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ARTICLE

Cold water immersion: Exploring the effects on well-being – scoping review

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Abstract: *Background*. As the prevalence of mental health disorders continues to rise, there is a growing need for effective and accessible holistic approaches to promote well-being. Cold-water immersion (CWI) has gained popularity in recent years due to its potential health benefits. This scoping review aimed to investigate the qualitative benefits of CWI through the experiences of healthy individuals. *Methods.* A systematic search of seven databases was conducted and included both peer-reviewed and grey literature from the following databases: PubMed, Embase, Psychinfo, SPORTDiscus, Proquest Health and Medical, Proquest Dissertation and Theses Global, and CINAHL. Quantitative studies examining CWI and its effects on well-being, along with the CWI parameters were included to complement the qualitative findings. A qualitative content analysis was conducted through an inductive approach. *Results*. In the initial search, 419 records were identified, out of which 13 studies were selected for inclusion in this review. A total of 34 unique codes were derived and grouped into eight content categories. Four overarching themes related to the CWI experiences were revealed: 1) physical and psychological health benefits, 2) connection to nature, 3) sense of connectedness, 4) personal growth. *Conclusion*. The experiences individuals gain from CWI are profound and can exert both direct and indirect influences on the promotion of well-being. However, further research is needed to establish the specific parameters that promote well-being through CWI.

Keywords: cold-water swimming, mental well-being, wellness, mental health, winter swimming

1. Introduction

According to the World Health Organisation (WHO), positive mental health or well-being is defined as a state where an individual recognises their own abilities, can manage daily stresses, are productive and contribute positively to their community (WHO, 2023). Well-being encompasses the experiences of feeling good, contentment and happiness, the feeling of control in one's life, and engaging in positive relationships (Ruggeri et al., 2020). It is associated with improved physical and mental health, longevity, immune functioning, productivity, and life satisfaction (Ruggeri et al., 2020). At a societal level, increased well-being has been associated with enhanced productivity and a greater likelihood of contributing to society, fostering economic development (Ruggeri et al., 2020). These aspects of achieving a higher level of well-being become threatened when mental health is not acknowledged and adequately addressed.

Mental health illness is a growing issue that is increasingly recognized worldwide, prompting greater efforts to address the problem. A holistic approach to coping with mental

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illnesses and improving well-being is essential in tackling this growing concern. In Australia, it is estimated that 44% of the population or 8.6 million people between 18-85 years old have experienced mental disorders at one time in their lives (Australian Institute of Health and Welfare, 2023b). It is predicted that the number of people suffering from a psychiatric disorder will increase in the next few years in both Western and Non-western countries (Doets et al., 2021; Lépine & Briley, 2011; Mathers et al., 2008). The rise of mental illnesses may also be accompanied by a rise in the requirements for mental illness treatments. In a 2022 survey conducted by the American Psychological Association (2022), six in ten practitioners reported no longer having openings for new patients; 46% of practitioners were unable to meet the demands for treatment; 72% have had longer waitlists since 2019. Additionally, in Australia, just under 45 million prescription medications for mental health illnesses were dispensed in 2021 (Australian Institute of Health and Welfare, 2023a). Although these medications can help address mental illness symptoms, individuals may experience several side effects including tremors and weight gain (McMillan et al., 2020). Furthermore, individuals taking these medications often reported moods like "zombie" states, which is perceived as an emotionless state (McMillan et al., 2020). Patients, particularly youth, may be less inclined to take medications due to the stigma that is associated with mental health illness (McMillan et al., 2020). As society continues to address the ongoing mental health challenges, the need for alternative methods to promote mental well-being becomes more evident.

Using cold therapy to promote well-being and positive mental health has become a growing area of interest. Cold therapy refers to voluntarily exposing the body or specific parts of the body to either cold air or water (Doets et al., 2021). As far back as 3500 BC, the therapeutic application of cold water has been documented (Allan et al., 2022). The ancient Greeks utilized cold water therapy for relaxation, socialization, and to treat various conditions, including fever, inflammation, and other ailments. In the 18th century, Dr. James Currie expanded on this knowledge, furthering the understanding of CWI's effects on human physiology (Allan et al., 2022). The concept of open-water swimming emerged in the 19th century, offering both physical and psychological benefits (Oliver, 2021). In the 20th century, CWI gained attention as a tool for post-exercise recovery. Today, there is growing attention to the mental health benefits of CWI, particularly delving deeper into the biochemical processes underlying CWI's effects (Allan et al., 2022). From a biochemical level, the stress caused by cold exposure has a potential anti-depressant effect (Doets et al., 2021; Hjorth et al., 2022). Cold exposure results in the activation of the sympathetic nervous system leading to the secretion of various hormones, including catecholamines, such as dopamine, epinephrine and norepinephrine, along with the release of cortisol (Hirvonen et al., 2002; Srámek et al., 2000). Leppäluoto et al. (2008) reported significant increases in plasma noradrenaline and dopamine concentration levels after immersion in 14°C water. Additionally, after regular exposure (4-12 weeks) to cold water, the release of cortisol appeared to significantly decrease indicating the ability to acclimatise to the cold (Leppäluoto et al., 2008; Srámek et al., 2000). These hormones play a key role in stress regulation, emotional regulation, and reward processing (Hirvonen et al., 2002). It is proposed that an imbalance in these key hormones can play a role in developing psychiatric disorders including depression and anxiety (Hirvonen et al., 2002).

A systematic review by Doets et al. (2021) investigated the influences of whole-body cryotherapy (WBC) for mental health problems. WBC is a modality of cold therapy and is defined as whole-body cooling (including the head) in temperature-controlled chambers that measure between – 60°C to –200°C (Doets et al., 2021). The study highlighted that WBC had positive effects on depression and anxiety and may be utilised as an add-on treatment for mental health

problems (Doets et al., 2021). However, the procedures required for WBC differ from cold-water immersion (CWI), as individuals are exposed to different temperatures. This potentially results in differing physical and psychological responses.

In a recent study, Espeland et al. (2022) investigated the health effects of recreational CWI. The main findings reported were primarily physiological in which changes included improved cardiovascular health, improved immune function, reduced inflammation, and improved recovery from exercise (Espeland et al., 2022). This study also revealed some potential psychological implications of CWI including having possible anti-depressant effects, along with regular CWI improving mood and energy (Espeland et al., 2022). A study by Hjorth et al. (2022) investigated whether cold water swimming was a safe alternative treatment for patients with depression. After 20 weeks, the results revealed regular cold water swimming improved well-being scores on the WHO-5 Well-Being Index from 39.2 to 54.0. For individuals dealing with mental illness, the research indicates that cold therapy may be a potentially safe alternative to help promote well-being (Hjorth et al., 2022). This raises the question of whether CWI affects well-being in a healthy population.

To date, the literature involving CWI has been predominantly focused on the quantitative evidence describing the potential health benefits, particularly in individuals diagnosed with a mental health disorder (Doets et al., 2021; Espeland et al., 2022; Hjorth et al., 2022). There remains a paucity in the literature concerning healthy individuals' experience of CWI and the impact it has on their well-being (Espeland et al., 2022). Therefore, research within healthy populations needs to be further explored. As addressing mental health and well-being requires a holistic approach, gaining insights into the experiences of healthy individuals engaging in CWI will provide a unique perspective on the promotion of well-being. Prioritizing well-being may help to mitigate the risk of developing mental health issues and foster a healthier society.

To the authors' knowledge, there has been no previous research summarising qualitative evidence involving the benefits of CWI on well-being in healthy populations. A preliminary search of the literature identified approximately 419 studies that investigated the effects of CWI on well-being in healthy individuals, indicating a need for a comprehensive review of the existing literature. Although previous research has revealed possible parameters for CWI to achieve physiological benefits, there is a lack of consensus on optimal immersion time, mode of CWI, temperature, and frequency of immersion in which benefits for personal well-being can be achieved. A scoping review was chosen as the most appropriate methodology for this study. This approach differs from a systematic review, which aims to analyze or synthesize the evidence to answer a specific research question. In contrast, a scoping review allows the researcher to map out the existing literature, thereby providing a framework for understanding the current state of research in the field (Peters et al., 2022). In the case of this review, the aim was to explore the current literature on CWI and well-being, along with outlining the themes that emerge from the findings. This review was guided by the following research question:
How is well-being influenced by CWI in a healthy population?

1.1 Objectives

The primary objectives of the scoping review were: 1) to outline the experiences of CWI on well-being in healthy individuals, 2) to outline the methodologies used in CWI specific to temperature range, duration, and frequency of immersion for improvements in mental well-being, 3) to identify any knowledge gaps within the literature to inform future research.

2. Methods

2.1 Protocol registration

The protocol for this scoping review was developed according to the PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation (Tricco et al., 2018). The final protocol registration was submitted to Open Science Framework (https://doi.org/10.17605/OSF.IO/JWMTR).

2.2 Eligibility criteria

The Population-Concept-Context (PCC) framework as reported in the Joanna Briggs Institute (JBI) Reviewers Manual was utilised to help develop the eligibility criteria for this study (Peters et al., 2022). To be included in this review the following criteria needed to be met: 1) any peer-reviewed or grey literature articles with an available full-text English version, 2) any full-text English translated articles for non-English sources, 3) healthy individuals with no known mental health diagnosis, 4) voluntary immersion into cold water must be the primary intervention, 5) studies where the primary outcome assessed was evaluating mental health and well-being.

Studies were excluded if they met any of the following criteria: 1) the study was conducted on animals, 2) the main intervention of the study was cold water shower or cold stress (without CWI), 3) if participants had a diagnosed mental illness, 4) participants wearing wet suits, 5) the outcome assessed was solely based on cognitive measures, and 6) review studies containing duplicate articles.

2.2.1 Population

This review focused on a healthy population of adults (aged 18 or older), which included all genders, ethnicities, socioeconomic backgrounds, and countries. Participants needed to be healthy, with no known medical conditions including any diagnosis of mental illness that may affect the outcome.

2.2.2 Concept

The concept of this review was to explore the current literature on CWI and its influence on well-being through the experiences of healthy individuals. From these lived experiences, mood, emotions, thoughts, and self-efficacy were of particular focus. Mood is an individual's description of the state or vibe they are in, usually derived from experienced emotions (Amado-Boccara et al., 1993). Emotions are an individual's natural and instinctive feelings and/or reactions, towards a significant event or matter (American Psychological Association, 2023). Thoughts are ideas and opinions that come to an individual's mind (American Psychological Association, 2023). Self-Efficacy is an individual's belief in themselves and their capabilities, or to achieve desired results (American Psychological Association, 2023). For the purpose of this review, CWI was defined as immersion of oneself into any body of cold water, below 20°C (Espeland et al., 2022).

2.2.3 Context

The following study designs were considered: systematic reviews, randomised controlled trials, non-randomised controlled trials, cohort studies, case studies, qualitative designs, and theses. For this review, all types of water were included, for example: fresh water, salt water and pool water. Additionally, there were no restrictions on the settings of water, which included but was not limited to outdoor bodies of water (oceans, rivers, lakes, and ponds), pools (community,

indoor, and outdoor), bathtubs, and plunge tubs. Finally, there were no restrictions placed on the time periods for which the study was to be completed, nor the length of time for follow-up after the intervention was provided.

2.3 Information sources

For this review, both peer-reviewed and grey literature sources were included. The following databases were searched in 2024 without any restrictions on the years of publication: PubMed, Embase, Psychinfo, SPORTDiscus, Proquest Health and Medical, Proquest Dissertation and Theses Global, and CINAHL. A specific search strategy was utilised for each database.

2.4 Search strategy

A multi-step approach was conducted to gather the relevant articles for this review. An initial rapid search conducted by the research supervisor (KK-S) provided a list of key terms, research questions, and benchmark articles related to the topic. The original search strategy was constructed in the PubMed database and utilised two key concepts, "cold-water immersion," and "mental well-being," along with related terms and synonyms. The Title-Abstract (TIAB) field codes were implemented into the search strategy, along with utilising the Systematic Review Accelerator (SRA) "SearchRefinery" tool to help to narrow down the initial search strategy (Scells & Zuccon, 2018). The SRA Polyglot tool was then utilised to convert the PubMed search strategy into compatible format for each of the databases (J. M. Clark et al., 2020). A finalised search was conducted in each of the databases and the articles were retrieved and uploaded into EndNote reference management software (20.6 Clarivate). The finalised search strategy for PubMed can be found in Table 1. The finalised search strategies for each database can be found under Supplementary Material 1.

Table 1. PubMed database search

Database	Search Strategy
PubMed	("cold water immersion"[tiab] OR "cold water swimming"[tiab] OR "cold immersion"[tiab] OR "ice bath"[tiab] OR "cold water swimming"[tiab] OR "cold water submersion"[tiab] OR "cold water therapy"[tiab] OR "ice water immersion"[tiab] OR "cold water exposure"[tiab] OR "winter swimming"[tiab] OR "whole-body cryotherapy"[tiab] OR "thermal sensation"[tiab]) AND ("Psychological Wellbeing"[tiab] OR "psychological wellness"[tiab] OR cognitive[tiab] OR Self-esteem[tiab] OR mood[tiab] OR "mental state"[tiab] OR "health promotion"[tiab] OR self-efficacy[tiab] OR "health effects"[tiab])

2.5 Study selection

For the initial screening process, duplicates were removed using the SRA Deduplicator tool (J. Clark et al., 2020). Two reviewers (MO & RM) independently screened the title and abstracts for relevancy to the research question and aims of the study to be included using the Screenatron tool on SRA (J. Clark et al., 2020). A third researcher (MW) resolved any disputes between MO and RM using the SRA Disputatron tool (J. Clark et al., 2020). Prior to the full-text screening, the researchers agreed upon the reasoning for each exclusion criterion. The final screening process took place on SRA Screenatron Tool (J. Clark et al., 2020). The full texts of the remaining articles that met the initial screening criteria were then retrieved, and two reviewers (MO & RM)

independently screened the full-text articles against the eligibility criteria (see 2.2 Eligibility Criteria). Full-text articles that met any of the excluded criteria were excluded and a reason was provided for their exclusion. Any disagreements in the articles included in this study were resolved through discussion with a third author, (MW) until the eligible studies were finalised. After the full-text screening was completed, the references of the included full-text articles were searched for any other additional articles that fit the eligibility criteria. A similar process of screening was undertaken, and any disagreement between the researchers required a third researcher (MW) to resolve disputes. A PRISMA flow diagram demonstrates the results of the search strategy process (Tricco et al., 2018).

2.6 Data extraction

Once the selection of the included articles was finalised, the research team created a data extraction template, which was developed on Microsoft Excel using the JBI manual for reference (Tricco et al., 2018). Prior to collecting the data, a pilot test was completed to ensure that the data was correctly extracted. Upon agreement with a finalised extraction template, two reviewers (MW & RM) independently extracted and inserted the data onto separate Excel templates. Any disputes between the authors were resolved in consultation with the third author (MO).

Data items from the studies included were collected to support the aims of this review. Key study characteristics included: title, author, aims and research question, year of publication, country of publication, population demographics (age, sex, ethnicity, country), sample size, method of data collection and analysis, outcomes assessed, and context/setting. Additional items for the quantitative data were collected. These items included; temperature, location of water, time of immersion, frequency of immersion, and level of immersion in the water. As previous quantitative studies have already discussed protocols for CWI, the parameters utilised in the included studies were collected in order to help support the qualitative findings for this review. As the primary aim of this study was to outline the qualitative benefits of CWI on the well-being of healthy populations, evaluating the quality of the articles did not align with this aim; therefore, a critical appraisal was not required (Tricco et al., 2018). After the extraction process was complete, the raw data was stored in Microsoft Excel.

2.7 Data analysis

After the data was extracted, the quantitative data (i.e., temperature) was demonstrated and compared in graphical forms and tables, along with a short narrative summary. The included articles were subsequently analysed using a qualitative content analysis approach (Bengtsson, 2016; Elo & Kyngäs, 2008; Kleinheksel et al., 2020; Skjott Linneberg & Korsgaard, 2019). The authors utilised an inductive approach to develop the codes. Codes are short labels that describe a concept (Kleinheksel et al., 2020). A codebook was developed by the research team and stored in Microsoft Excel. Definitions of the codes were developed based on the authors' interactions with the data (Downe-Wamboldt, 1992). To ensure consistency, one researcher (MO) was responsible for refining the codebook, along with keeping a final coded version of the text. Utilising a codebook ensured the research team stayed consistent while analysing the data (Bengtsson, 2016; Kleinheksel et al., 2020). The authors (MO, RM, MW) independently coded the included articles. To analyse the included articles, three different coding techniques were utilized including in vivo (verbatim), descriptive, and emotion coding (Saldaña, 2021). These techniques ensured all aspects of an individual's experience during CWI were analysed, while also allowing the researcher the ability to interpret the meaning and significance of the information (Saldaña,

2021). As the researchers became increasingly familiar with the literature, additional codes were identified and added to the codebook.

The research team met on three separate occasions to discuss and clarify any discrepancies in the coded data and update the codebook. Using the updated codebook, the authors re-coded the included articles. After several rigorous iterations, all the included articles were analysed and coded which enabled a final version of the codebook to be developed (See Supplementary material 2). A second cycle of coding was completed to allow researchers to apply the finalised codebook to the included articles. The frequency of each code was tallied in Excel. In a collaborative process, the researchers compiled the codes into categories (Bengtsson, 2016; Kleinheksel et al., 2020). Categories are defined as several codes that are related in context (Kleinheksel et al., 2020). Subsequently, the researchers established themes by grouping categories based on each individual interpretation of the data (Bengtsson, 2016; Kleinheksel et al., 2020). Themes represent an underlying meaning, describing an experience, emotion and/or behaviour (Kleinheksel et al., 2020). If a theme had already been illustrated within the included articles, the authors coded the supporting data and quotations, and developed their own themes.

3. Results

The study selection process initially identified a total of 419 records from the selected databases and registers with an additional 62 records being identified via other methods. After the screening and selection were completed, a total of 13 studies were deemed to be included in this scoping review (Bates & Moles, 2023; Christie & Elliott, 2023; Demori et al., 2021; Denton & Aranda, 2020; Foley, 2015; Kelly & Bird, 2022; Lindeman et al., 2002; McDougall et al., 2022; Murray & Fox, 2021; Oliver, 2021; Oliver et al., 2023; Trylińska-Tekielska et al., 2022; Yankouskaya et al., 2023). A PRISMA flow diagram illustrates this process (see Figure 1).

3.1 Study characteristics

A full breakdown of the study characteristics, including year of publication, country of publication, study design, and population characteristics of the 13 included articles, can be found under Supplementary Material 3.

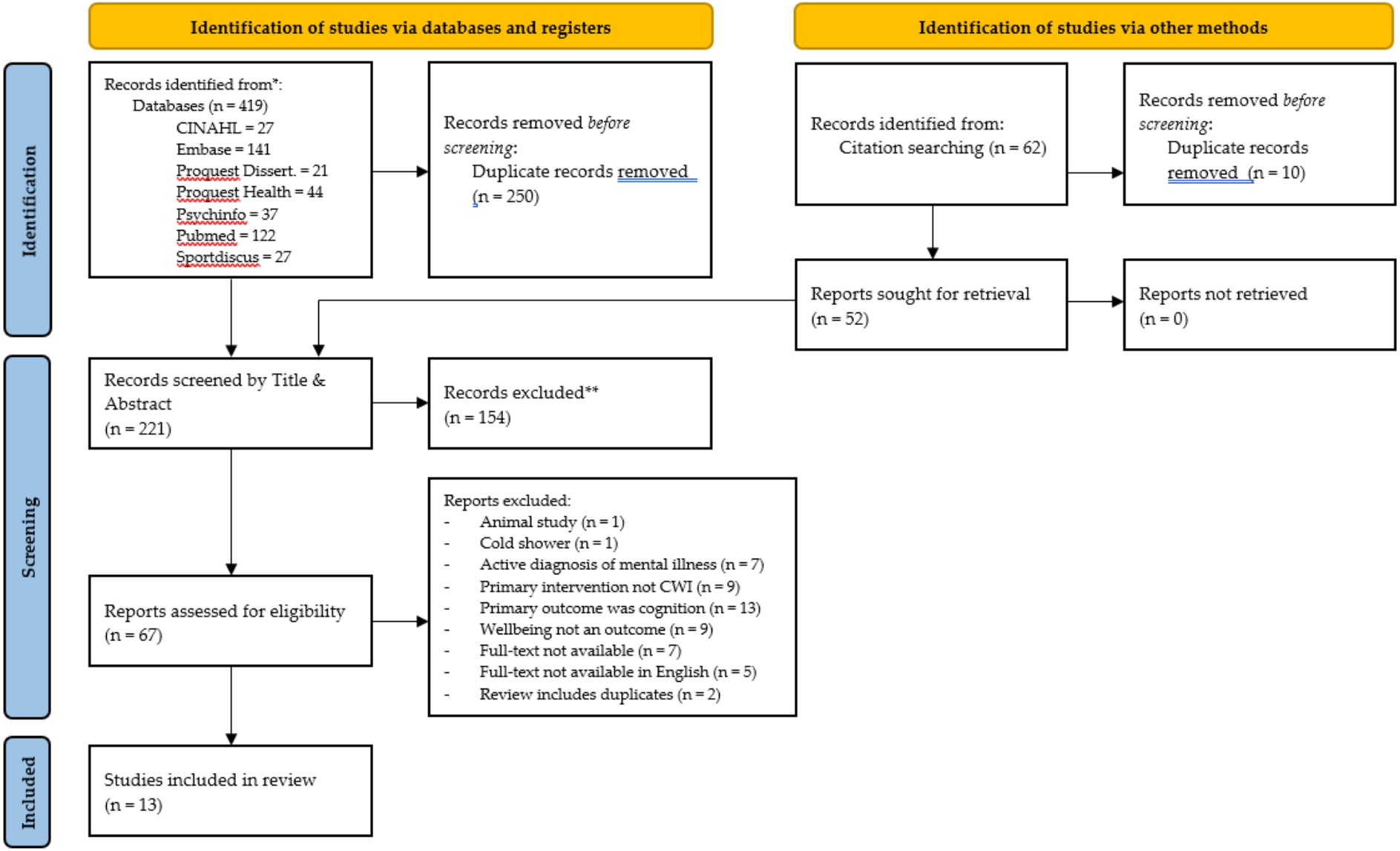
3.1.1 Years

The retrieved studies for this review were all journal articles (n = 13), published from 2002 – 2023. A significant number of the included articles were published after 2019 (11/13, 85%), with 2023 having the most publications (4/13, 30%).

3.1.2 Study design

The most frequently used research design was qualitative studies which made up 53% of the included studies (7/13). Among the qualitative studies, five out of the seven studies employed a phenomenological approach as their methodology (5/7, 71%). One study utilised an ethnographic approach (1/7, 14%), while one of the qualitative studies used both an ethnographic and phenomenological methodology (1/7, 14%). The remaining articles included quantitative study designs (5/13, 33%) and one mixed-method study design (1/13, 7%).

Figure 1. Study Flow Diagram (PRISMA-ScR Flow Chart)



3.1.3 Country of publication

Nearly half of the studies were published in the United Kingdom (7/13, 53%). The remaining countries included the following: United States (2/13, 15%), Switzerland (2/13, 15%), Romania (1/13, 7%), and Italy (1/13, 7%).

3.2 CWI characteristics

An overview of the CWI parameters used in the studies, encompassing geographical location, duration of participation in CWI, water temperature, frequency of CWI participation, and session exposure duration, are described in Supplementary Materials 4.

3.2.1 Location

Of the included studies, 10/13 (76%) provided information about the water source participants were exposed to. The majority of participants were exposed to seawater (7/13, 53%), while other sources included lakes (1/13, 7%), cold baths (1/13, 7%), and a combination of sea and lake exposure (1/13, 7%).

3.2.2 Tenure of CWI participation

Only four articles (4/13, 30%) reported on the years of experience, with one article (1/13, 7%) having no exposure to cold water in the previous 12-18 months (Yankouskaya et al., 2023). Demori et al. (2021) reported a mean of 9.6 years +/- 8 years experience with CWI. The other three articles ranged from six months to more than 35 years.

3.2.3 Temperature

Five of the articles (5/13, 38%) provided water temperatures. The average water temperature participants were exposed to was 13.8°C with the coldest temperature being 4°C and warmest being 19.9°C.

3.2.4 Frequency

Two of the articles included (2/13, 15%) were a one-off exposure. Two articles provided an average of days per month in which participants participated in CWI. These averages ranged from 2.5 - 8.5 days per month (Demori et al., 2021; McDougall et al., 2022).

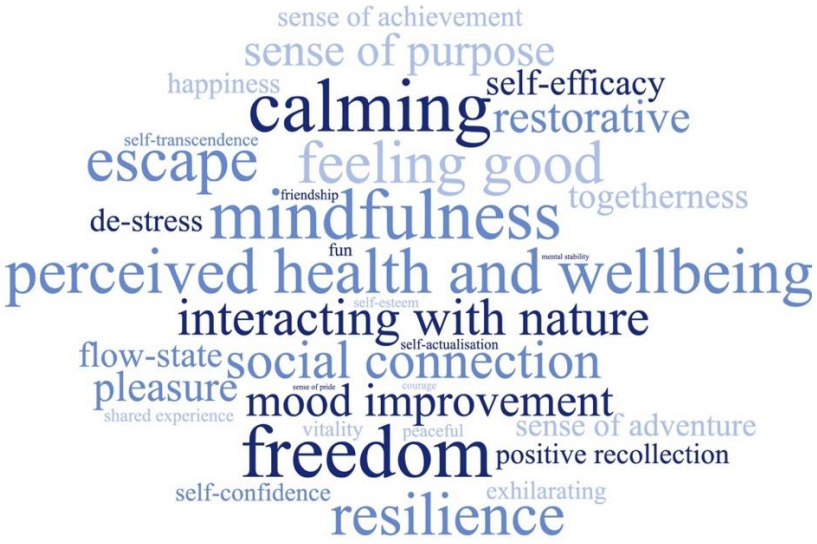
3.2.5 Duration

Only three articles (3/13, 23%) reported a duration for which the participants were exposed to CWI. The reported durations ranged from 5 minutes to 20 minutes. The average time for participants reported by Kelly and Bird (2022) averaged 18’36” +/- 1’48”, this is due to participants being able to leave the water at any point throughout the study.

3.3 Category and theme descriptions

A total of 34 unique codes were grouped into eight categories and four themes, and a finalized frequency count of each code can be seen in Supplementary Material 5. The code “Perceived health and well-being" was the most frequently coded (n = 30). Figure 2 represents the frequency of codes which the authors used to describe the experiences of CWI.

Figure 2. Code frequency word cloud



Categories were grouped into 4 themes relating to the participant's qualitative experiences of CWI including: 1) physical and psychological health, 2) exposure to nature, 3) sense of connectedness, 4) personal growth. The developed themes are a direct reflection of the codes. To depict how a theme was developed, individual meaning units (raw data) were coded and developed into results (See Table 2). Each of the themes are described, along with a visual representation below (see Figure 3).

Table 2. Example of process from raw data to theme

Meaning Unit	Code	Category	Theme
"…it was shockingly cold (4°C), and there was quite a strong current we weren't expecting, so it took us about 45 minutes to get there and 25 minutes to get back… but we like doing those sorts of challenges, like it's 'let's see if we can push it quite hard' really, and when you comeback from something like that you just feel like 'epic!'" (Christie & Elliott, 2023, p. 10)	Resilience Self-efficacy Achievement	Coping with adversity Personal fulfilment	Personal growth

3.3.1 Physical and psychological health

A common theme among individuals participating in CWI was that they reported physical and psychological health benefits. Three out of the eight categories contributed to the development of the theme. The content category of headspace was most frequently coded (n = 74). As CWI resulted in participants reporting being fully in the moment, and when immersing into the cold water, often found a sense of peace and clarity (Christie & Elliott, 2023; McDougall et al., 2022).

> You have to be present. Like it's like the most mindful experience ever . . . you don't have time to think about how you feel before you don't have time to think about what's going to come after. It's like you're so present. (McDougall et al., 2022, p. 7)

Having positive emotional experiences was often associated with CWI, as individuals often reported feeling good, and feeling exhilarated after going into the cold water.

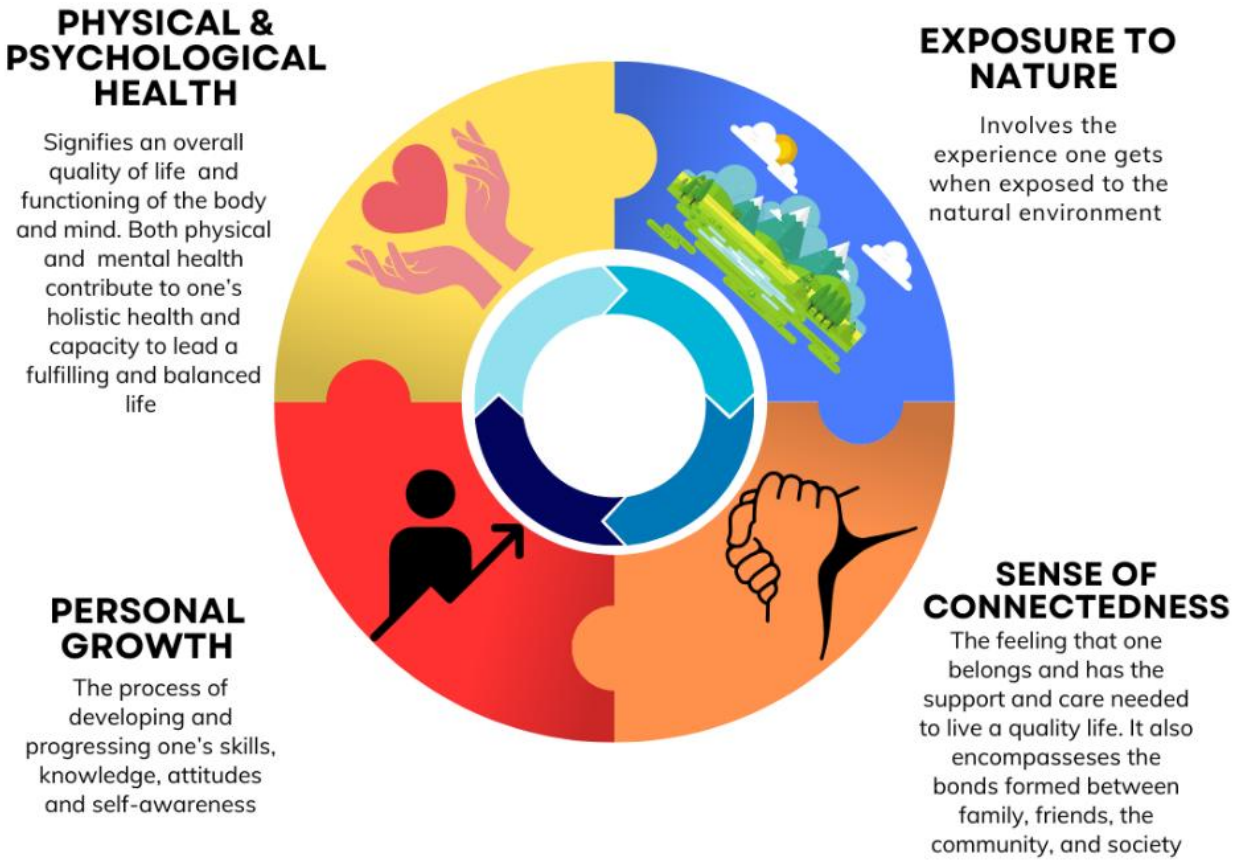
> . . . when we step into the water, our cortisol levels drop and our brains switch into a different mode. He asserts that this can boost creativity, settle the brain and the body down and reduce stress and reconnects you to the place, to yourself and to those you are with and makes you happy. (Oliver, 2021, p. 106)

Christie and Elliott (2023) related swimming in the cold water as "hedonic impacts ('wow, fantastic, I feel a million dollars!'), reinforced by non-verbal communication including beaming smiles and positive, animated gestures" (p.17). CWI was also utilised by the majority of individuals as a way to improve one's physical and mental health. Participants felt a sense of relief from certain longstanding ailments following their exposure to CWI.

> Since I started coming here around ten years ago, the arthritis in my legs has gone away, and I think it's the swimming that does that. (Foley, 2015, p. 221)

> I had a car accident eight years ago and I've had back issues ever since . . . when I first started, it initially it increased my use of painkillers, but after about six months, I completely stopped taking them basically and it was mainly because it just strengthened my core muscles. (McDougall et al., 2022, p. 6)

Figure 3. Four themes describing the qualitative benefits of CWI



3.3.2 Exposure to nature

One category (outdoor adventure) was developed from three individual codes, illustrating the theme of "exposure to nature." This theme was a significant part of CWI, as oceans, lakes, and rivers enabled individuals to form connections with the water and surrounding landscape. Moreover, the unpredictability of nature created a sense of adventure in some individuals, while,

for others, engaging in CWI represented a novel and intriguing experience worth trying.

> You will have the really clear calm seas which are incredible, and they're not boring . . . but they're not as exciting as the wild ones. So, the personality of the sea becomes your friend in a strange way. (Foley, 2015, p. 93)
>
> . . . sea swimming provoked a mixed response in terms of participation: some enjoyed the extra "challenge" provided by "choppy" conditions; others found such conditions intimidating. Those with a preference also referenced the buoyancy offered by the salt water that negated the need for wetsuits, offering an extra sense of freedom. (Christie & Elliott, 2023, p. 12)

3.3.3 Sense of connectedness

CWI offered the opportunity for people with similar interests to come together, form relationships, and share unique experiences that can only come from swimming in the cold waters. The underlying content categories, social relationships and shared experiences contributed to individuals forming friendships, engaging in conversation, and creating a sense of camaraderie, support, and acceptance. Christie and Elliot (2023) reported individuals felt connected because swimming provided the opportunity to "feel part of a group, or simply [have] a training partner (p. 16)."

> Many swimmers attest to having found a new community, a new "tribe," a new group of friends, all of whom share the love of outdoor swimming. Numerous groups of open water swimmers . . . encourage each other, chat and make social and community connections. (Oliver, 2021, p. 107)
>
> . . . the sense of other bodies being alongside seemed to impact on the swimming experience. Three swimmers described how their decisions might be influenced by those around them. In more challenging conditions, there was a feeling of being in it together which engendered a motivation that would be difficult to find without an ally equally prepared to take the plunge. Learning from those with more experience also allowed swimmers to stretch their limits. (Denton & Aranda, 2020, p. 654)

Furthermore, according to Christie and Elliott (2023), unique relationships were formed as participants found like-minded individuals to engage in swimming with and provide competition.

> . . . swimming with two swimming "buddies" he had now brought his open water swimming standard up . . . which had also provided a significant boost to his confidence levels, leading to his debut in an open water sprint event. (Christie & Elliott, 2023, pp. 8-9)

3.3.4 Personal growth

Combining the categories of coping with adversity and personal fulfilment led to the emergence of an overarching theme of personal growth. Regular participation in CWI progressively nurtured individuals' courage and created a resilience that ultimately translated into a profound sense of achievement as they successfully confronted the initial cold water immersion shock. Furthermore, regular participation in CWI appeared to result in "transformations" in which individuals developed a newfound perception of themselves, along with the confidence to face any challenge that comes upon them. This personal growth is a key theme that individuals

experience during CWI (Denton & Aranda, 2020).

> Participants explored the sense of achievement they felt after battling with cold waters. The sea provided a protective armour, allowing participants to feel "smug," having the mental strength to face anything: "there's nothing you can throw at me now." (Murray & Fox, 2021, p. 92)
>
> . . . it was shockingly cold (4oC), and there was quite a strong current we weren't expecting, so it took us about 45 minutes to get there and 25 minutes to get back . . . but we like doing those sorts of challenges, like it's "let's see if we can push it quite hard" really, and when you comeback from something like that you just feel like "epic!" (Christie & Elliott, 2023, p. 10)
>
> When I first get in, faced the challenge of the coldness of the sea and when one has found it is ok, you are feeling good about that. It hasn't killed you. (Denton & Aranda, 2020, p. 651)

CWI was also utilised as a way to cope when dealing with difficult challenges in life. It provided a new direction in life, when individuals were faced with grief due to losing a loved one. In a sense, CWI helped shape a new sense of identity, while helping to build a new routine, and at the same time providing an outlet to de-stress.

> I couldn't swim much I was going through a rough patch because my father just died and I really missed getting in the water because that's my form of exercise to deal with stresses of daily life… I found it really tough to miss the water. If I don't swim three times a week, four times a week, I notice the adverse impact that has on me. (McDougall et al., 2022, p. 9)

4. Discussion

This scoping review is the first to investigate how CWI influences well-being in healthy populations. As laid out in the introduction, the primary objectives of this study were: 1) to outline the experiences individuals have from CWI that may influence well-being, 2) to investigate the CWI parameters including temperature, frequency, and duration that result in well-being, 3) to identify any knowledge gaps to inform future research.

A qualitative content analysis was performed to outline the qualitative findings. From the 13 included articles, four unique themes were developed, highlighting the experiences healthy individuals gain from CWI that have a positive influence on well-being. Based on the qualitative findings, individuals participating in CWI are exposed to a complex experience characterised by interconnected concepts: physical and psychological benefits, sense of connectedness, personal growth, and exposure to nature, all of which may have a potential influence on improving well-being.

There are several possible explanations that may explain how CWI influences well-being. Firstly, CWI has a profound impact on well-being due to the multitude of physiological effects that result in mood enhancement, anti-depressant effects, and fostering mindfulness (Christie & Elliott, 2023; Hirvonen et al., 2002; Hjorth et al., 2022; Richter & Hunecke, 2021; Srámek et al., 2000; van Tulleken et al., 2018). It is proposed that increased mindfulness can enhance self-awareness, including incorporating strategies of self-care, awareness of body sensations, and emotional regulation strategies, all of which influence well-being (Richter & Hunecke, 2021). These findings were corroborated in an ethnographic study by Christie and Elliott (2023), who investigated the motives for participating in open-water swimming. The theme of perceived health and well-being enhancements was reported by participants who often experienced

relaxation, enhanced moods, and restoration of physical ailments after engaging in CWI. This evidence suggests that CWI, including swimming, may promote therapeutic benefits, which could be a key motive for engaging in CWI, and these potential benefits may have a significant influence on well-being.

Secondly, a sense of connectedness was found to be a common theme in CWI which may influence well-being. This theme was reported in a study by McDougall and colleagues (2022) who suggested that loch (lake) swimming provides an opportunity to come together and share a unique experience with other participants experiencing the same cold shock. It appears that the value of CWI goes beyond the physical benefits, promoting a wider social benefit that may also contribute to well-being. In a study done by Seppala et al. (2013), socially active individuals reported increased happiness, reduced levels of depression and anxiety, and greater resilience to stressors. The study further revealed that those with a low sense of social connection experienced greater psychological distress. This heightened distress can lead to social anxiety, decreased interpersonal trust and diminished self-esteem (Seppala et al., 2013). The sense of connection to others appeared to not only enhance an individual's well-being but may help to foster a feeling of support and camaraderie that uplifts the entire community.

Furthermore, CWI may provide a multifaceted approach to stress reduction and building resilience, which is essential for enhancing overall well-being. This finding is in accordance with a study by Demori et al. (2021), who highlighted winter sea bathing may be associated with lower levels of self-reported stress and increased well-being. Winter swimmers have improved overall health because of being able to better manage potential adverse stress situations like cold exposure. Through these stressful situations, the winter swimmers are able to turn these into positive stresses through cold water adaptability and habituation of the hypothalamus-pituitary-adrenal axis (Demori et al., 2021). A meta-analysis by Hu et al. (2015) analysing the relationship between resilience and mental health, revealed a positive correlation between resilience and psychological well-being (effect size r = 0.5). It is feasible that resilience helps individuals attain higher levels of well-being by reducing the harmful impacts of adversity like depression while helping promote the ability to deal with difficult situations. Overall, CWI may be able to promote valuable stress-reducing strategies and foster resilience and self-regulation skills. Embracing the discomfort of CWI may be one avenue for individuals to explore a path to personal growth, potentially contributing to well-being enhancements and a greater quality of life.

Lastly, this review found that CWI may promote a connection with nature that can lead to positive well-being experiences. This finding was corroborated in a study by Denton and Aranda (2020) who revealed sea swimmers experience strong connections with nature and the natural environment. This finding may be explained by blue spaces, which are defined as natural environments with water at its core, and offer the potential for health and well-being benefits (Britton et al., 2020). A systematic review by Britton et al. (2020) investigated the health benefits of blue spaces. The findings revealed blue spaces may have a direct influence on health, revealing significant positive associations with well-being indicators. It appears evident that interacting with nature can promote well-being (Britton et al., 2020). In relation, the findings of this review revealed that individuals clearly experience a strong interaction with nature during CWI, which may also positively impact well-being. It is evident that well-being is a multidimensional concept, and CWI may indeed contribute to several of these dimensions.

4.1 Gaps in the research and recommendations

Following this review, the optimal parameters to achieve well-being through CWI remain unclear. This can be primarily attributed to the paucity of qualitative studies that have

incorporated specific variables such as water temperature, frequency of participation, and duration of CWI session. Strict protocols, similar to the one used by Yankouskaya et al. (2023), where the researchers used temperature controlled whole-body baths is needed for future research to investigate the parameters that are needed for CWI influence on well-being. This will assist in understanding how much of a role nature has on well-being during CWI without blue spaces confounding the results. It brings into question whether the four themes outlined in this review could be experienced in other environments or using other modalities such as WBC.

The primary aim of this scoping review was to outline how well-being was influenced through the positive experience of CWI; however, negative experiences were also reported in the literature (Christie & Elliott, 2023; Foley, 2015; Kelly & Bird, 2022; McDougall et al., 2022; Oliver, 2021; Oliver et al., 2023). Primarily, these revolved around the perceived risks associated with swimming in cold water and the anxiety of swimming in natural bodies of water (McDougall et al., 2022; Oliver, 2021; Oliver et al., 2023). Future exploration of this would benefit from investigating all the negative and positive experiences. This may assist in better-informing practice guidelines for individuals participating in CWI to enhance their well-being. Another area for future research would need to eliminate the inconsistencies in relation to the definition of well-being. Utilisation of a validated measure of well-being such as the multidimensional well-being profile (WB-pro) developed by Marsh and colleagues (2020) may be a suitable option, particularly for qualitative studies.

4.2 Strengths and limitations of this review

The strengths of this scoping review included providing a broad overview of the existing literature, including both published and grey literature. Additionally, this review utilised two reviewers to independently screen and select articles, therefore reducing selection bias. Another strength in this review was that the content analysis, which was performed by the three authors, resulting in an iterative and collaborative process. To ensure there was stability and consistency in the coding process, the authors re-coded the data on three separate occasions (Kleinheksel et al., 2020). Discussion among authors was also conducted to ensure inter-coder agreement. Agreement among researchers can be said to lead to trustworthiness in the results (Elo & Kyngäs, 2008). Furthermore, instead of relying on one researcher's perspective to analyse the data, "positional reflexivity" among the researchers was encouraged (Kleinheksel et al., 2020). This resulted in each author applying their individual experiences and perspective to the analysis which contributed to a deeper interpretation of the data (Elo & Kyngäs, 2008; Kleinheksel et al., 2020).

As previously alluded to, the use of CWI to promote well-being in healthy individuals is an emerging topic, and as such, this scoping review was limited by the small number of available studies. With only 13 studies meeting the inclusion criteria, further research is needed to investigate the experiences of CWI in healthy individuals. Another major limitation in this scoping review was that no critical appraisal was done for the included studies, as this did not align with the aim of this paper. Therefore, this review may include articles varying in quality, with the possibility of bias within the included studies' methodologies. Furthermore, this review was limited to articles written in English, and as there is a growing amount of research emerging from European countries, there is the possibility of excluding articles written in other languages.

5. Conclusion

This comprehensive scoping review has offered an overview of the existing literature concerning CWI and its impact on well-being, through the experiences of healthy individuals. Among the 13

studies included in this review, four themes emerged after completing a qualitative content analysis: 1) physical and psychological health benefits, 2) connection to nature, 3) sense of connectedness, 4) personal growth. Partaking in CWI shows significant promise as a means to enhance well-being. This review also attempted to establish precise parameters for the prescription of CWI in order to optimise well-being, however, there was insufficient evidence to determine definitive conclusions regarding the ideal prescription guidelines. As the prevalence and significance of mental health disorders continues to grow, future research should aim to clarify the optimal practices and parameters around CWI that may improve well-being. Given its accessibility and cost-effectiveness, CWI can serve as a viable resource for mental health services.

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Data availability statement

The data utilized in this study can be accessed on request from the corresponding author.

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