

Title Page

The swimming habits of women who cold water swim

Megan Pound, Heather Massey, Sasha Roseneil, Ruth Williamson, Mark Harper, Mike Tipton, Jill Shawe, Malika Felton, Joyce Harper*

Megan Pound, Institute for Women's Health, University College London, UK, ORCHID: 0009-0001-8144-5401

Heather Massey, Department of Sport, Health and Exercise Science, University of Portsmouth, Brighton, UK ORCHID: 0000-0002-7542-513X

Sasha Roseneil, University of Sussex, Brighton, UK, Orchid: 0000-0002-0618-689

Ruth Williamson, Hampshire Hospitals NHS Foundation Trust, UK., ORCHID: 0000-0002-2734-1601

C. Mark Harper. University Hospitals Sussex NHS Foundation Trust, Worthing, UK and Sørlandet Sykehus, Kristiansand, Norway, ORCID number is: 0000-0003-2777-9555

Mike Tipton, Department of Sport, Health and Exercise Science, University of Portsmouth, Brighton, UK ORCHID - 0000-0002-7928-8451

Jill Shawe, University of Plymouth and Royal Cornwall Hospitals NHS Trust, Cornwall, ORCHID: <https://orcid.org/0000-0002-2766-7302>

Malika Felton, Department of Rehabilitation and Sport Sciences, Bournemouth University, Poole, UK, ORCHID is 0000-0003-4675-6076

Joyce C Harper, Institute for Women's Health, University College London, ORCHID: 0000-0001-6364-2367

*author for correspondence: Full address 86-96 Chenies Mews, Institute for Women's Health, University College London, London, UK WC1E 6HX, joyce.harper@ucl.ac.uk

Abstract

Background: Cold water swimming is growing in popularity, especially amongst women. We have previously reported that women felt that cold water swimming helps with their menstrual and menopause symptoms. But little is known about the habits of women who cold water swim.

Objectives: To determine the habits of women who cold water swim

Design: This was a mixed methods study.

Methods: An online survey asked women who cold water swim about their experience of swimming and how this affected their menstrual and menopause symptoms. The survey was advertised for 2 months on social media, with a focus on advertising in cold water swimming Facebook groups. In this paper, only the questions on the women's swimming habits were analysed.

Results: The analysis of 1114 women, mainly from the UK, revealed that most had been swimming for 1-5 years (79.5%). Most swim in the sea (64.4%) and only 15.5% swim alone. The majority (89.0%) swim all year around, swimming for mainly 30-60 mins in the summer and 5-15 minutes in the winter. The women mostly swim wearing swimming costumes (skins) throughout the year. The majority of the free text responses showed women found mental and physical benefits from cold water swimming.

Conclusion: It was not surprising to learn that women swim for longer in the summer than the winter, but hearing how they feel cold water swimming helps their physical and mental health is important. With the limitations on access and safety of many wild swimming sites in the UK, it is time to ensure that cold water swimming is safer and more supported.

Key words: swimming, cold water swimming, wild swimming, women, women's health, habits

Plain language summary;

The swimming habits of women who cold water swim

Cold water swimming is growing in popularity, especially amongst women. But little is known about the habits of women who swim. In this study we wanted to look at the habits of women who cold water swim, using an anonymous, online survey which was promoted through social media. Over 1000 women answered the survey and most of them had been swimming for 1-5 years. The vast majority swim all year round, for 30-60 minutes in summer and 5-15 minutes in winter. They mostly swim wearing swimming costumes only throughout the year. The women reported that they found mental and physical benefits from cold water

swimming. With issues around access and safety in many wild swimming sites in the UK, support is needed to ensure that swimming is safer and more supported.

Introduction

Cold water swimming is increasing in popularity in the UK and abroad, with membership of the UK Outdoor Swimming Society increasing from 300 members in 2006, to 187,000 members in 2022.^{1,2} In the current literature, there is some evidence that voluntary immersion in cold water may have health benefits.^{1,3,4} However most the data remains anecdotal or comes from case studies^{5,6}.

Cold water swimming has a multitude of definitions. The International Ice Swimming Associations (IISA) and the International Winter Swimming Association (IWSA) define cold water as +5.1 to +9°C, freezing water as +2.1°C to +5°C, and ice water as -2°C to 2°C.^{7,8} However, many studies use cold water swimming as an umbrella term to describe swimming at temperatures up to 20°C throughout the year.⁹ Not all cold water swimming consists of significant swimming, but rather cold water immersion (CWI), or colloquially ‘cold plunges’ or ‘dipping’, where swimmers expose themselves to the effect of the cold water for a short period of time.^{10,11}

Health Benefits of Cold Water Swimming

The physical and mental benefits of swimming have been long established.^{1,3,4,5,6,9} Swim England have collaborated with the Royal College of General Practitioners (RCGP) to promote ‘swimming as medicine’.¹²

The aerobic benefits of swimming are potentially enhanced by the effect of cold water.¹³ Ice baths or CWI are frequently used to aid athletes’ recovery and muscle repair¹⁴ but their actual benefits are debated.^{15,16,17} Increasingly, studies are demonstrating the adaptations that cold water swimmers develop to increase their cold-water tolerance, as well as further endocrine, cardiovascular and psychological benefits.^{1,11}

Massey et al.,¹⁸ undertook a survey of open water swimmers and showed the positive perceived impact on mental health conditions as well as suggesting a potential long-term improvement in the mood of novice cold-water swimmers. Case studies suggest that cold

water swimming could be used as treatment for depression associated with chronic illness and major depressive disorder.^{20,21}

Being present in an outside or 'blue' space has been shown to have a positive impact on mental health, following the theory of attention restoration, promoting recovery from cognitive exhaustion.^{21,22} Following a series of interviews conducted with participants whilst swimming, Denton and Aranda²³ concluded that the impact is multi-layered and included transformation, reorientation and connection. On a physiological level, it has been hypothesized the parasympathetic nervous system promotes this restoration, stimulating a stress recovery response.²⁴ More recently, Burlingham et al.,²⁵ undertook a feasibility trial of cold-water swimming in which it was observed that symptoms of depression and anxiety were reduced in participants.

Risks of cold water swimming

There are risks of cold water swimming including the obvious risk of drowning and the risk of cardiac arrest which is exacerbated by 'cold shock'.^{26,27} Local neuromuscular cooling can lead to physical incapacitation in as little as 10 minutes.^{28,29} Hypothermia is also a risk, especially for experienced, cold-adapted swimmers, who are poor at accurately estimating their deep body temperature whilst swimming.³⁰ Therefore, there is a danger that they may be unable to determine when to exit the water before becoming hypothermic.³⁰ Swimming-induced pulmonary edema (SIPE) occurs in healthy individuals as a result of cold water swimming.³¹ It is characterized by acute onset of cough and dyspnea while swimming, sometimes accompanied by exhaustion, excessive sputum and hemoptysis, or a combination.³¹

There is also the issue of pollution. Sewage pollution is becoming an increasingly common concern in UK rivers and seas, increasing the likelihood of gastroenteritis and other infections.^{32,33} In the UK, designated bathing waters are typically only monitored during the bathing season, generally from May to September. Although the vast majority of UK designated bathing waters meet prescribed standards during the bathing season, this may not always be the case.

With the increase in popularity of cold water swimming, we felt it was important to study women who cold water swim as no studies have been conducted specifically with women. The survey we did was split into two studies: the habits of cold water swimmers are reported here

and questions relating to whether women feel that cold water swimming affects women's menstrual and menopause symptoms, which has been reported elsewhere.³⁴ Through this, we hope to characterise those that engage in cold water swimming and gain a greater understanding of their motivations and hurdles to swimming.

Methods

This was a mixed methods, observational study. The STROBE Guidelines were used when preparing the manuscript. This project was approved by UCL Research Ethics Committee: 9831/007. To undertake the survey, participants had to click consent to continue onto the survey questions.

A research team of academic and clinical experienced cold water swimmers (Joyce Harper, Sasha Roseneil, Ruth Williamson, Heather Massey) designed the online survey using Qualtrics, with discussion with additional cold water swimmers. The survey comprised 42 questions which were mainly multiple choice with some open questions (Supplementary material 1).

The survey was validated through in-depth interviews with 6 women who were cold water swimmers, going through each question in turn. They made minor edits and suggestions. The final survey was advertised mainly via cold water swimmers Facebook groups but was also promoted on social media (Supplementary material 2). The survey was live from 7th June to 6th August 2022 and was closed when it felt that saturation was reached i.e. no additional insights were obtained.

Participants were considered eligible if they were women who swim outdoors in unheated water. The survey excluded men and those who did not swim outdoors in unheated water. After consenting to undertake the survey, the women were asked descriptive data including their age, sexual orientation, relationship status, number of children and self-described health data. They were asked about their cold water swimming habits and how swimming affected any menstrual and menopausal symptoms (the latter data is not shown in this paper and has been published elsewhere.³⁴

Results

Demographics

1357 women started the survey and 1114 pressed submit (1114/1357, 82.1%). Only submitted responses were included in the study.

The overwhelming majority of the participants resided in the UK (1041/1114, 93.4%)(Table 1). The age of the participants ranged from 16 to 80 years, with an average age of 49 years. Most of the participants were aged between 45-54 years (577/1114, 51.7%), heterosexual (981/1114, 88.1%), and married/in a civil partnership (670/1114, 60.1%). Nearly 70% of participants had one or more children (774/1114, 69.5%), but a large proportion did not (340/1114, 30.5%).

Participants tended to have either university undergraduate (303/1114, 27.2%) or university undergraduate and postgraduate (555/1114, 49.8%) qualifications (Table 2). Over half of the women had no religion (601/1114, 53.9%), and the vast majority had no disability (927/1114, 83.2%). The overwhelming majority of the participants described themselves of White (English/Welsh/Scottish/Northern Irish/British) background (965, 86.6%).

Health of the Participants

Women were asked to describe their health by selecting statements they felt applied to them (Figure 1). Most women stated they regularly exercise (accumulating at least 150 minutes of moderate exercise or 75 minutes of vigorous exercise in a week) (866/1114, 77.6%), had a healthy diet (participants own perception of “I eat well most/all of the time”) (844/1114, 75.6%) and do not smoke (843/1114, 75.5%). Only 68.4% (577/1114) stated they would consider themselves to have good mental health.

The women were asked to select the type of exercise they participate in outside of cold water swimming (Figure 2). The most common exercises stated were walking/hiking (817/1114, 73.3%) and yoga/Pilates/tai chi (524, 47.0%).

Cold Water Swimming Habits

Women were asked about their cold water swimming habits.

Women were asked why they swim, selecting all answers that applied (Figure 3). The majority of women (847/1114, 76.0%) stated the main reason they swim was to be outside, followed by their mental health (729/1114, 65.4%). Of the 729 women who state one of the main reasons

they swim is for their mental health, 299 stated they have good mental health, and 430 did not state they have good mental health. They also stated that exercise (670/1114, 60.1%) and general health (592/1114, 53.1%) were their main reasons for swimming. Nearly 1 in 5 women (199/1114, 17.9%) swim mainly to relieve menopause symptoms, but only 3.1% (35/1114 women) swam mainly to relieve menstrual symptoms.

We did not specifically ask women if they were perimenopausal, postmenopausal, etc, but 785 women were considered menopausal and directed to finish the menopause section, compared to 711 menstrual. Some women would be considered as both as they would have been going through the menopause during their time cold water swimming.

Women were asked how long they have been cold water swimming (Figure 4). The majority of women had been swimming for more than a year (885/1114, 79.5%).

Women were asked in which types of water they swim in (Figure 5), and who they swim with (Figure 6). Most of the women swim in the sea (717/1114, 64.4%), followed by a lake (458/1114, 41.1%). Most women swim with other people, with just 15.5% (173/1114) stating they normally swim alone.

The women were asked to state whether they swim in the summer, winter, or both (Table 3). 10.6% (118/1114) of women stated they swim in the summer only, compared to 5/1114 (0.4%) stating they only swim in the winter. The majority (991/1114, 89.0%) stated they swim in both the summer and winter. For the following graphs, the summer swimming statistics are out of 1109, compared to the winter swimming statistics which are out of 996.

Women were asked how often they choose to swim in each season separately (Figure 7). Those who stated they swim in both summer and winter completed the summer and winter question separately. In summer, the most common frequency for swimming was a few times per week (677/1109, 61.7%) Of the 996 women that stated they swim in the winter, most swim between once a week (338/996, 34.0%) and a few times per week (418/996, 42.0%). Any selection of 'Do not swim in the winter' was excluded from the analysis.

Women were asked how long these swims would last (Figure 8). In the summer, the most common length of time for a swim was 30-60 minutes (534/1109, 48.2%). In the winter, the majority of swims were stated to last between 5-15 minutes (534/993, 53.8%).

Women were asked what they wear whilst swimming, selecting all answers that applied (Figure 9). The most common item worn in the summer in this cohort of women is swimming costumes/skins (1037/1109, 93.5%). Those who selected 'Do not swim in the summer' were excluded from this analysis. In the winter, the majority of women stated they wear swimming costumes/skins (739/993, 74.4%), but a considerably higher percentage stated they also wore neoprene gloves and socks (695/993, 70.0%). Those who selected 'Do not swim in the winter' were excluded from this analysis. The percentage of women who wear a wetsuit increased in winter (250/993, 25.2%) compared to summer (110/1109, 9.9%).

Free text comments

At the end of the survey, 745 women gave free text comments, with the majority stating that cold water swimming helped their mental and physical health and that being in nature and swimming with friends made them happy. A sample of these are reported below.

Cold water swimming has been so good for my mental health.....The elation after a swim is remarkable and priceless.

Certainly puts you in a good mood and sets you up for the day

The main gain for me is it resets my mood if I'm feeling stressed or anxious.

I feel cold water swimming helps my emotional health and clears my head. I do feel physically better when I have gone for a swim.

Open water swimming is my happy place.

Wild swimming completely resets my physical and mental state to calm.

I like being in the fresh air and the effect of the invigorating sea is beneficial to mental health

Swimming outdoors gives me a sense of wellbeing because I am free to swim when I want, where I want and for how long. Immersing myself in a loch where there are no people, kids, lanes is just bliss.

I feel I have stolen a moment that nobody else will have. I feel alive and thankful.

Lifts your mood , you are with nature and the sea. It's relaxing and so much fun. Going with a female friend is just the best. Makes you feel SO ALIVE!

If I am unable to swim for more than a week, my mental health deteriorates.

Cold water is phenomenal. It has saved my life. In the water, I can do anything.

Leave my worries on the sand and for the time I'm in the sea I feel me again

Exercising in nature, alone or with a group of other women is healing.

Discussion

Cold water swimming has become a highly popular sport but this is the first study specifically asking about women's cold water swimming habits. In this survey we found that women's swimming habits varied, but most of the women were likely to swim in both summer and winter, wearing swimming costume/skins all year-round and most swim for 30-60 minutes in the summer which reduces to 5-15 minutes in winter. As well as a reduction in swim time in winter, many added neoprene gloves and boots to keep warm and some moved to wearing a wetsuit, which would reduce the rate of local muscle cooling and deep body cooling. This enabled them to continue swimming even during the coldest months. But it is important to note that swimming in the UK winter for prolonged time gives an increased risk of hypothermia³⁰, peripheral neuromuscular cooling and incapacitation.^{28,29}

Benefits of Cold Water Swimming

In our study, the reasons for swimming varied but the majority do so to be outside, to support recovery from poor mental health or maintain good mental health and exercise. The positive effects of exercising outside, often with a community, and in cold water, was reported to have health benefits and aligns with previous studies.^{1,23} Women were most likely to swim with other people, which could be for safety reasons but may also indicate the importance of community. Social isolation is an important determinant of mental and physical health so this is likely to contribute to the wellbeing benefits derived from the activity.³⁵

A set of data from the same survey that was reported here, asked women if they felt cold water swimming affected their menstrual and menopause symptoms.³⁴ Women reported that cold water swimming reduced their menstrual symptoms; notably psychological symptoms such as: anxiety (46.7%), mood swings (37.7%) and irritability (37.6%). Perimenopausal women reported a significant improvement in anxiety (46.9%), mood swings (34.5%), low mood (31.1%) and hot flushes (30.3%). The majority of women (56.4% for period and 63.3% for perimenopause symptoms) swim to relieve these symptoms and they felt that symptoms were helped by the physical and mental effects of the cold water which was more pronounced when it was colder. How often they swam, how long for and what they wore, was also important.

The majority of women in this survey swim in the wild: sea, lakes, rivers and reservoirs, with only 12% swimming in an outdoor pool. The free-text question corroborated this, with many of the women commenting on the freeing and life-affirming impact of being in a natural space. The importance of 'green' and 'blue spaces' for overall health may be a key benefit of cold water swimming.^{36,37} An Australian study suggested the additive effect of exercising in the blue space, contributing to a reported improvement in wellbeing.³⁸ This provides a basis for the encouragement of cold water swimming, rather than cold water immersions such as cold showers, which may not elicit the same positive effect due to the lack of 'blue therapy'.¹¹ But there are other types of exercise that can be done in the water, outside, such as surfing bodyboarding, and sea hiking, which may well have the same positive affects.

Barriers to Cold Water Swimming

Despite the many benefits reported, swimming in cold water is not without risk. In the UK, the government bathing-water quality website only runs from May-September, ignoring the winter months where heavy rainfall and consequent sewage overflow most commonly occur.³⁹ In addition, cold-water swimming is dangerous, particularly for novices. The risk of hypothermia and 'immersion pulmonary oedema or swimming induced pulmonary oedema' is not insignificant.^{9,31}

There may be social barriers to the uptake of cold water swimming, notably those who cannot swim. The Sport England Report showed 95% of Black adults do not know how to swim.⁴⁰

There are a number of barriers for people who have no experience of swimming, particularly people from ethnically diverse backgrounds, as many swimming pools can be expensive to access, can be intimidating mainly white spaces. Therefore the group of people from ethnically diverse communities who may wish to swim outdoors is at present small. To increase diversity in outdoor swimming, we need firstly to develop spaces that welcome diversity and support ethnically diverse communities to participate in swimming.

In addition, economic barriers may play a role. Although considered a ‘free activity’, cold water swimming can come with costs: being close to somewhere to swim, access to open water (which is supported in Scotland but not in the rest of the UK), access for those with disabilities, parking, equipment and kit required, as well as the time taken to do the activity. These factors make cold water swimming less accessible than previously theorised.

Study Limitations

The limitations of this study must be recognised. A power calculation was not done. We aimed to get as many respondents to the survey as we could. By using an online survey to conduct our research, there is no way to verify the participants met our inclusion criteria, and therefore the results may be misaligned with that of the true population. Furthermore, the use of an online survey introduces a sampling bias, where those without access to the Facebook groups or the social media sites used would not have been able to fill in our survey.⁴¹ The study is also limited by the demographics of the sample: mostly representative of white, highly educated women as highly educated and/or white women are more likely to fill in surveys⁴² which may have been limited by the social media sites the survey was advertised on.

Conclusions

The women who cold water swim have reported the physical and mental health benefits from swimming. Exercising in nature, with a community, is a combination that should be encouraged. But cold water swimming has the added benefit of the effect of the cold water, which many women said helped their physical and mental health. It was not surprising to that women swim for longer in the summer than in winter, and they wear more clothes in winter.

Globally we should be ensuring that cold water swimming is accessible and safe. In England and Wales, cold water swimming is restricted, with a lack of support for cold water

swimmers, especially with access to swim spots, access for those with disabilities and the issue of pollution. Scotland encourages cold water swimming, as swimmers have a right to swim as part of their statutory right of responsible access to most land and inland water. It is time to make cold water swimming safer and more supported.

Acknowledgements

We would like to thank all the Facebook groups that allowed us to advertise the survey and for all the women who completed it.

Declarations

- Ethics approval and consent to participate: This project was approved by UCL Research Ethics Committee: 9831/007. To undertake the survey, participants had to click consent to continue onto the survey questions.

- Consent for publication: Agreed

- Funding: The study was funded by UCL

- Competing interests: Joyce Harper gives paid talks on reproductive health

- Availability of data and materials: Some anonymous data may be available after consultation with UCL ethics committee.

Author contributions:

Joyce Harper, Heather Massey, Sasha Roseneil and Ruth Williamson designed the survey. Megan Pound and Joyce Harper did the primary data analysis. All authors reviewed the data. Initial manuscript written by Megan Pound and Joyce Harper with edits from all authors.

References

1. Massey H, Gorczynski P, Harper CM, et al. Perceived Impact of Outdoor Swimming on Health: Web-Based Survey. *Interact J Med Res* 2022 ;11:e25589.
2. Outdoor Swimming Society. 2022. *Our Story*. Available at: <https://www.outdoorswimmingsociety.com/about-the-outdoor-swimming-society/> [Accessed 3 April 2023].
3. Burlingham, A., Denton, H., Massey, H., Vides., N., Harper, C.M. 'Sea swimming as a novel intervention for depression and anxiety – A feasibility study exploring

- engagement and acceptability.’, *Mental Health and Physical Activity*, 2022, 23: e100472. <https://doi.org/10.1016/j.mhpa.2022.100472>
4. Pett P, Massey H, Denton H, Burlingham A, Harper M. Evaluation of Outdoor swimming courses as an intervention to refresh and revitalise NHS workers. *medRxiv* 2022:2022.04.11.22273166.
 5. van Tulleken C, Tipton M, Massey H, Harper CM. Open water swimming as a treatment for major depressive disorder. *BMJ Case Reports* 2018;2018.
 6. Didrik Espeland, Louis de Weerd & James B. Mercer Health effects of voluntary exposure to cold water – a continuing subject of debate, *International Journal of Circumpolar Health*, 2022 81:1, DOI: [10.1080/22423982.2022.2111789](https://doi.org/10.1080/22423982.2022.2111789)
 7. IISA. (2021). *IISA Swimming Rules and Regulations*, August 2021. Available at: <https://internationaliceswimming.com/wp-content/uploads/2021/08/IISA-Swimming-Rules-and-Regulations-Aug-2021.pdf> (Accessed: 1 March 2023).
 8. IWSA. (no date). *Water Classification*. Available at: <https://iwsa.world/water-classification/> (Accessed: 1 March 2023).
 9. Knechtle, B., Waśkiewicz, Z., Sousa, C.V., Hill, L., Nikolaidis, P.T. ‘Cold Water Swimming – Benefits and Risks: A Narrative Review.’, *International Journal of Environmental Research and Public Health*, 2020 17(23): 8984. <https://doi.org/10.3390%2Fijerph17238984>
 10. Eimonte, M., Paulauskas, H., Daniuseviciute, L., Eimantas, N., Vitkauskiene, A., Dauksaite, G., Solianik, R., Brazaitis, M. ‘Residual effects of short-term whole-body cold-water immersion on the cytokine profile, white blood cell count, and blood markers of stress.’, *International Journal of Hyperthermia*, 2021 38(1): 696-707. <https://doi.org/10.1080/02656736.2021.1915504>
 11. Tipton MJ, Collier N, Massey H, Corbett J, Harper M. Cold water immersion: kill or cure? *Experimental Physiology* 2017;102:1335-55.
 12. Cummings I. *The Health and Wellbeing Benefits of Swimming*: Swim England; Demori I, Piccinno T., Saverino D., Luzzo E., Ottoboni S., Serpico D., Chiera M., Giuria R. Effects of winter sea bathing on psychoneuroendocrinoimmunological parameters. *Explore* 2021;17(2):122-126.

13. Manolis, A.S, Manolis, S.A., Manolis A.A., Manolis, T.A., Apostolaki, N., Melita, H. 'Winter Swimming: Body Hardening and Cardiorespiratory Protection Via Sustainable Acclimation.', *Current Sports Medicine Reports*, 2019 18(11): 401-415
14. Cullen, M.F.L., Cazazza, G.A., Davis, B.A. 'Passive Recovery Strategies after Exercise: A Narrative Literature Review of the Current Evidence.', *Current Sports Medicine Reports*, 2021 20(7): 351-358. <https://doi.org/10.1249/jsr.0000000000000859>
15. Bleakley, C.M. and Davison, G.W., What is the biochemical and physiological rationale for using cold-water immersion in sports recovery? A systematic review. *British Journal of Sports Medicine*, 2010 44(3), pp.179-187.
16. Choo, H.C., Lee, M., Yeo, V., Poon, W. and Ihsan, M. The effect of cold water immersion on the recovery of physical performance revisited: A systematic review with meta-analysis. *Journal of Sports Sciences*, 2022 40(23), pp.2608-2638.
17. Moore, E., Fuller, J.T., Bellenger, C.R., Saunders, S., Halson, S.L., Broatch, J.R. and Buckley, J.D. Effects of Cold-Water Immersion Compared with Other Recovery Modalities on Athletic Performance Following Acute Strenuous Exercise in Physically Active Participants: A Systematic Review, Meta-Analysis, and Meta-Regression. 2023 *Sports Medicine*, 53(3), pp.687-705.
18. Massey, H., Kandala, N., Davis, C., Harper, M., Gorczynski, P., Denton, H. 'Mood and well-being of novice open water swimmers and controls during an introductory outdoor swimming programme: A feasibility study.', *Lifestyle Medicine*, 2020 1(2): e12. <https://doi.org/10.1002/lim2.12>
19. Demori, I., Piccinno, T., Saverino, D., Luzzo, E., Ottoboni, S., Serpico, D., Chiera, M., Giuria, R. 'Effects of winter sea bathing on psychoneuroendocrinoimmunological parameters.', *Explore*, 2021 17(2): 122-126. <https://doi.org/10.1016/j.explore.2020.02.004>
20. Tulleken, C.V., Tipton, M., Massey, H., Harper, C.M. 'Open water swimming as a treatment for major depressive disorder.', *BMJ Case Reports*, 2018 bcr2018225007. <https://doi.org/10.1136/bcr-2018-225007>
21. Oliver DM, McDougall CW, Robertson T, Grant B, Hanley N, Quilliam RS. Self-reported benefits and risks of open water swimming to health, wellbeing and the environment: Cross-sectional evidence from a survey of Scottish swimmers. *PLoS ONE* 2023 18(8): e0290834. <https://doi.org/10.1371/journal.pone.0290834>

22. Coventry, P.A., Brown, J.V.E., Pervin, J., Brabyn, S., Pateman, R., Breedvelt, J., Gilbody, S., Stancliffe, R., McEachan, R., White, P.C.K. 'Nature-based outdoor activities for mental and physical health: systematic review and meta-analysis.', *SSM – Population Health*, 2021 16: e100934.
<https://doi.org/10.1016/j.ssmph.2021.100934>
23. Denton H, Aranda K. The wellbeing benefits of sea swimming. Is it time to revisit the sea cure? *Qualitative Research in Sport, Exercise and Health* 2020;12:647-63.
24. Kotera, Y., Richardson, M., Sheffield, D. 'Effects of Shinrin-Yoku (Forest Bathing) and Nature Therapy on Mental Health: a Systematic Review and Meta-analysis.', *International Journal of Mental Health and Addiction*, 2022 20: 337-361.
<https://doi.org/10.1007/s11469-020-00363-4>
25. Burlingham, A., Denton, H., Massey, H., Vides., N., Harper, C.M. 'Sea swimming as a novel intervention for depression and anxiety – A feasibility study exploring engagement and acceptability.', *Mental Health and Physical Activity*, 2022 23: e100472. <https://doi.org/10.1016/j.mhpa.2022.100472>
26. Tipton, MJ, The initial responses to cold water swimming in man. *Clinical Science* 1989 77,581-588
27. Tipton, M. & Bradford, C. Moving in extreme environments: Open water swimming in cold and warm water. *Extreme Physiology & Medicine*. 2014 3. 10.1186/2046-7648-3-12.
28. Tipton, M. J., Franks, C. M., Gennser, M. & Golden, F. St. C. Immersion death and deterioration in swimming performance in cold water. *The Lancet* 1999 Vol 354 21 Aug: 626-9.
29. Frank Golden, Michael Tipton, *Essentials of sea survival*. Human Kinetics, 2002 - Medicine, Naval
30. Saycell, J., Lomax, M., Massey H., Tipton, M. 'How cold is too cold? Establishing the minimum water temperature limits for marathon swim racing.', *British Journal of Sports Medicine*, 2019 54(17): 1078-1084. <https://doi.org/10.1136/bjsports-2018-099978>
31. Hårdstedt, M, Linda Kristiansson, Claudia Seiler, Annika Braman Eriksson, Josefin Sundh, Incidence of Swimming-Induced Pulmonary Edema: A Cohort Study Based on

- 47,600 Open-Water Swimming Distances, *Chest*, Volume 160, Issue 5, 2021, Pages 1789-1798, ISSN 0012-3692, <https://doi.org/10.1016/j.chest.2021.06.034>.
32. Tudor, S. (2022). 'Sewage pollution in England's waters.', *House of Lords Library: In Focus*, 30 June. Available at: <https://lordslibrary.parliament.uk/sewage-pollution-in-englands-waters/> (Accessed 29th March 2023).
33. Xiao, S., Hu, S., Zhang, Y., Zhao, X., Pan, W. Influence of sewage treatment plant effluent discharge into multipurpose river on its water quality: A quantitative health risk assessment of *Cryptosporidium* and *Giardia*. *Environmental Pollution*, 2018 223: 797-805. <https://doi.org/10.1016/j.envpol.2017.11.010>
34. Pound M, Massey H, Roseneil S, Williamson R, Harper CM, Tipton M, Shawe J, Felton M, Harper JC. How do women feel cold water swimming affects their menstrual and perimenopausal symptoms? *Post Reprod Health*. 2024 Jan 25:20533691241227100. doi: 10.1177/20533691241227100. Epub ahead of print. PMID: 38271095.
35. Stevens M, Lieschke J, Cruwys T, Cárdenas D, Platow MJ, Reynolds KJ. Better together: How group-based physical activity protects against depression. *Social Science & Medicine* 2021;286:114337.
36. World Health Organisation. (2021). Green and Blue Spaces and Mental health. Available from: <https://apps.who.int/iris/bitstream/handle/10665/342931/9789289055666-eng.pdf> (Accessed 15 April 2023).
37. Gascon, M., Zijlema, W., Vert, C., White, M.P., Nieuwenhuijsen, M.J. Outdoor blue spaces, human health and well-being: A systematic review of quantitative studies., *International Journal of Hygiene and Environmental Health*, 2017, 220(8): 1207-1221. <https://doi.org/10.1016/j.ijheh.2017.08.004>
38. Murrin, E., Taylor, N., Peralta, L., Dudley, D., Cotton, W., White, R.L. 'Does physical activity mediate the associations between blue space and mental health? A cross-sectional study in Australia.', *BMC Public Health*, 2023 23(1): 203. <https://doi.org/10.1186/s12889-023-15101-3>

39. *Bathing Water Data*. (2023). Department for Environmental Food and Rural Affairs. [Database]. Available at: <https://environment.data.gov.uk/bwq/profiles/data.html> (Accessed 20 April 2023).
40. Outdoor Swimmer. (2021). *Trends in Outdoor Swimming Report*. Available at: https://outdoorswimmer.com/wp-content/uploads/2022/04/TrendsReport_Full_LR.pdf [Accessed 2 April 2023].
41. Andrade, C. 'The Limitations of Online Surveys.', *Indian Journal of Psychological Medicine*, 2020 42(6), 575-576. <https://doi.org/10.1177/0253717620957496>
42. Harper JC, Botero-Meneses, JS. An online survey of UK women's attitudes to having children, the age they want children and the effect of the COVID-19 pandemic, *Human Reproduction*, Volume 37, Issue 11, November 2022, Pages 2611–2622, <https://doi.org/10.1093/humrep/deac209>