Individuals with Acquired Brain Injury During the COVID-19 Pandemic.

Note: F = Frequency of times theme is mentioned within the transcripts, grouped by each intervention

	Surf-ability	**Bike-ability**	**Psychotherapy**	**Psycho-education**	**Fun Group**
Facilitating Trust and Safety (F=49)	F=16	F=2	F=12	F=6	F=25
Fostering Positive Emotions (F=42)	F=13	F=5	F=15	F=3	F=25
Managing and Accepting Difficult Emotions (F=16)	F=3	F=2	F=8	F=2	F=8
Promoting Meaning (F=36)	F=11	F=5	F=21	F=12	F=16
Finding Purpose and Accomplishment through Activities (F=44)	F=15	F=9	F=24	F=12	F=22
Facilitating Social Ties (F=91)	F=26	F=13	F=32	F=16	F=42
(Re) Connecting to Nature (F =31)	F=27	F=2	F=5	F=2	F=3
Barriers to Efficacy (F = 21)	F=14	F=0	F=9	F=1	F=12

Appendix V. Topic guide for ripple effects mapping focus group

Note: this Appendix Refers to Chapter 7: The 'Rippling' Waves of Wellbeing: A Mixed Methods Evaluation of a Surf-Therapy Intervention on Patients with Acquired Brain Injury

<u>Ripple Effects Mapping Session</u>
<u>Surf-Ability Project</u>
<u>April 2022</u>
<u>Topic Guide</u>

<u>In-Depth Ripping</u>

Items needed:
- Large white paper posted on the wall
- Tape
- Markers
- interview questions printed on paper with space for participants to take notes during interviews.

Overview:

"This impact mapping evaluation project will help us better understand the ripple effects of the program on individual participants, groups, communities, and regions involved. This mapping process provides a method of visually illustrating to stakeholders the impact of this program, validating the effects of the program, and creating stronger support and public value. The purpose of this study is to explore overall (individual, group, community) changes that have taken place as a result of participating in the program."

Part 1: Appreciative Inquiry Interview

Find a partner who is not already a good friend
Share a story briefly about the program being evaluated using one of these sample

"Share a story about how the experience of attending the surf-ability program had a subsequent impact on your life."

Optional Probing Questions for Participants:
Have you made any new connections or depended relationships?
Are there any specific achievements or successes you can think of?
Have you shared what you've learned with anyone?
What new resources or opportunities do you (and/or the community) have as a result?
Did your and/or others' (family, partners') attitudes and behaviors change as a result? If so, any specific examples?

Part 2: Mapping

Each pair offers both of their stories, draw out the details and welcome input from all attendees.

Facilitator Probing Questions:
Then what happened?
How did this impact future decisions?
How did you feel then?
What did that lead to?
Who was involved?

Part 3: Reflections and Theming

- *Now we will identify what you see as the most significant change(s) on the map.*
- *What is most interesting about the map?*
- *How might we use the map to help us tell our story about how we are making a difference?*
- *Are there any new directions or possibilities for the program we might recommend?*

"Thank you for engaging in the Ripple Effects Mapping Exercise, the next step is for the map be digitized and coded. You are welcome to take photographs of the map. I will make the final evaluation available to you all once it is ready."

Appendix W. GENIAL Roadmap to Wellbeing Worksheet (3 x Pages)

Note: this Appendix Refers to Chapter 8: Discussion and Impact of Thesis.

The GENIAL Roadmap to Wellbeing

The GENIAL Roadmap to wellbeing is a self-reflection tool designed to support you to 1) reflect on the key domains of wellbeing as they relate to your own life and (2) set targeted goals based on these reflections to help you build your wellbeing.

The roadmap is an outline of the key 'GENIAL' factors which contribute to health and wellbeing. The more we can increase each of these components, the better the chance we give ourselves to improve our sense of wellbeing. The roadmap works best when we give ourselves space and time to truthfully reflect on each domain, identifying both our current strengths and weaknesses.

Instructions:

1. Read through each domain of the roadmap (page 2)
2. Use the questions to prompt you to reflect on how you feel about each component in your life right now (the past two weeks).
3. Mark one number on each arm to indicate which components are going well for you right now (6), versus which components might need some attention (1).
4. After you have completed each arm, turn to page 3 to start goal setting. Try to use the roadmap to guide the goals and daily habits you set for yourself based on recognised areas for improvement. For example, if you scored 'connection to nature' as low on the roadmap, you might set yourself the goal of going for a 30 minute walk every day in nature.
5. Use the goal setting prompts (page 3) to help you clarify a plan and get clear on your goal. You can use the space provided on page 3 to do this.

References

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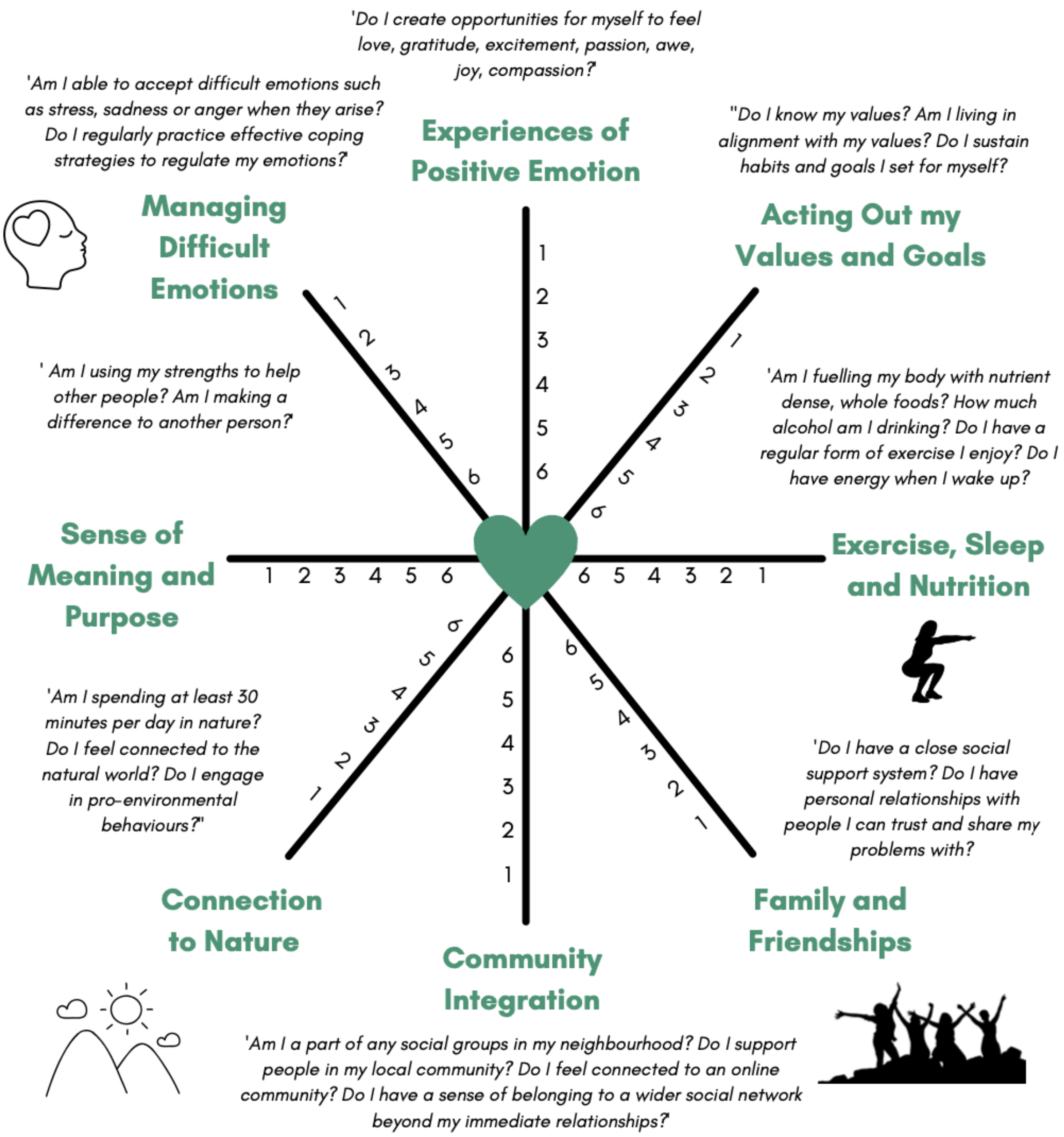
The GENIAL Roadmap to Wellbeing



The GENIAL Roadmap to Wellbeing

Goal Setting

Which domain would I like to try and improve?

....

Prompts to help you get clear on your plan:

- *What is one small daily habit I need to develop?*
- *When and where will I perform this ?*
- *What changes can I make to my environment to make it easy to perform this behaviour?*
- *How can my close social network support me?*
- *Can I join a community of people with similar goals to mine?*
- *What are the benefits of this new behaviour?*
- *How will I reward myself for sticking to the behaviour?*
- *How will I track my progress?*

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Note: Image taken from worksheet created by Lowri Wilkie on Canva