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**Opinions on Sustainable Health Education in
Physiotherapy: A Survey Study**

By

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Abstract

Background: Climate change is the single biggest health threat facing humanity, yet research shows that healthcare professionals (HCPs) lack knowledge of the relationship between planetary and human health. Education for HCPs is essential to change this, and sustainable health education (SHE) is now being implemented in undergraduate curriculums across a variety of health professions globally. The involvement of stakeholders, including students and educators, is necessary to enable effective implementation and engagement with SHE.

Aim: This study aims to explore the opinions of physiotherapy students and graduates from the University of Nottingham (UoN) on incorporating SHE into physiotherapy curriculums.

Methods: A multiple choice and short answer online questionnaire was distributed to students and graduates of UoN between 14/11/2022 and 08/01/23. Quantitative data was analysed using frequencies and percentages while free text responses were analysed thematically to identify common themes.

Results: In total, 45 participants were recruited, (34 students at UoN and 11 graduates). 60% of participants believed that HCPs should have knowledge of sustainability topics and 62% believed physiotherapy students should have SHE at university. Common barriers identified were the perception that SHE was not relevant to physiotherapy, the belief that sustainability isn't a priority in healthcare and that SHE in the curriculum would increase workload for students. No clear preference for method of delivery of SHE could be identified.

Conclusion: Most participants supported implementation of SHE into physiotherapy curriculums. However, concerns were raised about relevance, prioritisation, and workload, which must be considered when designing curriculums with elements of SHE.

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1. Background

1.1 The global picture

The health risks associated with climate change - including air pollution, communicable diseases, increased allergens, declining water quality and extreme weather events (appendix 1) - make climate change the single biggest health threat facing humanity (Karlner et al., 2019; World Health Organization, 2021a). It's predicted to cause 250,000 additional deaths between the years 2030-2050 (World Health Organization, 2021a). The Intergovernmental Panel on Climate Change (IPCC) reported that the evidence claiming climate change is a threat to human health is "unequivocal" and that action is needed to increase the likelihood of a liveable future for all (Pörtner et al., 2022). While everyone is at risk, people in low-income and disadvantaged communities are likely to be disproportionately affected by the climate crisis due to limited access to resources that could improve their resilience (World Health Organization, 2021b), demonstrating the link between climate change and health inequalities.

In 2015, world leaders came together in Paris to tackle these issues (UNFCCC, 2015). 194 parties stated they would substantially reduce global greenhouse gas emissions to limit global temperature rise (United Nations, 2015). The sustainable development goals (SDGs) were also adopted in 2015 and set seventeen goals to work towards a fairer and healthier planet (United Nations, 2015a). Despite these efforts, there are concerns that changes are not happening quickly enough to stop global temperatures from rising more than 2°C in comparison to 1850-1900, making severe impacts much more likely (Laybourn-Langton and Smith, 2022; Meinshausen et al., 2022).

1.2 Roles of HCPs

These issues have mobilised the global community of healthcare professionals (HCPs), with many suggesting there is a moral imperative to act to protect the wider determinants of health (Clery et al., 2022). The nongovernmental organisation 'Healthcare without harm (HCWOH)' reasons that a pillar of medical ethics is to "do no harm" and yet the global health sector is responsible for 4.4% of global greenhouse gas emissions (Karlner et al., 2019). Therefore, the current healthcare system is failing to provide ethical and sustainable care, and HCWOH develops resources to educate and encourage HCPs to help change this (Health Care Without Harm, no date). Secondly, HCPs are trusted and respected in society and are therefore in an advantageous position to be able to articulate the problem and advocate for change (Maibach, Frumkin and Ahdoot, 2021; Clery et al., 2022). HCP-led organisations such as the Planetary health Hub and 'Med Act' lobby for changes such as the

phasing out of oil and gas, green jobs, and healthier environments (MedAct, no date; Planetary Health Hub, 2023). Additionally, programmes such as 'My Green Doctor' educate HCPs on how to make their clinics as sustainable as possible, and with more than 32,000 members, it's clear that sustainability is something many HCPs care about (My Green Doctor, no date). These examples demonstrate HCPs care about planetary health, however, it's important to recognise anecdotal evidence isn't as persuasive as statistics in this case (Hoeken and Hustinx, 2009).

Literature also shows HCPs have generally positive attitudes towards advocating for planetary health (Kotcher et al., 2021; Lister et al., 2022). A multinational survey study involving 4652 HCPs looked at views on climate change and found 85% of participants felt they had a responsibility to bring it to the attention of the public and policymakers (Kotcher et al., 2021). Several barriers that prevent HCPs from acting were also reported, including time constraints, lack of knowledge, the belief it wouldn't make a difference and lack of support from peers (Kotcher et al., 2021). Similar findings were reported by a survey study of 100 HCPs in South Africa, which found that a lack of resources and policies was another barrier (Lister et al., 2022). Although this evidence is statistical in nature and therefore more compelling than anecdotal evidence, limitations such as a high risk of response bias and poor completion rates must be considered.

Much of the literature agrees that HCPs need more knowledge to be able to take effective action (Hathaway and Maibach, 2018; Kotcher et al., 2021; Lister et al., 2022). However, research into climate action by HCPs or assessing the effectiveness of interventions remains scarce, with only two intervention studies published between 2000-2020 (Dupraz and Burnand, 2021). This is a barrier to action which may be due to the focus on individual illness and the comparative lack of education on promoting improvement of the social determinants of health (Marmot, 2001; Maric and Nicholls, 2022; Hon and Hewitt, 2023).

1.3 Changes in Physiotherapy

As well as a lack of research concerning planetary health within healthcare (Dupraz and Burnand, 2021) there is minimal inclusion of allied health professions (AHPs) in the existing evidence base (Asaduzzaman et al., 2022). There are 14 AHPs, one of which is physiotherapy.

The lack of research is concerning because AHPs are the third largest clinical workforce in the UK's National Health Service (NHS) and are involved with all phases of patient care across health, social care, education, early years, schools, criminal justice system and voluntary sectors (NHS England, 2022). This gives AHPs a platform from which to educate

on the relationship between planetary and human health. NHS England recognises that in the AHP Delivery Strategy (appendix 2). Five “areas of focus” are highlighted one of which is ‘Environmental Sustainability’ (NHS England, 2022). This should be “integral to everything we do” in line with the NHS's ambition to become ‘Net Zero’ by 2050 (NHS England, 2020). The strategy also states that a good understanding of the net zero agenda will be a “crucial part of our competencies”, illustrating the need for further education (NHS England, 2022).

Environmental physiotherapy (EPT) was first seen as a concept in the published literature in 2019, with an editorial calling for this to be a novel field of research, practice, and education (Maric and Nicholls, 2019). Since then, there has been a wealth of discussion on theories and areas for potential research. Some of the main themes explored include: the notion that physiotherapy is already more sustainable than many other professions and can therefore lead the way in climate action (Maric and Nicholls, 2019; Padhy and Raj, 2021; Palstam et al., 2021, 2022), the historical reasons behind the disconnect between the clinical environment, the patients' environment and the natural environment (Nicholls and Cheek, 2006; Maric and Nicholls, 2019; Stanhope et al., 2023), and the need to involve sustainability in clinical decision-making (Mortimer et al., 2018; Maric and Nicholls, 2019; Palstam et al., 2021).

1.4 Education

One of the focuses of EPT is education (Maric and Nicholls, 2019), capitalising on the ability of higher education institutions (HEIs) to create change through self-organisation of their system structure (Fagiewicz et al., 2021). HEIs are also “main actors” in society and are therefore key in the production and distribution of knowledge on climate change and mitigation (Fagiewicz et al., 2021; Kinol et al., 2023). Physiotherapy curriculums, often provided by HEIs, should be based on an analysis of health and social needs of the country in which it is delivered, and reflect relevant WHO guidance (World Physiotherapy, 2019). The impacts of climate change on health in the UK are well documented (Vardoulakis and Heaviside, 2012; Hajat et al., 2014; Paavola, 2017; Mishra et al., 2021), and WHO guidance has indicated the need to train the health workforce on the relationship between climate and health (World Health Organisation, 2021). Therefore, to adhere to World Physiotherapy guidelines, curriculums should involve an element of planetary health and sustainability, often referred to as sustainable health education (SHE) (Teherani et al., 2017).

This is being championed by the EPT association, which is an international network interested in exploring and advancing the field of EPT (Environmental Physiotherapy Association, no date). The association created an EPT Agenda (Maric et al., 2020), which

aimed to ensure every student beginning physiotherapy education from 2020 onwards would have some education regarding the relationship between the environment and human health, and how this relates to physiotherapy (Maric et al., 2020). The association shares ideas on how EPT has been incorporated into physiotherapy education globally, to serve as an 'inspiration base' for physiotherapy academics, students, and practitioners (Maric, 2022). Currently, there are 68 institutions formally participating in the EPT agenda globally, demonstrating progress, but also plenty of capacity to grow considering there are over sixty HEIs offering physiotherapy education in the UK alone (EPT Agenda 2023, no date; Chartered Society of Physiotherapy, 2022).

To generate successful engagement with SHE, the attitudes and opinions of stakeholders - in this case students and educators - are essential (Fagiewicz et al., 2021). Research has been conducted into student and educator opinions on SHE in the field of medicine (Bugaj et al., 2021; Lal et al., 2022), but there is none, to the author's knowledge, in physiotherapy.

1.5 Local changes

The University of Nottingham (UoN) was ranked as the third most sustainable university globally in 2022 (World Universities Ranking, 2022). It has a detailed sustainability strategy which states it will make an "outstanding contribution" to supporting the SDGs and Nottingham City's goal to become "net-zero" by 2028 (Nottingham City Council, no date; University of Nottingham, 2020). This strategy emphasises engagement with staff and students regarding sustainability, which is reflected in the new Undergraduate Physiotherapy curriculum, recently accredited by the Chartered Society of Physiotherapy (Gould, 2023). As of 2023 students will participate in modules such as 'Health in Society', 'Population Health and Wellbeing' and 'Sustainable Health', which lend themselves to SHE at a societal and individual level (University of Nottingham, 2023).

1.6 Rationale

There is a need for more sustainability globally and in the healthcare sector (Karlner et al., 2019; World Health Organization, 2021a; Pörtner et al., 2022). HCPs are willing and motivated to be a part of the movement but are faced with barriers including lack of time, knowledge, and support (Hathaway and Maibach, 2018; Kotcher et al., 2021; Lister et al., 2022). Education of the health workforce has been identified as an urgent action to enable sustainable healthcare (World Health Organization, 2021b) but there is no universal SHE for HCPs, and there is minimal inclusion of AHPs in the learning process (Asaduzzaman et al., 2022). There have been policy changes (NHS England, 2022), developments in literature

(Maric and Nicholls, 2019) and transitions in education (Maric et al., 2021), which evidence actions within the AHP and physiotherapy communities to improve awareness of SHE topics. There is a goal to incorporate SHE into physiotherapy curriculums in HEIs (Maric et al., 2020), but there is little research into the opinions of students and educators on this. This gap in research needs to be addressed, as the engagement of stakeholders, such as students and educators, is essential in the adoption of new ideas (Fagiewicz et al., 2021). Identifying and addressing barriers from the viewpoints of stakeholders will optimise the chances of engagement (Fagiewicz et al., 2021). Therefore, this study aims to explore the opinions of physiotherapy undergraduates and graduates from UoN on incorporating SHE into physiotherapy curriculums. Secondary aims are to identify potential barriers that may occur if UoN were to implement SHE, and to identify how students would prefer to learn about sustainability in healthcare.

1.7 Objectives

To achieve the aim of this study, the author has:

1. Explored the current literature on planetary health and physiotherapy education to develop an understanding of the evidence and current practices.
2. Designed, piloted, and shared an online study to gain knowledge of student and graduate opinions on the topic outlined.
3. Analysed the results of the survey descriptively and discussed how they relate to the current evidence base and future research.

2. Methods

2.1 Study Design & Participants

A cross-sectional convenience sample of participants was recruited over eight weeks (14/11/2022 - 08/01/2023). Participants were eligible if they were a physiotherapy student at UoN or a physiotherapy graduate from UoN. The researcher opted to collect data from a single University, so participants were able to give more specific feedback on the curriculum at UoN. Participants who consented and completed the questionnaire were included. The STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines were used to guide the development of this study (appendix 4) (Ghaferi, Schwartz and Pawlik, 2021).

2.2 Survey Development and Distribution

An online questionnaire was developed using inspiration from existing literature (Kotcher et al., 2021; Lister et al., 2022). Feedback from experienced academic staff was used to ensure the questionnaire was of good quality, expert feedback being a key element of questionnaire development (Artino et al., 2014). Before distribution, the survey was piloted with four undergraduate students, to ensure the questions could be understood and evoked appropriate responses. This improved the reliability and validity of the questionnaire (Jain, Dubey and Jain, 2016). The benefit of developing a new questionnaire is that it is specific to achieve the aims of the study. However, the limitation is that it has not been validated and there are no prior studies with which to directly compare results (Artino et al., 2014).

The questionnaire was designed with a mixture of closed and open questions. Closed questions were used to obtain specific quantitative information and open questions were used to generate qualitative data by allowing participants to explain their knowledge, opinions, or concerns. The benefits of using an online survey modality include better speed, reach, ease, cost, flexibility and reduced social desirability bias (Ball, 2019). However, the convenience sampling technique leaves them vulnerable to selection and attrition bias, as seen in similar studies (Lister et al., 2022). To limit attrition bias, researchers ensured the survey would take no longer than ten minutes, as higher dropout rates are more likely when surveys are longer than this (Communications for Research, 2016).

A convenience sample from the target population was reached by distributing the survey, along with a small description of the study, on relevant social media pages. It was also shared by university staff on class distribution lists, and via contacts at a single hospital trust with a high percentage of UoN graduates.

2.3 Survey content

This questionnaire was made up of multiple sections and the questions were adjusted depending on the participant's answers. For example, graduates received some different questions to undergraduate students. This was to ensure that participants were only given questions that were relevant to them. The first section of the questionnaire collected demographic information such as age group, gender, country of residence, and year of study. In the next section, graduates specifically were asked if and how environmental sustainability had affected their work life. All participants were then asked to share their opinions of SHE in healthcare and physiotherapy. The two main questions were: (1) In your opinion, is it important that healthcare providers have knowledge of environmental sustainability topics? (2) Do you think sustainability topics should be incorporated into physiotherapy degree programmes? Participants were then invited to explain reasons for their opinions in open-text questions. Those who believed SHE should be taught at university were asked what topics they wanted to learn about, and what method of teaching they would prefer. The final section consisted of three open-text questions where participants were asked if they had any concerns, what their initial reactions were and if they had any final thoughts they wanted to share.

2.4 Data analysis

Quantitative data was analysed using descriptive statistics such as frequencies and percentages. Qualitative data was analysed thematically according to Miles and Huberman techniques of labelling, coding, categorising, and theme development (Miles and Huberman, 1994). This was an iterative process completed by a single researcher, which limits the rigour of the study as interpretation of results were subject to only one person. It's recognised that qualitative data is subjective, and therefore it's essential that reflexivity is practiced throughout the research process (Olmos-Vega et al., 2022).

2.5 Ethical considerations

This study was approved by the Medical School Ethics Committee proportionate review process at UoN (appendix 5). Participants had to read information regarding the study at the beginning of the survey before consenting to partake. Participation was voluntary and participants were made aware they could withdraw at any point during the survey until they submitted their responses on the final page. They were also informed that all data was anonymous, and no student details were recorded by the questionnaire. All data was used only for the research specified and was stored on a password-encrypted database on an encrypted computer, to maintain data security. Participants were made aware of how to contact the researcher, or the ethics committee should they have any concerns to discuss.

3. Results

3.1 Demographics

In total, 34 out of a possible 196 undergraduate physiotherapy students (17% response rate) and 11 physiotherapy graduates completed the questionnaire. It's not possible to give a response rate for the graduate population as it's unknown how many graduates were reached. All eleven graduates confirmed they were currently working in the UK.

Parameter	Number of participants (%)	
Age		
18-24	35	(78)
25-34	8	(18)
35-44	1	(2)
45-54	1	(2)
Gender		
Female	34	(76)
Male	11	(24)
Stage of education		
BSc Physiotherapy Student	34	(76)
Physiotherapy graduate	11	(24)
Graduate speciality		
MSK	4	(36)
Neurology	4	(36)
Other	3	(28)
Year of study		
Year 1	10	(29)
Year 2	13	(38)
Year 3	11	(33)

Table 1 - Participant Demographics (n=45)

3.2 Closed text questions

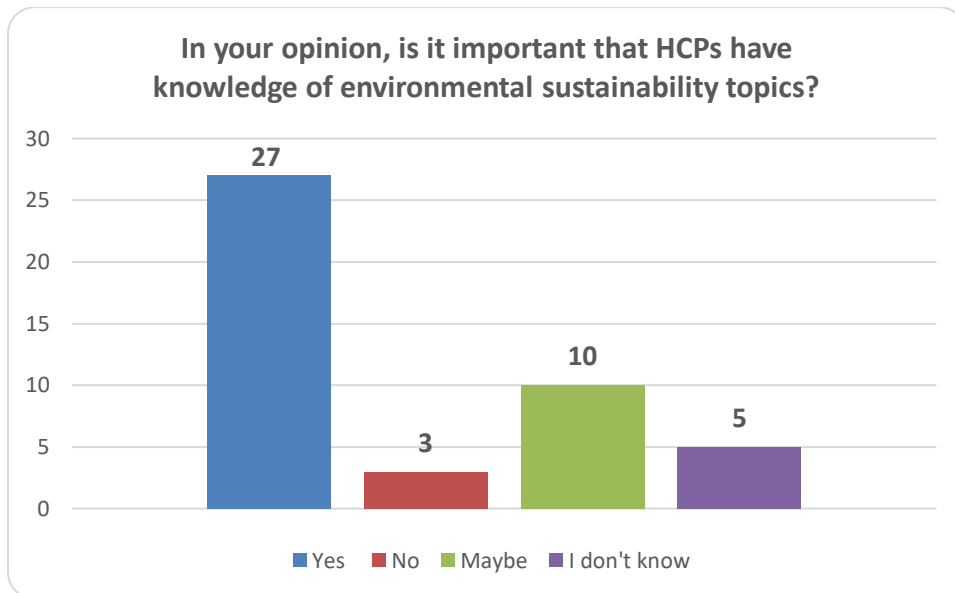


Figure 1 - Should HCPs know about sustainability topics?

The majority (n=27, 60%) of participants believe that HCPs should know about sustainability topics while 7% (n=3) stated they do not believe this knowledge is important for HCPs.

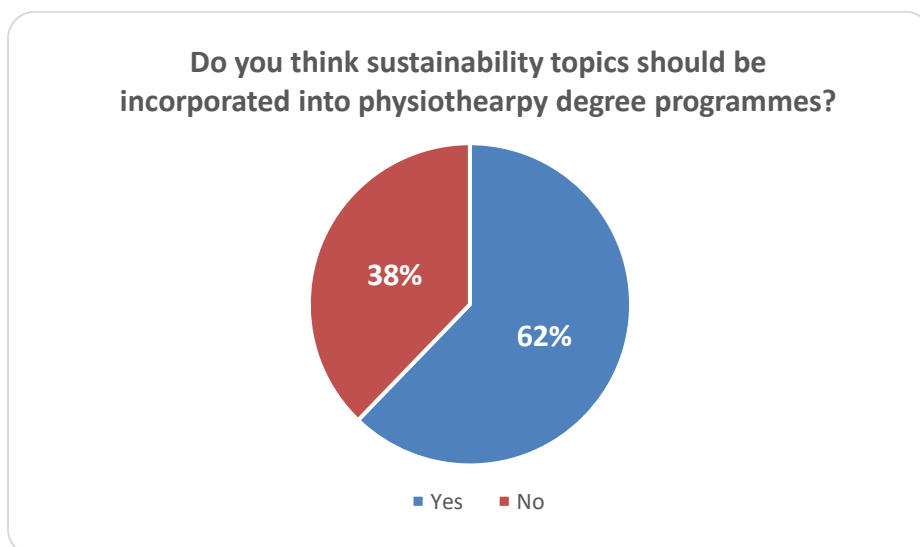


Figure 2 - Should SHE be incorporated into physiotherapy education?

Twenty-eight (62%) participants thought sustainability should be involved in some way in physiotherapy education while seventeen (38%) believed it should not.

REASONS SUSTAINABILITY TOPICS SHOULD NOT BE A PART OF PHYSIOTHERAPY EDUCATION

- I don't know enough about the topic
- I don't see the relevance of sustainability to physiotherapy
- I don't think there is enough time to cover these topics
- I have other interests I would rather learn about
- Other...

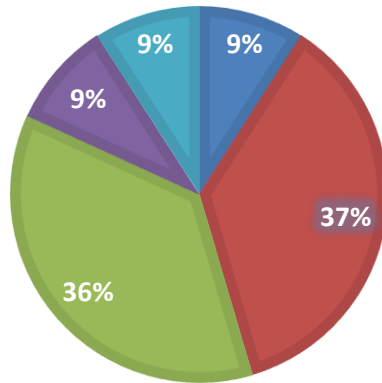


Figure 3 - Reasons SHE should not be a part of physiotherapy education.

Figure 3 shows the responses to a multiple-choice question, which asked participants to select the reasons they did not think physiotherapy students should learn about sustainability (n=17). Thirty-seven percent didn't see the relevance and thirty-six percent did not think there was enough time to cover this in the curriculum.

Those who answered "Other", explained the following reasons for doing so:

- The topics would not be treated seriously enough by students.
- They are more relevant for management careers.
- Increasing content could leave students & clinicians vulnerable to burnout.

Only participants who agreed SHE should be involved in physiotherapy education completed the multiple-choice questions in Figure 4 and Table 2 (n=28).

Most would prefer SHE to be incorporated into several different modules (38%) or delivered as an option module (28%) (Figure 4).

The most popular topics to be included were environmental impact on therapeutic interventions (82%), environmental-related diseases, treatment, and prevention (79%) and sustainable resource management (75%) (Table 2).

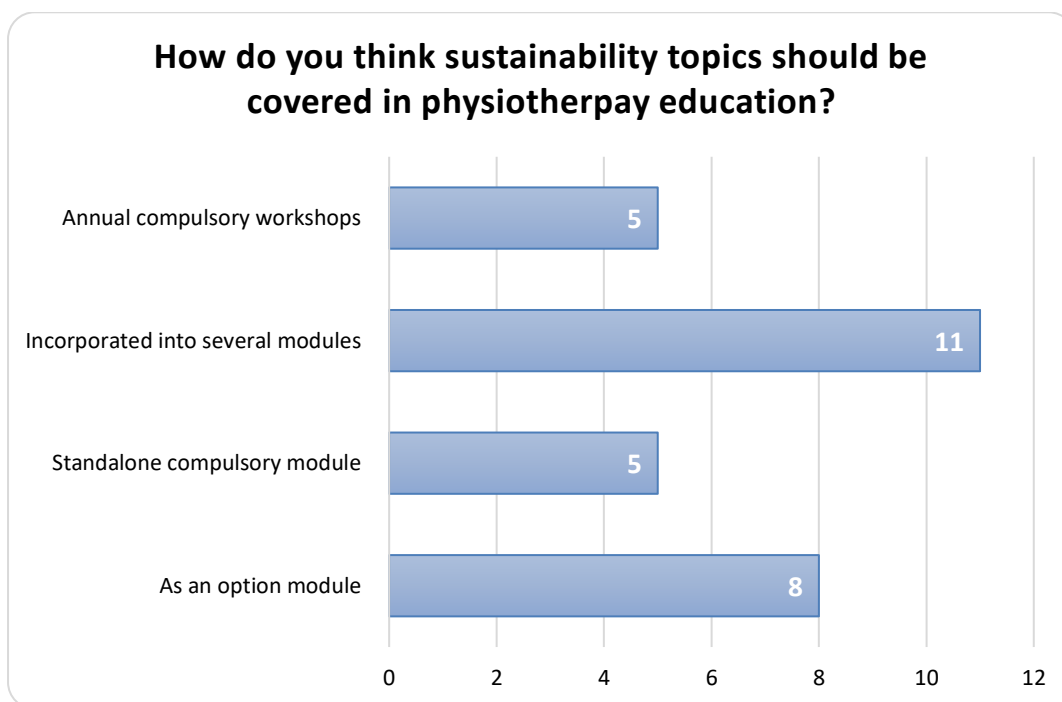


Figure 4 - How should SHE be taught in a physiotherapy degree?

Topic	Number of participants (n=28)	(%)
The ecological crisis	9	32
Interconnection of human and earth systems	4	14
Environmental exposure as a foundation for health and wellbeing	16	57
Environment-related diseases, treatment, and prevention	22	79
Sustainable resource management	21	75
Active transport	5	18
Understanding the environmental impact of therapeutic interventions	23	82
UN sustainable development goals	7	25
Local and global socioeconomic, cultural, and environmental conditions	12	43

Table 2 - which topics should be covered in a physiotherapy degree?

3.3 Open text questions

From all open-text responses, seven themes were identified (Figure 5).

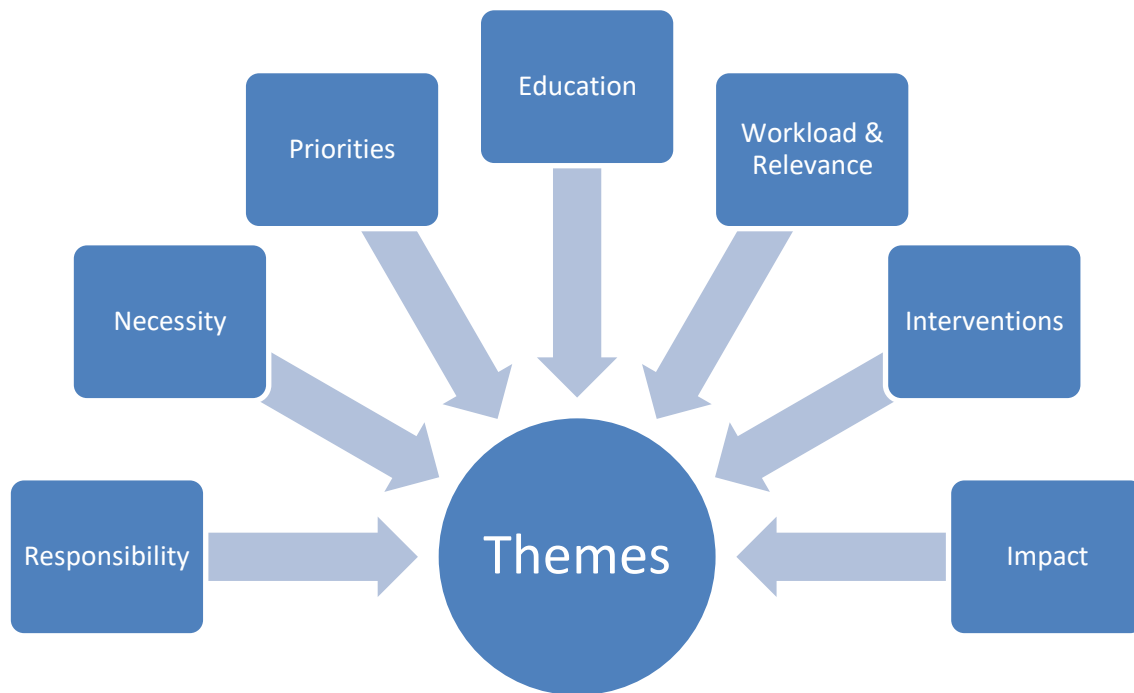


Figure 5 - Themes identified during thematic analysis.

Responsibility

Participants expressed a range of opinions on the theme of responsibility, with many believing that everyone is responsible.

“Caring for the environment is a shared responsibility and everyone sane is responsible to do their part.” – UG, 1st year, female, 35-44.

“We need to protect our planet in any way we can” – UG, 2nd year, female, 18-24.

Others believed HCPs should not be expected to know more than anyone else.

“I don’t know how far beyond regular environmental knowledge of the general populations, that physiotherapists should have to know.” – UG, 2nd year, female, 18-24.

Finally, some believed it was the responsibility of managers and policymakers, rather than HCPs. *“I think it is up to the trust and governing bodies to ensure that they have sustainability policies”* – UG, 3rd year, female, 18-24.

Necessity

Participants acknowledge the importance of making changes to society to protect the environment.

“Protecting our environment is essential for the future.” – Physiotherapist, female, age 25-34.

“I believe that sustainability is a necessity in today's society and it is growing ever more important.” – UG, 3rd year, male, 18-24.

“Environmental sustainability impacts everything that we do. It's important to be aware of it so that we can make a difference” – UG, 2nd year, female, 18-24.

Priorities

In contrast to those who felt it necessary to make society changes to become more sustainable, others believed it was not the biggest priority in a healthcare environment. Conflicts of interest included hygiene, patient care, finances, existing pressure, and avoiding burnout.

“Your primary role (being a carer) doesn't align with what's best for the environment”
– UG, 1st year, female, 18-24.

“A practitioner that tries to grasp at all concepts (of which I see sustainability as a somewhat relevant topic) leaves them vulnerable to experiencing higher level of stress and burnout”
– Physiotherapist, Neurology, male, age 18-24.

“It is extremely difficult to reduce waste while also keeping sterile”.
- Physiotherapist, neurology, male, age 25-34

“It seems financial drivers are vastly outweighing any environmental drivers in healthcare”.
- Physiotherapist, female, age 25-34.

Education

Education was commonly discussed by participants, with not enough information and lack of education noted.

“I have no idea how to link sustainability into health care” – UG, 3rd year, female, 18-24.

Others highlight how education can bring to light gaps in knowledge.

“You don't know what you don't know, therefore basic awareness is very important.”
– Physiotherapist, Neurology, male, age 25-34.

“Giving especially students resources and guides is a good way to start.”
– UG, 1st year, female, 18-24.

Some graduates also expressed concern that they were unable to pass on knowledge regarding sustainability if they had none themselves.

“This is something i am not hugely aware of which i feel i should be so as to help educate and train junior colleagues” – Physiotherapist, female, age 25-34.

Workload and Relevance

Some participants worried that incorporating an aspect of sustainable health into physiotherapy education would increase the workload for students or even disengage them, especially if the content was not relevant to their roles as clinicians.

“If the content was unnecessary or it’s like common knowledge/ been taught before. I would feel like it was adding extra workload onto an already content-heavy degree.”

– UG, 1st year female, 18-24.

“Students may not focus on this as they might not see the relevance to their degree. May also be frustrated if they were assessed” – Physiotherapist, MSK, female, age 18-24.

In contrast, others felt that if the content was relevant and workload not hugely increased, it would be a good addition to the course.

“As long as it ties into the content we are already learning it would be a nice addition”

– UG, 2nd year, female, age 18-24.

“If it was a theme, it shouldn’t increase content” – UG, 3rd year, male, age 18-24.

Interventions

This theme was discussed by graduates only. They identified seven types of interventions that they use or were aware of, that reduce impact on the environment.

- (1) Using personal protective equipment sparingly

“I try to use PPE sustainably, using as needed”. – MSK Physiotherapist, female, 18-24.

- (2) Staff making changes in their personal lives

“More about personal reflection to reduce waste”

– Physiotherapist, Neurology, female 45-54.

- (3) Recycling

“There are recycling bins on wards, but that seems to be about it”

– Physiotherapist, female, 25-34.

- (4) Technology to reduce waste

“Using technology (i.e. in creation of exercise programmes) instead of paper handouts”

- Physiotherapist, Neurology, male, 25-34.

- (5) Changes in trust policy and procedure

“Aware of the trust’s desire to go paperless” – Physiotherapist, Neurology, male, 25-34.

- (6) Staff awareness

“Net zero NHS is talked about within the staffroom occasionally”

- Physiotherapist, Neurology, male, 18-24.

- (7) Reusing equipment

“We reuse our walking aids to limit waste” – Physiotherapist, Neurology, male, 18-24.

Impact

Graduates discussed the theme of impact. Six stated that their work-life had not been affected by environmental sustainability.

"I haven't heard about any legislation, nor had any training on sustainability"

- Physiotherapist, MSK, female, age 18-24.

"Sadly, there has been little talk about improving our environmental impact at work (NHS acute)" - Physiotherapist, female, age 25-34.

"Very rarely is this topic discussed or addressed" - Physiotherapist, female, age 25-34.

In contrast, two commented on how their patients had been negatively affected by poor environmental conditions.

"I have seen some patients who had had chest infections due to living in poor environmental conditions" – Physiotherapist, MSK department, female, age 18-24.

"Patients who have had chest infections/sepsis caused by neglect / poor heating / social situations" – Physiotherapist, Neurology, Male, age 25-34.

Initial Reactions

All participants stated their initial reactions when introduced to the topic of SHE in physiotherapy. Most reactions were positive, with 24 being interested and only 5 reporting a negative reaction (table 3).

Reaction	Frequency
Positive	30
Interested	24
Excited	2
Pleased	3
Relieved	1
Negative	5
Boring	2
Frazzled	1
Not interested	1
Neutral	1
Confused	18

Table 3 - Participants' initial reactions

4. Discussion

4.1 Key findings

This study aimed to explore the opinions of physiotherapy undergraduates and graduates from the University of Nottingham (UoN), identify potential barriers to the implementation of SHE in physiotherapy curriculums, and identify preferences for SHE delivery. It is the first study, to our knowledge, to do this. The results highlighted the differing opinions of participants, with twenty-eight agreeing sustainability topics should be incorporated into physiotherapy education, and seventeen believing they should not. Lack of understanding of the links between environmental sustainability and health was evident, especially concerning physiotherapy practice, with eighteen participants stating their initial reaction was “confusion”. Several barriers to implementation were identified, which included the belief that planetary health is not relevant to clinical practice, the belief that there are bigger priorities in healthcare, and the worry that it would increase the workload for students. Finally, preferences for how SHE could be delivered, and topics participants would like to learn about were identified.

4.2 Support for SHE in Physiotherapy

The results of this survey study were mostly in-line with the current literature and policy on planetary health within HCP training, which supports the need for SHE (Shaw et al., 2021; World Health Organisation, 2021; NHS England, 2022). Of the forty-five participants, twenty-seven (60%) believed HCPs should know about sustainability and twenty-eight (62%) believed sustainability topics should be incorporated into physiotherapy education. “Necessity” was also a major theme identified and thirty participants (67%) had a positive reaction to the proposed topic (e.g., interested, excited, pleased, relieved). These results show that most participants had supportive attitudes toward increasing the education of HCPs on sustainability.

However, the percentage of positive attitudes is much higher in other survey studies which looked at the attitudes of HCPs toward sustainable healthcare (Kotcher et al., 2021; Lister et al., 2022). Overwhelmingly positive attitudes and a high degree of interest in taking on responsibility were reported by the South African survey study of HCPs, with 86.4% believing it is their responsibility to educate the public on this topic (Lister et al., 2022). The differences in findings may have been due to study design, as other studies asked more questions about participants' knowledge and gathered more detailed information by using Likert scales (Lister et al., 2022) which makes data comparison difficult. Other differences include the difference in demographics, with other studies gathering data from HCPs

internationally (Kotcher et al., 2021) or nationally (Lister et al., 2022), whereas the current study only collected data from one university. Another difference is that this study surveyed both students and graduates instead of focusing solely on qualified HCPs.

However, the difference in findings may also be due to other reasons, such as a lack of understanding and current education on these topics. A multisite survey study into the attitudes of nursing students (n=846) across seven universities globally found that positive attitudes towards SHE significantly increased after it was included in the curriculum (Álvarez-Nieto et al., 2022).

4.3 Lack of knowledge

A lack of understanding regarding the links between environmental sustainability and health was evident in the results, especially concerning physiotherapy practice. Eighteen participants stated they felt confusion as an initial reaction to the topic and some explained in their own words that they did not have enough information to form a reasoned opinion. They also stated they did not understand how sustainability links to healthcare. These findings are consistent with that of a systematic literature review conducted in 2017 which concluded that HCPs felt they need to learn more about the relationship between climate and health (Hathaway and Maibach, 2018). Awareness-raising and knowledge-building on sustainability were also recommended from stakeholder interviews in Nordic countries, in a study that aimed to explore the potential futures of healthcare (Pereno and Eriksson, 2020).

Participants' belief that they lack knowledge may have been exacerbated by the lack of definitions given in the survey itself. The definition of environmental sustainability is "meeting the resource and services needs of current and future generations without compromising the health of the ecosystems that provide them" (Morelli, 2011). As this study was concerned with the opinions of students and graduates, rather than their existing knowledge, it may have been useful to provide basic information on what sustainability topics are and how they relate to practice before the survey. Alternatively, also measuring knowledge would have provided more data which could be compared to other similar studies (Lister et al., 2022).

Another issue for graduates was that they did not know how to pass on knowledge about sustainability in healthcare to students and staff effectively. This lack of capacity to explain, inspire and teach about sustainable health was also found in an Australian mixed-methods study (Brand et al., 2020). This study explored educator perceptions of sustainable health across thirteen disciplines in one university and found that knowledge on the topic was strong, but the ability to pass it on was limited (Brand et al., 2020). It's unknown if this concern is shared by health educators in the UK, but these results indicate they might be.

4.4 Barriers

Three main barriers to the implementation of SHE into the physiotherapy curriculum were identified.

The first is the belief that sustainable health is not relevant to physiotherapy practice, and therefore it isn't the responsibility of physiotherapists to understand it. Of the seventeen participants who stated SHE should not be included in the physiotherapy curriculum, 37% stated this was because they did not think it was relevant. Relevance was also one of the top concerns raised by participants in free text responses. Contrary to this, current literature and policy suggest that climate change and sustainable health are relevant to physiotherapy with examples across a variety of specialities, including orthopaedics (Palstam et al., 2022), respiratory care (Hansel, McCormack and Kim, 2015; Tiotiu et al., 2020), cardiovascular health (Comeap, 2010; Frank Kelly, 2018; Vallianou et al., 2021; Maynard, 2022), communicable diseases (Mishra et al., 2021) and pain management (Banerjee and Maric, 2021). The local and global policy also encourages SHE due to its increasingly understood relationship to healthcare (World Physiotherapy, 2019; World Health Organisation, 2021; NHS England, 2022). Education on the relationship between sustainability and health may help to overcome the perception of irrelevance, as it did in nursing students (Álvarez-Nieto et al., 2022).

Another barrier is the idea of managing priorities. Some participants believed that there is a conflict of interest between providing the best care, reducing the impact on the environment, and keeping costs low. The sustainable value in healthcare model (appendix 3) addresses this concern by weighing up the benefits for the patient and population with the environmental, social, and economic costs (Mortimer et al., 2018). By utilising this model in quality improvement, services and staff can ensure they provide the most appropriate care. It is also true that many interventions that benefit the environment also benefit people, for example advocating for active transport, access to green spaces and balanced sustainable diets can have significant positive outcomes for both people and the planet (GOV.UK, 2022). The UK government is encouraging HCPs to advocate for these 'win-win' interventions and talk about the relationship between climate and health with colleagues, patients, and management (GOV.UK, 2022). When framed in this way, prioritising patient health aligns with sustainability efforts, especially when considering prevention strategies.

The final barrier is the perception that incorporating SHE will increase the workload for physiotherapy students. 37% of participants who did not think SHE should be in

physiotherapy curriculums stated this was because there is not enough time in the programme. This is in line with evidence which shows that sources of stress in physio students mainly relate to coursework demands and learning the amount of content in the required period (Tucker et al., 2009; Brooke et al., 2020). Fitting SHE into the curriculum was also identified as a barrier by educators in Australia and New Zealand, as the physiotherapy curriculum is often already intense (Lal et al., 2022). One way to overcome this barrier is by incorporating SHE into as many modules as possible, which was the preference of participants in our study (figure 4) and has been implemented with success at other Universities (Lowe and Regan, no date).

4.5 Preferences for course specifics

Most participants stated they would prefer sustainability topics to be incorporated into several modules (n=11) or as an option module (n=8). The idea of threading SHE through the curriculum is highlighted by other authors as an effective method of teaching the population and planetary health (Guzmán et al., 2021; Dunleavy et al., 2022). This method would also remove the fear of assessment which participants highlighted would increase stress. Preferred topics to include were also identified (Table 2), however, the risk of cognitive bias and the framing effect in these results are particularly high due to the multiple-choice nature of the question.

4.6 Limitations

Due to the following limitations of this study, the results should be interpreted with caution. Firstly, there was a small sample size and response rate from the target population which limits the internal validity. This is because, with a small sample size (17% of the student population), there is an increased risk of type two error (Andrade, 2020), therefore it is not possible to infer conclusions about the wider populations. There is also a high risk of response bias, as the study was voluntary and therefore it is likely that people who already had an interest in the area will take part (Collier and Mahoney, 1996). Another possible source of bias would be if the participants knew of upcoming changes to the curriculum, which could influence their opinions.

This study also had limited external validity, as the participants were mainly female and from the 18-25 age category. They were also all from one university, and all graduates who took part in the study were from one healthcare trust, due to the poor efficacy of the recruitment methods. This has made data very specific to UoN, limiting generalisability. Another limitation was that there was also a poor understanding of major themes being asked of

participants, for example, the definition of “sustainability”. This limited participants’ understanding and therefore their opinions. Finally, reflexivity is essential when researchers are conducting thematic analysis. My biases as a current physiotherapy student who has a positive attitude towards climate action greatly increase the risk of confirmation bias and must be considered when interpreting the findings from this study.

4.7 Implications for future research

During the process of completing this study, the researchers have identified opportunities for future research and curriculum development. In retrospect, the authors would use an existing questionnaire, such as the Sustainability Attitudes in Nursing Survey (SANS) (Álvarez-Nieto et al., 2022) and adapt it to make it relevant to physiotherapy. This would ensure that data could be more easily comparable to published data, and would reduce confusion surrounding clarity of definitions, as the questionnaire is already validated. Other opportunities would be to expand the recruitment parameters to include more universities, or other HCP courses such as sports rehabilitation to increase the number of participants and therefore gather more generalisable data. Alternatively, this study could be redone using the same method after SHE has been implemented at UoN and compare data to find if attitudes were significantly different before and after.

4.8 Conclusions

This cross-sectional survey study aimed to explore the opinions of physiotherapy students and graduates from UoN. This project was inexpensive and could be replicated on a larger scale, however, the validity of this project was limited by the small sample size and poor generalisability. Nevertheless, some useful results were found, showing that participants had a range of opinions, with the majority believing that SHE should be involved in the physiotherapy curriculum. Barriers to implementation were concerns surrounding the relevance of SHE to physiotherapy, increasing workload, and the belief sustainability is not a priority in healthcare. These barriers must be considered when designing curriculums with elements of SHE. No clear preference for the method of SHE delivery could be identified, however, most participants stated they would rather content be threaded through several topics within the curriculum. A similar study could be repeated in the future and results compared to identify if there are significant changes in opinions.

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6. Appendices

6.1 Appendix 1: Impact of climate change on human health

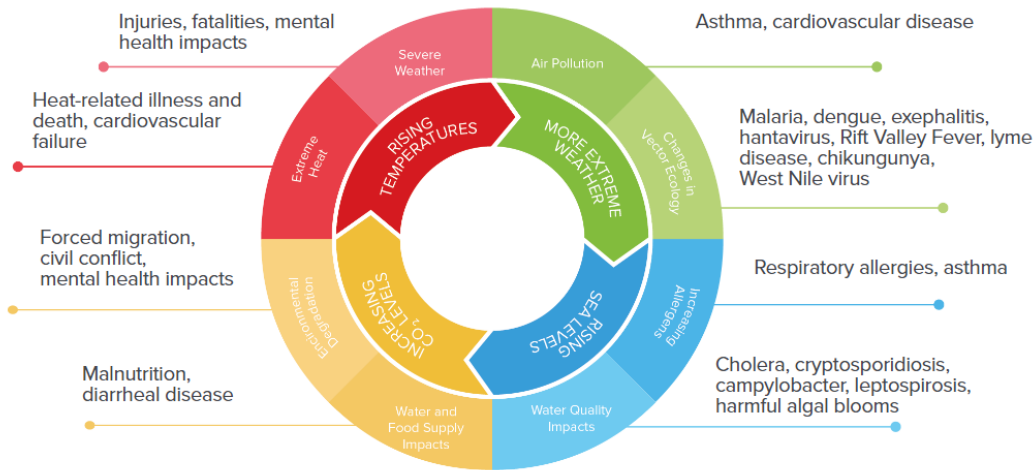
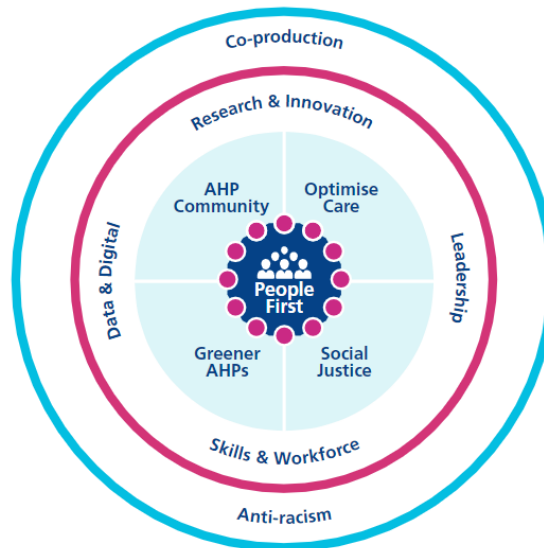


Figure 1: Impact of climate change on human health (Source: U.S. Centers for Disease Control and Prevention)

Appendix 1 - Karliner et al (2019).

6.2 Appendix 2: The AHP Strategy for England: AHPs Deliver (2022-2027)



Appendix 2 - NHS England (2022).

6.5 Appendix 3: Sustainable Value in Healthcare Model

$$\text{Value} = \frac{\text{Outcomes for patients and populations}}{\text{Environmental + social + financial impacts (the 'triple bottom line')}}$$

Appendix 3 - Mortimer et al (2018)

6.4 Appendix 4: STROBE Guidelines

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest
Outcome data	15*	Report numbers of outcome events or summary measures
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
Discussion		
Key results	18	Summarise key results with reference to study objectives
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

6.5 Appendix 5: Ethical approval



**University of
Nottingham**
UK | CHINA | MALAYSIA

Faculty of Medicine & Health Sciences Research Ethics Committee

Faculty Hub
Room E41, E Floor, Medical School
Queen's Medical Centre Campus
Nottingham University Hospitals
Nottingham, NG7 2UH
Email: FMHS-ResearchEthics@nottingham.ac.uk

10 November 2022

Dominic O'Connor
Assistant Professor
Physiotherapy & Sport Rehabilitation Sciences
School of Health Sciences
B Floor, Medical School
QMC Campus
Nottingham University Hospitals
NG7 2UH

Dear Dr O'Connor

Ethics Reference No: FMHS 124-1022– please always quote	
Study Title: Student and graduate opinions on incorporating Environmental Sustainability Topics into the Physiotherapy Curriculum at the University of Nottingham.	
Supervisor: Dominic O'Connor, Assistant Professor, School of Health Sciences	
Student: Millie Kent, Year 3	
Course: Research Methods and Planning module, Physiotherapy & Rehabilitation Sciences, School of Health Sciences.	
Proposed Start Date: 01/09/22	Proposed End Date: 30/04/2023

Thank you for submitting the above application which has been considered by the Committee at its sub-committee meeting on 25 October 2022 and the following documents were received:

- FMHS REC Application Form and supporting documents version 1.0: 20.10.2022

These have been reviewed and are satisfactory and the study is given a favourable research ethics opinion.

A favourable research ethics opinion is given on the understanding that:

1. The protocol agreed is followed and the Committee is informed of any changes via e-mail.
2. The Chair is informed of any serious or unexpected event.
3. An End of Project Progress Report is completed and returned when the study has finished (Please request a form).

Yours sincerely

Dr John Williams, Associate Professor in Anaesthesia and Pain Medicine
Chair, Faculty of Medicine & Health Sciences Research Ethics Committee