

Exploring the barriers and facilitators to the integration of planetary health into the undergraduate medical curriculum: A mixed-methods study of the perceptions and attitudes among students and educators at the Royal College of Surgeons in Ireland

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List of abbreviations

DALY – Disability adjusted life years

DSC – Data Science Centre

DSP - Dominant social paradigm

EA – Environmental attitude

GMC – General Medical Council, United Kingdom

HEART - Health and Environment Adaptive Response Taskforce

IPCC - Inter-governmental Panel on Climate Change

MeSH – Medical subject heading

NEP – New Ecological Paradigm

PRISMA - Preferred reporting items for systematic reviews and meta-Analyses

RCSI – Royal College of Surgeons in Ireland

REC – Research and Ethics Committee

SANS - Sustainability Attitudes in Nursing Survey

SCNMCR - Salford Centre for Nursing, Midwifery and Collaborative Research

UCL – University College London

UK – United Kingdom

USA – United States of America

USOMB - United States Office of Management and Budget

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Summary

Background:

Planetary health is a burgeoning field that advocates for evidence-based policies to promote human health, wellbeing and equity globally - while acknowledging the political, economic, social and environmental systems that dictate the efficacy of these policies. The overall aim of this project was to investigate the barriers and facilitators that exist to the integration of planetary health into the undergraduate medical curriculum at the Royal College of Surgeons in Ireland (RCSI). The objectives were: to appraise the existing literature regarding the integration of planetary health issues into medical curricula; to identify and explain the current level of knowledge that undergraduate medical students and medical educators have towards planetary health issues; to assess whether and how planetary health topics should be integrated into the curriculum from an undergraduate medical student and medical educator perspective; and, to make recommendations for implementing planetary health as part of a future undergraduate medical curriculum.

Methods:

A comprehensive, narrative review of the literature was completed. Qualitative semi-structured interviews were conducted with medical educators involved in the active teaching of undergraduate medical students. Consecutively, a quantitative survey was distributed to undergraduate medical students. Findings from both the qualitative and quantitative arms of the study were integrated.

Results:

Both educators and medical students, in the majority, believe that planetary health should be integrated into undergraduate medical education (77% of students agreed with the statement “It is important to make environmental change and its health-effects a part of medical curriculum”), in the context of a current perceived deficit. Educators and students endorsed a wide array of teaching methodologies and the notion of an integrated, spiral curriculum.

Conclusions:

This study makes recommendations for the implementation of planetary health in medical curriculum. Further research is needed to set priorities for future undergraduate medical curriculum content development and delivery.

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Dedications

I dedicate this thesis to the memory of my father and to my mother and siblings, who unerringly support and inspire me with love, kindness and devotion in all areas of my life.

Chapter 1

Introduction

1.1 Climate change and health

Since the 19th century global warming has occurred at a rate and extent which exceeds any other global warming event of the last 2000 years (1) Global warming and the climate crisis are pivotal issues in the fields of public and global health. These issues have far reaching consequences for human health and healthcare policy. As a result, in the past decade there has been growing recognition of the connection between sustainable development and human health (2). An article published in Nature Magazine (Nov. 2019) argues that the world is in a state of "climate emergency", and that if the future global temperature rise is not limited to 1.5 degrees then we will reach an irreversible "tipping point" leading to catastrophic environmental and health effects (3).

Climate change is not just an environmental issue but a health issue (4). The long-term public health benefits of carbon reduction and climate change mitigation are significant. In 2000, climate change was estimated to be responsible for 5.5 million Disability Adjusted Life Years (DALY) (5). Nearly 20 years later the Inter-governmental Panel on Climate Change (IPCC) report published in 2019 found that in the last decade the rate of sea level rise has doubled (6). Across the world, average temperatures have increased by 1 degree above pre-industrial baseline (7), and this has already resulted in a myriad of interweaving direct and indirect health effects: severe storms and floods (8), heatwaves and droughts (9), air pollution (10), new and emerging infectious diseases (11-13) biodiversity loss (14), poor mental health (15), reduced food yields (4, 16, 17), freshwater depletion (18), and increasing global conflict (19) constituting but a few examples.

1.2 Planetary health and the role of the doctor

Planetary health is a burgeoning field which encourages "evidence-based policies to promote human health and prosperity while preserving the environment which allows us to thrive". It is a field which relates to the "interdependence of human health, animal health and the health of the environment." (20).

The field of planetary health deals with issues that impact all domains of clinical practice. It is a term that neatly encapsulates the interface between environmental change and human health. For the purposes of this study, it will be used as a term that encompasses the areas of sustainable healthcare, climate change, ecological instability and global warming referenced in the literature.

Health professionals - who have been trained to advocate for health, communicate risk, and manage complex systems - are ideally placed to raise awareness of, and educate about, planetary health. Physicians, in particular, are in a key position in society to influence policy and public opinion (21). Given the profound link between environmental issues and human health, those within the medical profession have a responsibility to inform others of

the dangers of climate change and to advocate for a more sustainable society (22, 23). This thesis explores the barriers and facilitators to the integration of planetary health content into an undergraduate medical curriculum.

1.3 Aim and objectives

(i) Aim

This project aims to investigate the barriers and facilitators that exist to the integration of planetary health into the undergraduate medical curriculum at the Royal College of Surgeons in Ireland (RCSI).

(ii) Objectives

1. To appraise the existing literature regarding the integration of planetary health issues into medical curricula;
2. To identify and explain the current level of knowledge that undergraduate medical students and medical educators have towards planetary health issues;
3. To assess whether and how planetary health topics should be integrated into the curriculum from an undergraduate medical student and medical educator perspective;
4. To make recommendations for implementing planetary health as part of a future undergraduate medical curriculum.

1.4 Thesis outline

This thesis is comprised of seven chapters. The first chapter provides the introduction, along with the background and context for the research and outlines the aims and objectives of the thesis.

The second chapter is a review of the literature to examine the existing research on planetary health and undergraduate medical/nursing education and to identify potential gaps in the literature.
The third chapter describes the methodology; the study design and methods used in conducting the qualitative and quantitative arms of the study.
The fourth chapter presents the results of the qualitative arm of the study.
Chapter five outlines the results of the quantitative survey.

The sixth chapter is the discussion. This chapter is comprised of three sections:

1. Qualitative discussion; in which the results from the qualitative analysis are discussed
2. Quantitative discussion; in which the results from the quantitative survey are discussed
3. Integration; in which the results from both the qualitative interviews and quantitative survey are triangulated and framed in the context of the literature. Barriers and facilitators to the integration of planetary health in undergraduate medical education are consolidated in this section.

The final chapter is the conclusion. A reflection on the research objectives is given here and recommendations for future research are provided. Finally, based on the findings of the study, recommendations for the integration of planetary health into undergraduate medical curriculum are formulated.

Chapter 2

Literature Review

2.1 Aim and objectives of the literature review

This literature review was conducted to establish the existing research base pertaining to the overall research aim. The review was synthesised using a narrative approach.

(i) Aims:

1. Describe the extent, focus and nature of research relating to the field of planetary health within medical and nursing education
2. Synthesise and summarise research results

(ii) Review objectives:

1. Identify the barriers and facilitators to the integration of planetary health into medical and nursing curricula
2. Explore the perspectives of undergraduate medical/nursing students and medical/nursing educators towards the integration of planetary into medical nursing/curriculum
3. Investigate the steps that have been taken to integrate climate change into medical curricula at different global Higher Education institutions and identify how successful these steps have been.

2.2 Methods

2.2.1 Search strategy

A research librarian was consulted to assist with the search strategy. The core principle in guiding the review was to be as inclusive as possible within the resources and timescale for the project.

The search strategy was informed by the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol as outlined by Liberati et al. 2009 (24) .

Firstly, key terms were identified through the analysis of results yielded from an initial broad yet limited preliminary search performed on the databases MEDLINE (Pubmed) and EMBASE. Seminal papers were identified and key search terms were developed through an analysis of the title and abstracts of these papers. Furthermore, the reference lists of these identified articles were examined as a means of discerning relevant key terms present in the title/abstract of other core papers. Relevant key words and search terms were also identified using MeSH.

Keywords for planetary health included “global health”, and “climate change” and (main descriptors and exploded items).

The next step in the search strategy consisted of a second search across the following databases: MEDLINE (Pubmed), EMBASE and Global Health (These were accessed using the RCSI library network.)

The table below (Table 1) gives a summary of the main keywords and subject headings:

Table 1 - Literature review search terms & keywords

Aspect	***Keywords***
Planetary health	((((("planetary health"[Title/Abstract]) OR (("Global Health"[Mesh]) OR ("climate change"[Mesh)] OR (("global health"[Title/Abstract] OR "ecohealth"[Title/Abstract] OR "international health"[Title/Abstract] OR "sustainable healthcare"[Title/Abstract] OR "environmental stability"[Title/Abstract] OR "global warming"[Title/Abstract] OR "climate change"[Title/Abstract] OR "worldwide health"[Title/Abstract])))))
	AND
Medical Curriculum	((((("Education, Medical"[Mesh]) OR (("medical education"[Title/Abstract] OR "medical curriculum"[Title/Abstract] OR "medical students"[Title/Abstract] OR "clinical education"[Title/Abstract]))))) OR (("Education, Nursing"[Mesh]) OR "nursing students"[Title/Abstract] OR "nursing education"[Title/Abstract] OR "nursing curriculum"[Title/Abstract]))))
	AND
Attitude	**(**((attitude OR knowledge OR attitudes OR barrier OR barriers OR facilitation OR facilitator OR enable OR enabler OR integrating OR preventing OR inhibiting)))

2.2.2 Screening

Population (inclusion)

- Undergraduate medical students
- Undergraduate nursing students

Population (exclusion)

- Any population falling outside the inclusion criteria i.e., papers whose population did not include medical or nursing students

Note: The decision was made to exclude other health professions; literature pertaining to health professions other than medicine and nursing might stray too far from the experiences relating to medical education and the profession and as such there is a risk that findings from these papers might not be representative of the cohort within this study (undergraduate medical students).

Literature relating to nursing was included as the professions of nursing and medicine work closely together in a clinical capacity and there is significant overlap in the curricular material that both medical and nursing students would encounter as part of their undergraduate education.

Although literature relating to both undergraduate medical and nursing was included in the literature review, the participants of this research project do not include undergraduate nursing students or educators.
The decision was made to focus solely on undergraduate medical education for a couple of reasons:

1. Separate to the author's work on this thesis, the author was participating in an inter-institutional "all Ireland" working group whose aim was to conduct a planetary health curriculum review specific to undergraduate medical curriculum. It is the authors hope that this thesis will help to inform and underpin some of the work done in this project.
2. Due to the author's familiarity with the field of undergraduate medical education as medical educator, practising clinician and previous medical student, the decision was made to focus on undergraduate medical education alone. The aim was to capitalise on the author's awareness of this field in order to better collect data and formulate research results in a coherent and timely fashion.

Topic (Inclusion)

- Studies which investigated undergraduate student/educator attitudes towards planetary health topics in medical/nursing curriculum
- Studies that investigated the barriers/facilitators towards the integration of planetary health into medical/nursing curriculum
- Any paper relating to the topic of planetary health in medical/nursing education including comments/opinion pieces which offered a perspective on the issue or studies related to both pedagogy and

content i.e., all studies examining the why, what and how of planetary health topics in curriculum.

Topic (exclusion)

- All papers that fell outside the inclusion criteria above were excluded, including papers related to global health rather than a focus on planetary health i.e., only papers which specifically dealt with climate change and environmental issues were included.

Outcomes

- No restrictions

Study design

- No restrictions

Setting

- No restrictions

Language

- Research not in English was excluded. This decision was made due to a lack of translational resources.

No limitation was placed on the location or date of publication. A quality appraisal was not conducted on the articles. The aid of a research librarian was enlisted in refining these categories and search terms and ensuring that the string of search terms translated coherently between each database.

Screening took place in five stages.

(i) Title and abstract screening of each result, to identify research that overtly fit the exclusion criteria
(ii) The remaining results from all databases were exported to Endnote. The remaining abstracts were scrutinised in order to assess their suitability as per the inclusion criteria
(iii) The full texts of all remaining texts were sought using the RCSI library database access portal and were subsequently reviewed to determine suitability for inclusion.
(iv) Reference lists of all relevant sources were reviewed in order to identify any pertinent grey literature.
(v) Grey literature identified was put through the same process of Title/Abstract review and subsequent analysis of the full-text.

2.2.3 Type of synthesis

Based on preliminary small-scale scoping studies, studies on the topic of this literature review were found to be diverse in methodology. As such, a narrative synthesis approach was deemed most appropriate for the summarising of the findings present. Approach to narrative synthesis and the state-of-art review was informed by The Economic and Social Research Council (ESRC) guidance on narrative synthesis reviews of implementation or effectiveness (Popay et al. 2006) (25) and by Salford Centre for Nursing, Midwifery and Collaborative Research (SCNMCR) guidance on scoping reviews (Grant et Booth, 2009) (26).

2.2.4 Search results

A total of 61 studies met the criteria for review, as outlined in the flow diagram in figure 1.

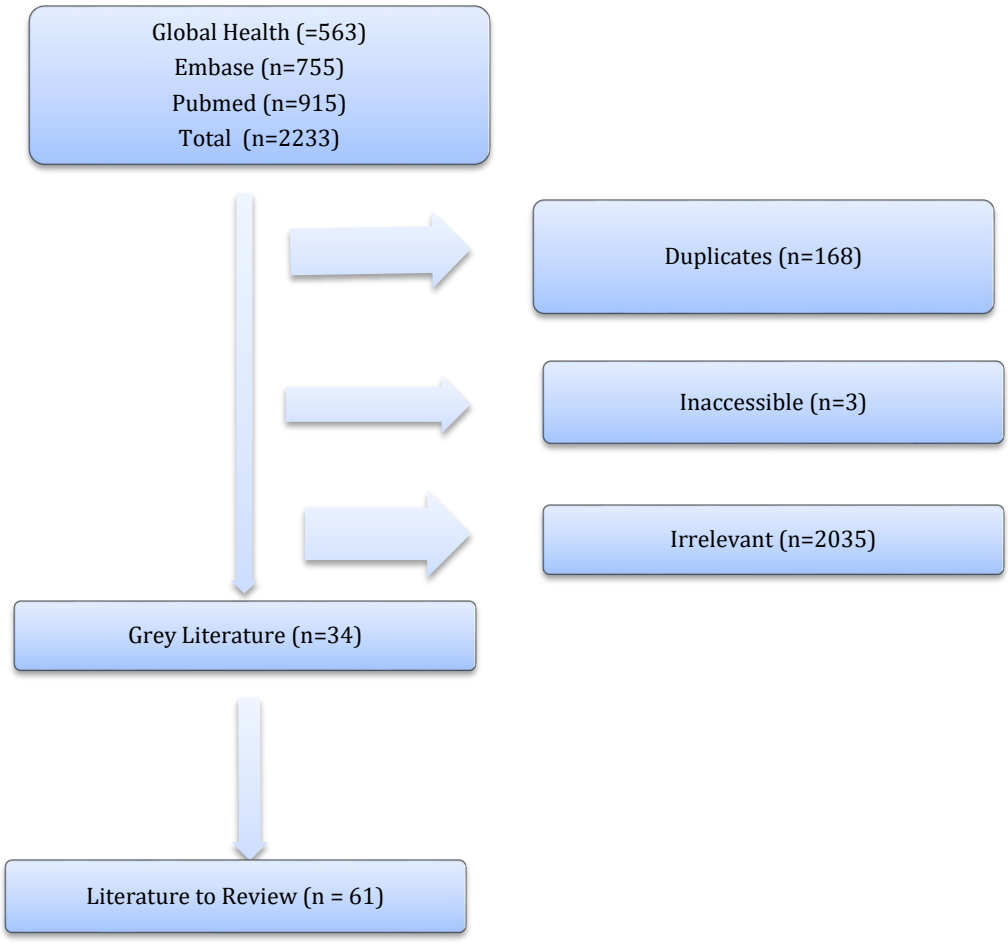


Figure 1 - Prisma flow diagram

2.3 Literature review

2.3.1 Introduction

Of the sixty-one papers reviewed; twenty-nine of these papers were commentary pieces/articles, fourteen of these papers represented case reports, ten of these papers were quantitative studies, two papers were qualitative studies and a further three papers were literature reviews. Three papers were mixed-methods studies.

In terms of the nationalities that the research papers originated from: the largest proportion of the literature reviewed originated from the United Kingdom (UK) (N = 21), followed by the United States of America (USA) (N = 20). Five papers originated from Canada and four papers originated from China. Three papers came from European authors outside of the United Kingdom (one paper coming from Germany, Spain and Denmark respectively). Three papers came from Australia and one paper came from New Zealand. Two papers originated from Saudi Arabia in the Middle East. One paper came from India and a further one paper came from Africa.

It is worth noting that most papers refer to planetary health issues using terminology such as “climate change”, “sustainability” or “environmental instability”. As mentioned previously, for the purposes of this review “Planetary Health” is often used in lieu of these terms and can be interpreted interchangeably.

2.3.2 The call for the inclusion of planetary health topics in nursing and medical education

In the last few years, there has been growing global acknowledgement of climate change and environmental instability as a threat to human health. Whitmee et al. 2015 (27)– published by the Lancet commission on planetary health*: “Safeguarding human health in the Anthropocene epoch”* clearly delineated and characterises the health effects related to planetary health issues.

This acknowledgement of the link between planetary health issues and human health is reflected in the literature with international calls for the inclusion of these topics in both nursing and medical education. Given that planetary health topics do not, at present, enjoy widespread inclusion across medical curricula in any country, it stands to reason that a number of papers exist making a case for their implementation. There are many examples within the literature that argue for the addition of planetary health topics to undergraduate medical curriculum, spanning a couple of decades, and originating from a diverse array of countries.

The role of the medical physician as an interface between the public and the realm of science is mentioned in the literature as a potential means for increasing planetary health awareness within society at-large (USA) (28). Harnessing the potential of this leadership role to have a positive influence in society with respect to planetary health issues requires the proper education

of medical students on these topics (UK) (29). Planetary health represents an opportunity for the role of the medical practitioner to evolve, as Logan et al. 2019 persuasively detail – currently, there is the opportunity for a "Golden age of Medicine 2.0" (USA) (30). This requires an adaptation of medical education to prioritize a broader view of preventative medicine and recognizes the importance of planetary health in preventing significant negative health outcomes for human beings. The potential that climate change and environmental instability have to act as a catalyst in redefining the role of the physician as a socially-conscious and eco-literate advocate for global health begins with undergraduate medical training (Australia) (31), (UK) (32), (Australia) (33). As Huss et al. 2020 (Germany) (34) outline, integrating "sustainable healthcare" into curricula should seek to promote "a deep understanding of global issues including environmental sustainability and universal values such as justice, respect for all humanity and equality" and would develop critical thinking skills, social empathy and self-awareness amongst students.

The strong case for inclusion of these topics into medical curricula, which is evident in the literature, can also be found in papers that pertain to nursing education. The United Nations 2030 Agenda for sustainable nursing goals served as a potent instigator in galvanizing advocacy for a re-examining of the role of nursing and the adoption of a more holistic ethos within the profession (USA) (35), (USA) (36). In the literature, there is a call for nursing on a global scale to shift towards planetary nursing to encompass the integration of animal, environmental and human health (UK)(37). Kirk 2002 (UK)(38), has suggested that nursing students are ill-equipped to understand the relationship between climate change, sustainability and health. Nursing has the opportunity to lead in this regard through comprehensive undergraduate education and training on these issues (USA) (39), (China) (40).

2.3.3 Barriers and facilitators to the integration of planetary health into the curriculum

2.3.3.1 Introduction

The inclusion of planetary health in medical curricula is not yet the standard best-accepted practice when implementing a curriculum design at the institutional level. As such, much of the existing literature makes a case for the inclusion of these topics, or provides recommendations for implementation. Some existing literature specifically investigates the potential barriers and facilitators to the integration of planetary health into undergraduate medical curriculum.

One of the key pieces of existing research identified was performed by Tun et al. 2019; researchers performed semi-structured interviews with a diverse range of medical educators in order to establish barriers and facilitators towards the integration of sustainable healthcare in medical education (41). This was the only paper that emerged from the literature review which has a

similar aim to this study in that it specifically investigates barriers and facilitators to the integration of planetary health into the undergraduate medical curriculum through interviews with medical educators. The main barriers and facilitators that emerged from this study are summarised in the table below (Table 2) and served as a useful reference point when analysing other existing literature that may have touched on the topic of barriers and facilitators to the integration of planetary health in undergraduate medical education in a less overt manner.

Table 2 – A summary of the barriers and facilitators from Tun et al. 2019(41)

Barriers	**Facilitators**
1. Lack of knowledgeable teacher 2. Lack of space 3. Uncertainty of location 4. Need for learning resources 5. Difficulty in assessment 6. Emotional impact needing resistance	1. Competition between institutions 2. Demand from students 3. Shift towards sustainability in higher education 4. GMC Mandate 5. Leadership from other stakeholders 6. Support and resources

2.3.3.2 Educator knowledge

The potential barrier of a lack of knowledge or awareness around these topics amongst educators has been highlighted on a couple of other occasions within the literature (29), (42). Further supporting this evidence, a number of papers stated that proper training of staff and faculty in these topics or the recruitment of experts in the field would act as powerful enablers (43), (44), (45). Contributing to this argument, Green et al. 2020 (46) – writing on behalf of a group of 29 medical students from UK universities including Cambridge, Newcastle, UCL, Barts, Cardiff, Glasgow, and Oxford - made recommendations for peer-to-peer learning as the optimum means of delivering planetary health teaching as a way to circumvent the challenge of a deficit of knowledge amongst medical educators. Tun et al. 2020 also published a follow up study to their paper in 2019 in which they highlighted the need for faculty development within medical education as a crucial goal with a view to facilitating the integration of planetary health topics into the medical curriculum (43), the importance of faculty training has also been highlighted elsewhere in the literature (45), (47).

2.3.3.3 Overcrowded curriculum

Medical curricula have increasingly become more overburdened with content and a lack of space and resources has been cited in the literature as a significant barrier to the introduction of new material. Due to the often constrained nature of the resources available to policy-makers at institutions the already overcrowded curriculum can fall victim to stagnancy secondary to legislative challenges or a lack of political will to commit funding, time or manpower to new ventures (48), (49). Often this perceived lack of space (41) in the curriculum leads to an acknowledgment of the need to address issues of climate change and sustainability as part of an institutional ethos, without formally adopting content on these topics within curriculum (50).
In order to address the issue of resources; a point made on numerous occasions in the literature is the value of developing curriculum content/learning objectives that are both well-developed and structured (44), (44), (51), (50), (45). Having an organized framework or clear content to hand would act as a valuable resource and would mitigate the need for the utilisation of existing university resources in developing this content from scratch.

2.3.3.4 Senior management support

A lack of senior management support has been identified as a significant barrier to the integration of planetary health topics into medical curricula within the literature (42). A perceived lack of the relevance of topics of planetary health and sustainability in medical/nursing curricula amongst educators and clinicians could certainly be contributory to a deficit in senior support and on its own constitutes a formidable barrier (52), (53).

A more authoritative style of leadership within an institution or a reluctance to depart from established social paradigms or traditional models for acceptable curricular content could hinder attempts to introduce a more productive topic like planetary health (30). Conversely, organisation structure, stable leadership and a culture of cooperation are structural enablers that would assist in the implementation of planetary health topics (48). Leadership behaviour and leadership advocacy serve as powerful drivers in determining the ethos of an institution. A prospective campaign for the integration of planetary health topics into medical curriculum should “demand institutional backing” and “involve clinicians” at a senior level in order to bolster the success and degree of buy-in towards these topics across all departments within a university (42).

2.3.4 Case studies/recommendations for implementation

In addition to the myriad of papers that discuss the challenges and enablers to implementation of planetary health topics into the medical curriculum, a number of articles make recommendations and suggestions on best approaches to optimally achieve integration in the context of the existing literature.

Some papers made these recommendations based on case studies; illustrating attempts made to include planetary health into medical/nursing curricula and formulating suggestions on implementation based on the success of these different projects. Examples of case studies can be found both within the field of medical and nursing education (54), (55), (42), (43), (56).

As alluded to previously when discussing barriers and facilitators in the literature, Tun et al. 2020 (43) made the case for faculty development as means for facilitating planetary health teaching through the discussion of four case studies in which faculty development either directly or indirectly involving students is underway. These cases are situated in the University of California, US; Lancaster Medical School, UK; Georgetown University, US and Bond University, Australia.

In a study by Walpole and Mortimer. 2017 (42), seven medical schools participated in a nine-month collaborative project in which they endeavoured to develop, deliver and evaluate a teaching programme on sustainable healthcare. This study reflected on the result of this project and the effectiveness of the pedagogies employed. In the discussion, the authors highlight three salient findings from the paper:

1. A collaborative approach that allowed discourse between levels of expertise, experience and different institutions conveyed significant benefit in achieving the project's aim.
2. Topics of sustainability are suitable for teaching across a broad range of pedagogies and do not detract from the development of "generic skills and other core knowledge".
3. Curriculum development should be based on "established and coherent" learning outcomes.

This study by Walpole and Mortimer (2017) serves as a useful reference point when discussing the arguments made by other smaller-scale studies that also make recommendations for implementation of planetary health content into the medical/nursing curriculum. The three findings made in the paper (shown above) encompass many of the points addressed in the literature and as such, serve to highlight these points when compared side-by-side, given that they emerge independently in a number of other studies.

On this note; other studies are evident that support the notion that planetary health topics would be well suited to a trans-disciplinary and collaborative approach, both with respect to curriculum design and delivery (45), (29), (57), (58). Gomez et al. 2013 (28) make the argument that a comprehensive medical curriculum will require "input from medical practitioners, public health professionals, environmental scientists, ecologists, and policy experts". They reference environmental health courses at both Yale and Harvard Medical School as examples of this. This point is also made in a case outlined by Profit et al. 2013 in which two Canadian nursing professors detailed their experience of supporting a curriculum review in Zambia to promote an environmental health programme – they conclude that the collegiality and respect among the participants from many disciplines provided the basis for a positive experience in intersectional collaboration and global health (54).

With respect to teaching methodologies, on review of the literature there are additional papers that make reference to the suitably of planetary health topics to a broad range of pedagogies and integration into existing teaching methodologies. In order to facilitate ease of implementation, some papers recommend that planetary health teaching be incorporated into already existing content or that existing material be broadened to accommodate planetary health themes (59), (60), (44). Wellbery et al. 2018 (45), sign-posted areas in the curriculum such as cardiovascular health (related to changing air quality), sexually transmitted infections (related to displaced populations), and mental health disorders (related both to displaced populations and also to extreme weather) as examples of places in which planetary health could be assimilated.

Problem-based learning has been suggested as a potential methodology for the delivery of this content, in that it would allow students to explore clinical and public health implications of planetary health issues in a considered and reflective manner (61). Problem-based learning in this manner, when delivered through case-based scenarios, has proven effective in the context of different attempts to deliver planetary health content, internationally (62). Some papers advocate the use of didactic learning and case-based teaching in tandem; with the didactic teaching as a means of presenting the topics to the students in a broad sense and the case-based learning as a method of highlighting the effects of these issues through a more specific, individual lens (63), (44).

In the context of case-based learning, some literature makes a recommendation that cases be grounded in a clinical setting, with clinically relevant scenarios (64). As Lavey et al. 2018 (65) points out; students are often galvanized by realistically simulated real-world scenarios, and are eager to hone clinical skills. Placing case-based learning in this context would be a means of bolstering student engagement with the subject matter.

Taking advantage of modern technology and utilizing e-learning was also a method advocated in the literature. Musaeus et al. 2018 (66), demonstrate how e-collaborative tools can be used to improve climate literacy within the medical curriculum and this sentiment is echoed by Richardson et al. 2016 (67) and Goodman et al. 2011 (57) with respect to nursing education. Furthermore, Green et al. 2020 (46) make recommendations for peer-to-peer learning through the medium of e-technologies as the optimum means of delivering planetary health teaching.

It is important to note that, in terms of the location of content, the most prominent argument made is for the spiralling of planetary health content throughout curriculum, in that topics would be introduced in the first year of study and then built upon in subsequent years (50), (57), (58). It should be noted that in their study, Tehrani et al. 2017 (50) advocated for spiralling of curricula and for developed learning objectives to be included in both pre-clinical and clinical years. However, they suggest that the pre-clinical years of medical school would be better suited to a higher proportion of learning objectives than the clinical (thirteen in the pre-clinical versus six in the clinical). On review of the literature, no study was found to make specific recommendations as to whether these topics would be better suited to the

earlier or later years of medical school. However, as discussed above, the importance of delivering teaching in a clinical context is addressed (64), (65).

2.3.5 Resources and learning objectives

Planetary health is a relatively new field without established implementation in curricula at present and there is an assertion that many healthcare educators currently do not possess the requisite knowledge, experience or competencies to deliver a comprehensive and balanced education to undergraduate medical/nursing students on planetary health topics. A number of papers therefore endeavour to provide resources and to recommend learning objectives/outcomes that educators can reference and build upon.

In 2014, Walpole et al. (2015) (68), conducted a UK-wide consultation through a Delphi-process which garnered opinions of healthcare students, healthcare educators and other key stakeholders in order to draft learning outcomes for the delivery of environmental sustainability teaching in medical education. The first; 'describe the relationship between the natural environment and human health', assesses student-knowledge on environment-mediated health-effects through the lens of planetary health. The second; 'discuss the duty of a doctor to protect health in a time of global environmental change' relates to environmental stewardship and the acknowledgement of the responsibility of the physician to regard health holistically, with an awareness of the determinants of health. The third; 'demonstrate skills for a sustainable health system' relates to utilising information about planetary health to assess and improve decisions about health services delivery. These domains outlined by Walpole et al. 2015 have since been refined (69) and piloted (29), (44), (70) (Walpole et al. 2016, 2017,2019) in medical and nursing education.

Separately, frameworks for environmental competencies in medical education developed by other researchers have produced recommendations that align with similar themes as those described by Walpole et al. 2015 (68). Bell et al. 2010 (59) also made recommendations for similar undergraduate medical learning outcomes in their paper for climate change competencies. A literature review conducted by Parker et al. in 2019 (71) identified three competencies specific to the environment that were necessary for healthcare: "systems thinking", "resource stewardship" and "social and environmental justice". There is significant crossover between the outcomes outlined here and the second and third learning outcomes suggested by Walpole et al. 2015.

Although not specifically addressed by either of these papers, the first learning outcome suggested by Walpole et al. 2015, which recommends a strong knowledge base around the health effects related to environmental disruption is emphasised elsewhere in the literature (50), (69).

A number of papers also make recommendations for learning outcomes related to planetary health within the undergraduate nursing curriculum. In 2014 a nurses' sustainability toolkit was developed at Plymouth University, UK (72); the toolkit was developed following a Delphi study involving expert nurse educators from four universities – Plymouth (UK), Maastricht (Netherlands),

Jaen (Spain), and Esslingen (Germany). The six learning domains for undergraduate nursing education in issues of sustainability recommended by the toolkit are as follows: 1.Underpinning concepts: sustainability and health; 2. Providing environmentally sustainable health care; 3. Relationships between health and the environment; 4. Healthy (sustainable) communities, and, 4. Social and policy context. A number of other examples in the literature could also be drawn upon by nursing educators for recommendations regarding curriculum content and outcomes (73), (47), (55). Leffers. 2017 (74), and McDermott Levy 2019 (47) both provide learning objectives and detail specific health effects pertinent to nursing education e.g., heat-related, poor air quality, natural disasters, food and water insecurity and air pollution are health effects mentioned by both papers. Upvall et al. 2019 (75) and Pilling et al. 2016 (36) recommend the Sustainable Development Goals as a framework for the development of planetary health learning outcomes within nursing curriculum.

2.3.6 Opinions of students/educators

There are a variety of examples in the literature of research examining the perspectives and knowledge base that undergraduate medical/nursing students hold towards the integration of planetary health topics in medical curriculum. A number of common findings are evident when comparing the results of these studies.

One of the most prominent discussion points that emerged from the literature is the finding that, when questioned, the undergraduate student cohort indicated a high level of awareness of planetary health issues, but described a deficit in concrete knowledge related to the subject matter. Pandve et al. 2011 (76), conducted a study in which they endeavoured to assess awareness of climate change issues amongst medical students attending medical college at Pune city, India. 250 students were surveyed via questionnaire. 98% students agreed climate change to be an issue, however only 47% students thought that health-related issues related to climate change should be a priority. Yang et al. 2018 (77), carried out a cross-sectional survey of medical students, public health and nursing students in universities in China which aimed to measure the knowledge and perceptions of students about climate change and its impacts. They found that there was an overwhelming belief in the respondents that climate change is a negative phenomenon and a global concern. However, only 60% of the respondents could correctly identify the causes of climate change. Nigatu et. al. 2014 (78) and Liao et al. 2019 (51) made similar discoveries in their studies; finding that medical students generally acknowledged climate change and environmental instability as genuine and concerning issues, while simultaneously expressing a lack of knowledge in relation to the specifics of their relationship with human health. Cruz et al. 2018 also made similar findings in two separate studies (79), (80) that investigated predictors of student attitudes towards the environment and sustainable development in health care using the Sustainability Attitudes in Nursing Survey 2 (SANS-2) and the New Ecological Paradigm Scale (NEP). Interestingly, they found that a lower awareness of environmental health in nursing correlated with a lower attitude score i.e.,

students that demonstrated a lower awareness of environmental issues in general, were less inclined to support the inclusion of these topics into nursing education.

On review of the studies that questioned undergraduate nursing/medical students on their knowledge of specific health effects, some other commonalities in findings emerged. Studies found that students were more likely to indicate an awareness of direct health effects with a clearly demonstrable cause and effect that often occur within a narrow temporal window; such as extreme weather events causing heat-related illness or flooding (77). This is in contrast to indirect health effects with more complex or long-term consequences - which are less likely to attract students' attention. Of note, detrimental effects to mental health secondary to climate change and environmental instability were poorly acknowledged in two separate studies (51) (78).

There were some notable findings related to participant demographic characteristics influencing study results, Nigatu et al. 2014 (78) found that a slightly higher proportion of female students (78.6%) than male students (76.7%) were aware of climate change and its health impacts. This was supported by findings by Liao et al. 2019 (51) and Sayan & Kaya 2016 (81).

Country of origin also had an impact on student responses in a number of studies. Chen et al. 2020 (82) carried out a study involving 69 nursing students from China and 32 nursing students from England which aimed to compare undergraduate nursing students' knowledge about sustainability across the two countries. They found that all students had a positive attitude towards sustainability however that Chinese nursing students rate sustainability issues significantly higher in importance than English students. Cruz et al. 2018 (79) also found that country of residence, type of community, and knowledge about environmental issues and their impact on health in any nursing course were significant factors that influenced the students' attitudes toward environmental sustainability. Richardson et al. (2016) (83) used a comparative survey design within the Sustainability Attitudes in Nursing Survey (SANS_2) questionnaire comparing first year student nurses' attitudes towards sustainability across four European countries. 916 nursing students participated (UK: 450, Germany: 196, Spain: 124, Switzerland: 146). They found that German nursing students scored higher than students from the UK and Spain, suggesting that the cultural and social context in which the student resides can have a significant impact on their attitude towards these topics.

Student perspective articles in the literature also offer an interesting insight into the attitudes of undergraduate medical/nursing students. Rabin et al. (2020) (84) provide a unique perspective piece written by medical students that highlights the significant role that medical students can have in instigating the integration of "climate change content" into medical education. Green et al. 2020 (46) wrote a student response to Tun et al. 2019 (41) in which they made recommendations for peer-to-peer learning as the optimum means of delivering planetary health teaching. Further to this the Canadian Federation of Medical Students launched the Health and Environment Adaptive Response Taskforce (HEART) in 2016 as a direct response to growing student interest and concern related to planetary health issues (85). These studies indicate a demand amongst medical students for further education on

issues of planetary health and they reflect a sentiment amongst the undergraduate medical student cohort that there is insufficient teaching on these topics. A study by El Omrani et al. 2020 supports this sentiment, finding that from a broad survey of 2817 medical schools, only 15% had incorporated topics of climate change and health into their curriculum however, in an addition 12% of medical schools students had independently led climate-related activities (86).

In contrast to the relatively large number of studies in the literature that investigate student perspectives towards planetary health issues, studies that expressly explore the perspectives of medical/nursing educators are relatively few. Tun et al. 2019 (41) and Tomes (2011) (48) explore the perspectives of medical educators around the barriers and facilitators towards the integration of planetary health themes into medical curriculum, which have been addressed previously in this literature review. Other studies have drawn upon the experience or opinions of medical educators or experts on the field of education in drafting learning objectives or curricular content for planetary health (44), (70).

However, on review of the literature, no studies were found that specifically investigated the attitudes of a diverse cohort of medical educators with a view to gleaning insight into attitudes and knowledge of planetary health amongst the wider educator population.

2.3.7 Conclusion

On review of the literature, it is evident that there are numerous voices, calling for the inclusion of planetary health topics into undergraduate medical/nursing education. Although there is an international distribution of research, it is interesting to note that the majority of research originates from western countries (UK & USA).

Further to this, there are studies that make practical recommendations for the inclusion of these topics; as outlined above, examples range from case reports, literature reviews and commentary pieces that make suggestions based on the existing literature. Case-based learning, problem-based learning and the utilisation of e-technologies are all examples of teaching delivery methods suggested within the literature. In terms of the location of planetary health teaching within the curriculum, the most prominent theme that emerges on review of the literature is advocacy for spiralling of this content throughout the curriculum.

There is a wealth of research evident that has investigated the perspectives of both undergraduate medical and nursing students in relation to the role of planetary health within their curricula, internationally. Although the majority of these studies are quantitative in nature, some also employed qualitative methods such as focus groups. One of the strongest recurring findings in this literature was the propensity towards a high level of awareness of planetary health issues but a comparatively low level of knowledge amongst the student cohort. Furthermore, demographic characteristics such as gender and

nationality were, on occasion, found to have an impact on student perceptions.

As mentioned previously, there are only a handful of papers that include undergraduate medical/nursing education as part of their study population and no studies were identified that specifically investigated the attitudes of a specifically selected cohort of medical educators with a view to identifying perspectives that are representative of the wider undergraduate medical educator population.

There are a number of papers that address the issue of barriers and facilitators towards the integration of planetary health topics indirectly (often through acknowledgement of potential barriers/enablers while primarily focusing on making recommendations for implementation). However, as mentioned previously there are only a couple of papers that directly explore the potential barriers and facilitators as their primary research question. In both these studies, the methodology does not include a component investigating student and educator attitudes and perspectives in tandem.

On review of the literature, there are a couple of studies that directly investigate the barriers and facilitators towards the integration of planetary health topics in curriculum (41), (48). However, these studies involve educators as the only participant cohort. Furthermore, Walpole et al. 2015 (68) serves as the only example on review of the literature that employs mixed methods to explore the opinions of both medical students and educators in relation to planetary health topics in curriculum. However, the focus of their study is in drafting learning objectives and making recommendations for implementation, and does not explicitly explore participant attitudes or existing knowledge in relation to planetary health topics.

On review of the literature, this study is the only study that employs mixed methods to explicitly explore both student and educator attitudes and knowledge towards the broader topics of planetary health in the context of making this investigation into barriers and facilitators. Indeed, no other study was identified in the literature review that specifically investigates undergraduate medical educator knowledge of the health effects related to planetary health. Furthermore, no other study was identified that explored both student and educator attitudes in tandem with investigating the perspectives of both cohorts towards the integration of planetary health topics into medical education.

Chapter 3

Methodology

3.1 Study design

This study had originally intended to employ a sequential, explanatory mixed methods approach (87). However, in light of the unanticipated COVID-19 pandemic and subsequent restrictions on access to the undergraduate medical student and medical educator cohorts, the study was adapted to a concurrent triangulation mixed-methods design (88).

In a concurrent design, both the qualitative and quantitative arms of the study are executed (almost) simultaneously (89). Combining qualitative and quantitative methods provides enhancement or clarification of the results from one method, with the results from the other (90, 91). In this way data collected from both the quantitative and qualitative components of this study will produce an outcome greater than the sum of its parts.

Triangulation refers to the synthesising of data gleaned from both qualitative and quantitative data with a view to identifying new insights or complementary themes. As Morse 1991 (92) explains, the purpose of this design is to "obtain different but complementary data on the same topic".

A convergence model for concurrent triangulation design was used in this study (Figure 2). This represents an approach in which the researcher collects quantitative and qualitative data separately in the context of a common research question and then the different results are converged (through comparing and contrasting the different results) during interpretation. This model is particularly useful when seeking to complement or corroborate qualitative findings with quantitative results (87).

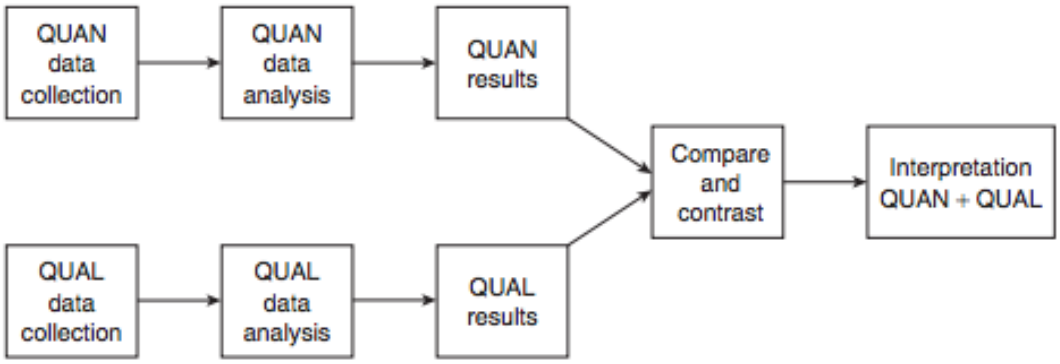


Figure 2 - A mixed methods triangulation design: convergence model illustrating the different phases of this study - diagram taken from Creswell 2007 (87)

The methodology drew on the epistemological framework of pragmatism as validation for the use of mixed methods in this study. Pragmatism is a widely recognised approach to mixed method research (93) that aligns research methods to the research question itself. The concept of pragmatism revolves around specific issues relating to the research informing the principal line of action, while still recognising the different world-views of quantitative and qualitative paradigms. Pragmatism recognises knowledge as relative depending on context and as constantly redefined, rather than absolute (88). In this study, in relation to the evaluation of an entity as nuanced and relative

as an individual's perspective or attitude, pragmatism supports the use of mixed methods. As Mason (2006) points out, our understanding of phenomena may be inadequate if we view them along a single dimension (94).Through mixed methods it is possible to enhance or clarify the results from one method, with the results from the other.

3.2 Qualitative interviews

3.2.1 Semi-structured interviews

The semi-structured interview consists of a series of open-ended questions, often with follow-up or probing questions interspersed. The conversation is encouraged to flow organically around the subject material – rather than conforming prescriptively to an established agenda (95). Semi-structured interviews were chosen for this research to allow for the investigation of the views of the participants in an exploratory way, without corralling them to adhere too closely to a particular theme or topic. The free-flowing format encouraged by the semi-structured interview is appropriate to the subject matter of this thesis as the topics of climate change and environmental instability can often provoke dramatically different opinions and, as such, the aim was to allow space for these different perspectives.

3.2.2 Participant selection and data collection

Semi-structured interviews were conducted by the principal researcher. The interviews were carried out with educators at the RCSI. The researcher had a professional relationship with approximately five of the participants, which had been established prior to interview. This relationship included sharing an office space and collaborating on teaching duties within RCSI.

Purposive sampling was employed to select participants for the semi-structured interviews. Purposive sampling is a type of nonprobability sampling. Invitations to participate were sent to specifically chosen individuals with the aim of achieving a sample cohort with a diverse set of demographics (96). Staff involved in the active teaching of undergraduate medical students at RCSI were deemed eligible to participate. An effort was made to sample participants across a broad range of specialties and from varying levels of responsibility and seniority within the delivery of curriculum. Every effort was made to ensure a balance with respect to gender.

Participants were invited to participate via e-mail. An information leaflet regarding the study and a consent form were attached along with an e-mail invite (Appendix A). The RCSI research ethics committee had vetted the attached forms. Twenty-five e-mail invites were extended to eligible educators. Five educators did not respond to the e-mail invitation. Five educators declined the invitation to participate due to time constraints. Fifteen educators agreed to participate.

No educators from the public health faculty were interviewed – this was to avoid disproportionately reflecting the opinion of the public health department; public health faculty have been shown to be more environmentally sympathetic and as such this may lead to the emergence of a disproportionately favourable outlook towards the interview question during analysis, that would not accurately represent the views of the wider sample group. This also allowed exploration of the assumption that there is "resistance from the established medical profession" to the concept of planetary health in education (41).

Interviews were conducted during June 2020. Due to the onset of the COVID-19 pandemic a couple of months prior to this, both the principal researcher and the vast majority of educators were working remotely at the time of interview. As such, interviews were conducted over "Microsoft Teams", a video communication platform. Terms of confidentiality as outlined in the information leaflet were re-stated at the beginning of each interview. The interviewer also gave confirmation of receipt of the signed consent form (Appendix B). During the interviews, both the participant and interviewer were required to have their camera turned on so that they could maintain face-to-face contact throughout the interview via video link. Nobody else was present during the course of the interviews apart from the principal researcher and the participant. Interviews lasted from 30 minutes to 1 hour. Data saturation was achieved after 10 interviews were conducted. The definition of data saturation is taken from the description given by Grady 1998 (97); no new themes or insights were being gleaned during the course of the interviews. A further two semi-structured interviews were conducted and then interviews were stopped.

Interviews were recorded on the principal researcher's mobile device and subsequently transcribed. Medical educator responses were pseudonymised. No video recording was made on "Microsoft teams". Audio recordings were destroyed following their transcription.

The online transcribing service "Trint" was used to aid in transcribing the interviews, on the recommendation of one of the academic supervisors (https://trint.com/) (98).

3.2.3 The interview schedule

Questions for the semi-structured interviews were informed by the literature review and guided by the research objectives. Prior to initiating the formal semi-structured interviews, a pilot interview was performed. This pilot interview was conducted with a medical educator who fit the inclusion criteria for the study. However, given that its function was to pilot the central questions and to hone the principal researcher's interview skills – responses from this interview were not included in the analysis.

Adhering to the open-ended semi-structured interview format, three broad themes were addressed during the interviews:

1. What current level of awareness do medical educators have towards the health effects related to climate change and environmental instability?
2. Do medical educators believe that these topics should be integrated into medical education?
3. What are the barriers and facilitators towards the integration of these topics into medical curriculum?

These broad themes were posed in the form of direct questions to interview participants as the cornerstone of the interview script. An effort was made to encourage the natural course of conversation through follow-up questions and prompting. Due to the fluid and responsive nature of the conversation, a number of different themes and subthemes were revealed through the course of the interviews.

3.2.4 Interview analysis

Braun and Clarke's (2006) (99) framework for thematic analysis was employed in the analysis of the semi-structured interviews. Reflexive thematic analysis was deemed the most suitable analytical method in this study as it encourages a flexible and organic coding process. The reflexive thematic process endorsed by Braun and Clarke facilitates the conceptualization of themes as reactive and determined by the data. It allows forensic analysis of the data and the identification of shared themes and ideas which are underpinned by an overlying concept. In this way it supports the reliability of qualitative coding through a robust, iterative reflection on the data and stimulates original and multifaceted findings that are independent from the study aims and objectives which have been determined from the outset. The example outlined by Noble and Smith (2013) (100) was employed when conducting the analysis in order to aid in demonstrating the robustness of the findings and facilitating transparency.

The online transcribing service "Trint" was used to aid in transcribing the interviews, on the recommendation of one of the academic supervisors (https://trint.com/). Recordings from the interviewer's mobile device were uploaded to Trint and transcribed from there into text. Recordings were subsequently deleted from the interviewer's mobile device. The principal researcher was the only data coder during analysis.

Initially each transcribed interview document was reviewed and re-familiarised with the content of the individual conversations. The interviews were manually formatted during this time and corrections were made for grammar and spelling errors that occurred during the automatic transcribing process. An example of a transcribed and formatted interview can be found at Appendix C.

Next, the interview texts were re-reviewed, individual keywords were highlighted, as were phrases that dealt with a specific theme or made a particular point. An in-built highlighter function on the Trint web-app was utilised to do this. While highlighting subject responses in vivo, an attempt was made to succinctly summarise the phrases identified using the margin on the Trint web-document, in which line-by-line comments could be applied (Appendix D).

After completion of this further familiarisation with the content of the text and refinement of the data into manageable segments, each summarised keyword was examined and assigned a code which most encapsulated the point being made (Appendix E). The coding at this point was inductive, meaning it was completely informed by the data and not yet concerned with grouping or sub-grouping individual codes. Following the sorting and line-by-line coding of the data in this manner, codes were grouped together to identify patterns and points of shared meaning between them.

Through classification of the various codes in this manner a number of categories emerged to which the different codes could be assigned. These categories were assimilated to identify broad initial themes (Appendix F). Following a review of the interview codes to ensure alignment with the initial themes identified, a thematic map of the analysis thus far was generated (figure 3).

Through reflection on the thematic map and further refinement of the categories and subthemes identified, the specifics of each theme were teased out and the final themes and overarching concepts were established (Appendix G).

The principal researcher acted as the data collector and conducted all the analysis. Analysis was done using the “Trint” web-app and Microsoft Word, as outlined. No additional software was used.

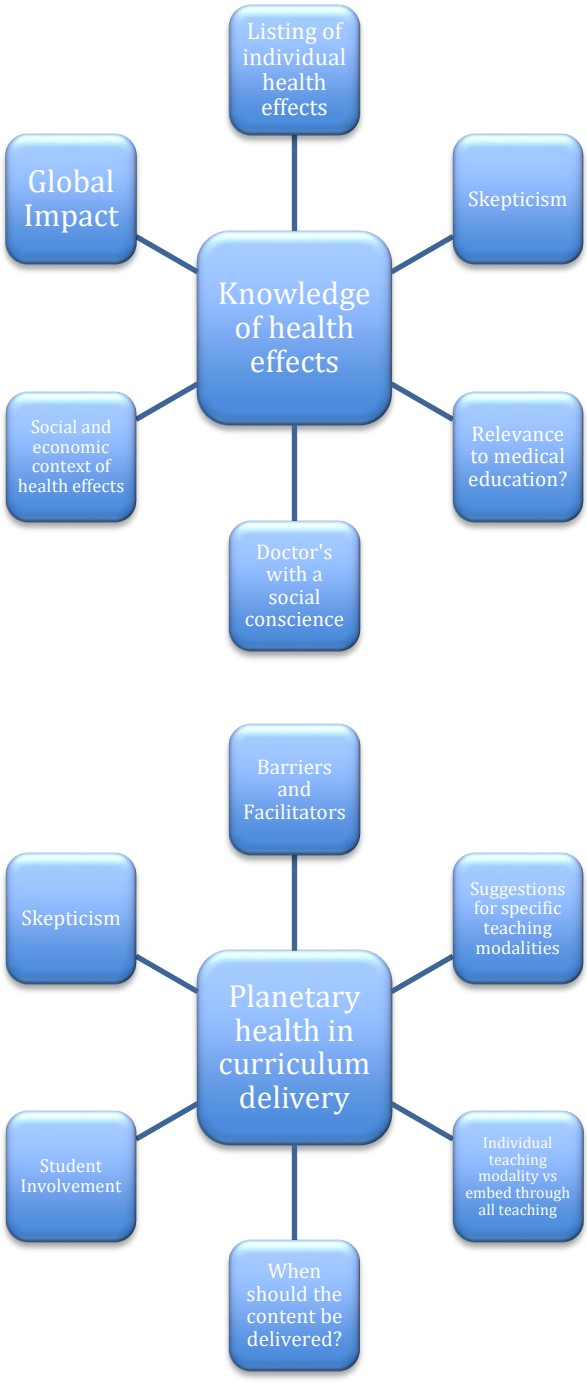


Figure 3 - Thematic map of the analysis

3.3 Quantitative survey

3.3.1 Survey objectives

A survey was developed in order to meet the following objectives (see appendix H for full copy of the survey):

1. To measure the extent to which undergraduate medical students hold an ecologically-friendly or environmentally sympathetic world view towards planetary health.
2. To determine the level of acknowledgment undergraduate medical students have towards planetary health topics
3. To assess the students' attitudes towards the integration of these topics into both current and future medical undergraduate curriculum
4. To identify links between the demographic characteristics of the respondents and their environmental attitudes/attitudes towards the integration of planetary health topics into medical curriculum.

3.3.2 Survey design

The survey is divided into four sections (Appendix H).

The first section is the revised New Ecological paradigm (NEP) scale by Dunlap et al (101) The NEP is a scale that has been extensively used to classify the views that people have about the natural environment (styled as "ecological worldview" by Dunlap et al). The NEP consists of 15 items that relate to limits to growth, the position of humans in the environment, the fragility of nature, and the imminence of eco-crisis. Respondents were asked to record their agreement with these statements on 5-point Likert-like scales. The higher the respondents' scores, the more likely that they are to endorse an ecologically sympathetic and environmentally friendly world view (102). The validity of the NEP as a tool for capturing environmental attitudes has been validated on numerous occasions. Hawcroft and Milfont (2010) (103) conducted an extensive meta-analysis of the NEP's use over a 30-year period and concluded that "until a gold-standard EA [environmental attitude] measure has been widely accepted, it is probably advisable for researchers to continue using the NEP scale as a standard measure of EA".

The second and third sections focus on assessing the level of acknowledgement towards planetary health issues amongst respondents and measuring the attitudes of respondents towards the integration of these issues into curriculum. These questions include a 22-item instrument designed to measure a number of different constructs associated with how medical students feel about climate change, their understanding of health-effects and their acknowledgement of the importance of integrating environmental themes into the curriculum. The questions have closed-ended responses using Likert-type items or other categorical items e.g. "yes", "no", "Do not know". The questions designed for this part of the study were

modelled on the instrument used by Polivka (2012) (104) and Streich (2014) (105) with some modifications for the following reasons:

- both of the referenced studies were aimed at determining attitudes within nursing education. The wording was changed for this study to reflect medical education e.g. “school of nursing” to “medical education”;
- items 2 – 4 of section 2 of the instrument for this study were modified so that the wording of the question stems better reflected the Likert-scale and specified the health effects of climate change e.g. rather than asking whether climate change is “bad” or “good” the question was modified to ask if “environmental change will have negative health effects for human beings”;
- a question in the original instrument on the community impact of climate change was deleted as it was considered not to be as relevant to the undergraduate medical curriculum;
- some items were added to the instrument designed to assess student attitudes specifically to the relationship between planetary health and medical curriculum at RCSI, adapted from 5 broader questions in the original instrument related to nursing curriculum (questions 1 & 2 of section 3);
- the health-related illnesses in item 3 section 3 of the instrument for this study were modified from the original to reflect the health-effects outlined by a report from Whitmee et al. 2015 – published by the Lancet commission on planetary health*: “Safeguarding human health in the Anthropocene epoch”* (Figure 4) (27). This paper was chosen as it constitutes the most comprehensive existing report on the health effects related to planetary health. Responses to these stems were also added to allow students to detail the prominence of these health-effects in medical curriculum at RCSI;
- an open-ended question was added which allowed respondents to express their opinion on the optimal means of the integration of planetary health themes into curriculum.

Of note, in terms of the vocabulary used when posing questions to respondents; the decision was made to frame questions in the context of “climate change and ecological instability” and “the health effects of climate change” rather than directly asking about “planetary health” or “planetary health issues”. Substituting “climate change and ecological instability” for “planetary health” in this manner was done in order to prevent any misunderstanding on the part of the respondents as planetary health is a relatively new term and may not be familiar to many medical students.

The final section included questions about the demographic characteristics of the respondents including age, sex, ethnicity and year of study.

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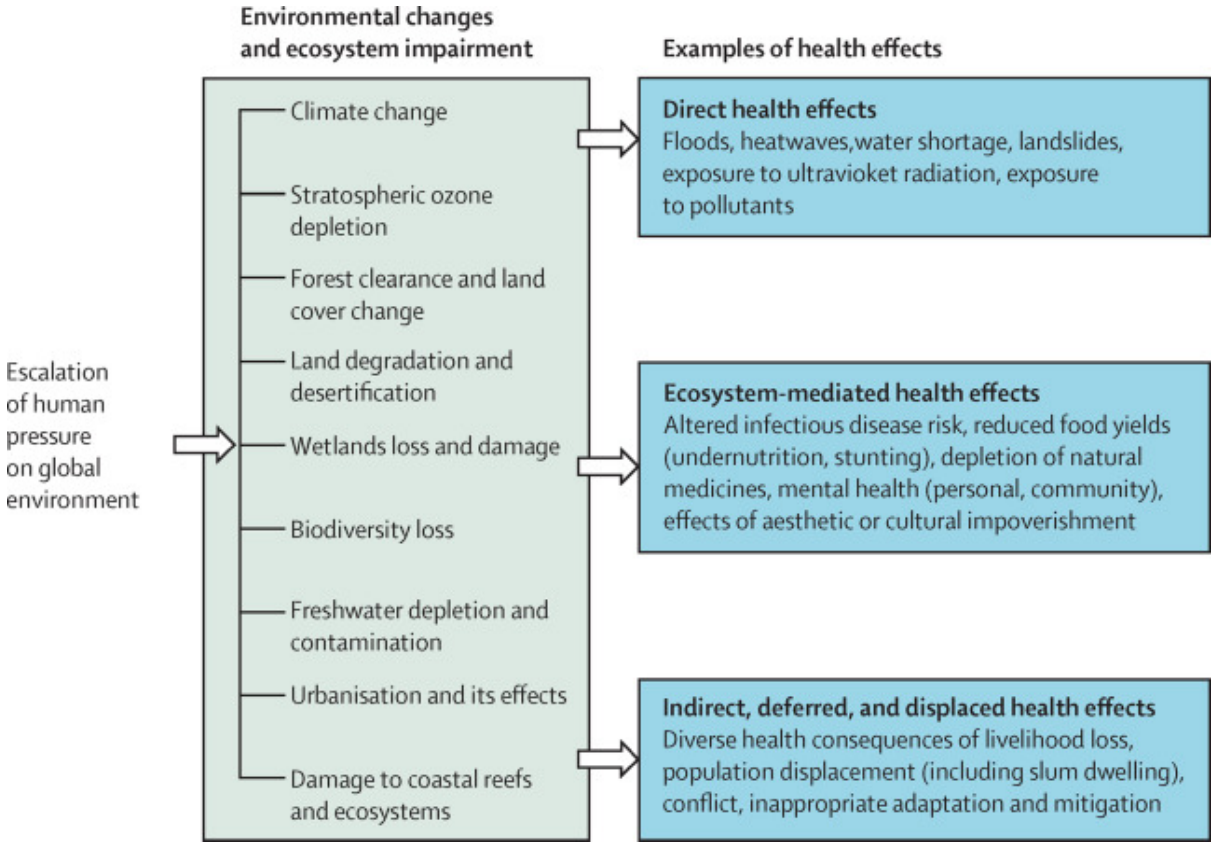


Figure 4 - Health effects outlined by Whitmee et al. 2015 "Safeguarding human health in the anthropocene epoch" (27)

Prior to distribution, the questionnaire was vetted from grammatical errors and spelling mistakes by the principal researcher.

3.3.3 Data collection

The survey was distributed in July 2020. An e-mail inviting students to participate in the study was sent to all undergraduate year groups using e-mail class lists. The e-mail invite contained an information leaflet (Appendix J) which gave details about the study and survey and a brief introductory note summarizing the purpose of the study and the contents of the survey. Due to the fact that the survey was fully –anonymised, consent to participate in the survey was implied through participation in the survey. This was explained to students in the information leaflet provided.

The e-mail invite also contained a link to a secure website (https://www.surveymonkey.com/) (106) for completing the anonymous survey.

The survey took an average of 11 minutes to complete. Reminder e-mails were sent at approximately 1, 2 and 3 weeks after the initial e-mail invite was sent.
Out of 1541 total undergraduate medical students 281 undergraduate medical students responded to the invite by participating in the survey, giving a 18.2%

response rate. Of the 281 respondents who undertook the survey, there was an 80% completion rate.

3.3.4 Survey coding and analysis

Following the close of the Survey in August 2020. Data were exported from the surveymonkey.com website into excel documents. Data were fully anonymised by the surveymonkey.com online survey-tool prior to exporting the data into Excel.

The data were then cleaned and imported into Jamovi in order to analyse trends and compare the responses in relation to various characteristics and between different groups. The “Exploration” descriptive statistics tool in Jamovi was employed to demonstrate trends and tendencies within the data. Comparisons in responses between groups were investigated using ordered logistic regression.

Help was enlisted from the Data Science Centre (DSC), RCSI in the analysis and interpretation of the data.

3.4 Integration

Intrinsic to a mixed methods approach is the integration of the findings from both the quantitative and qualitative components of the study in order to yield new insight beyond what can be gleaned from analysis of the individual components alone (93).

As discussed earlier in this chapter, a triangulation model was used in the interpretation and integration of the qualitative and quantitative arms of this study (88). The findings from both the qualitative component and quantitative component were listed in microsoft word and further analysed side by side, making note of points of convergence and divergence amongst the data in a separate document (107).

3.5 Ethics

Ethical approval for this project was granted by the Royal College of Surgeons in Ireland (RCSI) Research and Ethics Committee (REC).

All educators who participated in the semi-structured interviews were required to sign a consent form prior to the interview. Participants were sent an information leaflet detailing the study prior to the interviews. All interviews were audio-recorded and transcribed. Medical educator responses were pseudonymised. The recordings were transcribed by a professional third party who had no stakes in student education at RCSI (98). Audio recordings were destroyed following their transcription; however transcripts of the interviews

will be held for five years on a secure RCSI server.

Students were sent an e-mail invite to participate in the quantitative survey, participants were explicitly informed that their data would be anonymised in the e-mail invite and in an information leaflet sent as an attachment with the invite. Undergraduate medical student responses were anonymised by the SurveyMonkey web app (106).

3.6 Author and reflexivity

The author is a male and graduated with a degree in medicine (MB BAO BCh) from the National University of Ireland, Galway in 2018. At the time of the interviews the author was in full-time employment as a clinical educator to final-year medical students at the Royal College of Surgeon's in Ireland (RCSI).

The author's position as a current employee of RCSI provided a number of advantages when conducting this study. Given that the author was actively engaged in the teaching of final year medical students at RCSI, the author had insight into the current practices and curricular content at this institution, which helped to guide the semi-structured interviews. As mentioned previously, given that the author had a professional relationship with many educators at RCSI, there is a possibility that participants of the semi-structured interviews may have felt obligated to participate due to this relationship. In order to mitigate this risk, purposive sampling was used to ensure a diverse array of respondents with varied demographic characteristics.

Further to this, given that the interviews were conducted over video-call, the participant's relationship with the author may have influenced their responses to the questions posed. However, in order to eliminate bias, participants were explicitly advised as to the fact that the data being recorded would be pseudonymised. Furthermore, the interviewer endeavoured to remain as neutral as possible when both asking questions and responding to participant statements.

A further advantage conveyed by the author's position as an employee at RCSI is that the author was able to extend invitations to both students and faculty from their RCSI verified e-mail account, possibly lending credibility to the invitation and increasing the likelihood of participant uptake.

However, although the invitation was extended to all year groups and the author was involved in teaching final years alone, a proportion of students may have been familiar with the author due to previous teaching interactions. This familiarity may have influenced student uptake in regards to the quantitative survey. In the undergraduate medical student invite e-mail and information leaflet, participants were advised that all their responses would be entirely anonymised, reducing the likelihood that the participant's former knowledge of the author would provoke bias when inputting survey responses.

In relation to the author's personal perspective on the field of planetary health and its connection with medical education:

Prior to embarking on this research project; the author had an abiding interest in global health issues. The author also had an interest in environmental justice and believed that issues of environmental instability and climate change were deeply linked to human health. Before embarking on the research for this thesis the author had little to no knowledge of the field of "planetary health" although was familiar with the term. Throughout the research process, the author greatly deepened their understanding of the field of planetary health and found it to be the most appropriate term in encapsulating issues of "climate change and environmental instability", particularly with respect to their impact on human health.

Prior to beginning this research project, the author would have endorsed the prospect of an integrative undergraduate curriculum that emphasises the importance of acknowledging the global health context in which topics relating to human health are situated. Due to the author's beliefs on this topic – there was the potential for bias in the gathering and interpretation of the research data. However, in order to mitigate this, the author endeavoured to be as objective and impartial throughout the conduction of this research to adhere closely to an evidence base throughout.

3.7 The RCSI

The Royal College of Surgeons in Ireland (RCSI) is a medical professional and educational institution, which is also known as RCSI University of Medicine and Health Sciences.

The RCSI boasts a diverse international cohort of students from around the world. The RCSI is Ireland's first private University. Student feedback and student experiences are powerful forces in influencing reform and developments at RCSI and their voice is taken extremely seriously by senior management at the institution.

At the time of embarking on this research project, RCSI was undertaking a review and redesign of its undergraduate medical curriculum. This period of transition and fluidity provoked by the ongoing formulation of this new curricular framework partially inspired this research project, with a view to utilising the results of this project to make informed recommendations for consideration during the curriculum design process.

Chapter 4

Qualitative Results

4.1 Participant demographics

12 interviews were recorded, transcribed and analysed.

Quotes that provided a unique insight or were representative of an overarching opinion held by a number of participants are recorded below.

Each quote stated is followed by a tagline, e.g.; Educator 1, Male, Clinical, Medicine, Junior educator. This is to denote the educator number, gender, whether they hold a clinical or non-clinical teaching role, if they are situated within the medical or surgical departments and their position within the department. The aim is to provide context on stakeholder demographic characteristics.

The distribution across these demographic characteristics is as follows (table 3):

Table 3 – Medical educator participant demographics

Gender	Male	Female	
	6	6	
Role	Clinical	Non-clinical	
	10	2	
Speciality	Medicine	Surgery	Health Sciences
	6	4	2
Position	Junior	Senior	Department Lead
	6	4	2

4.2 Health effects and their relevance to medical education

4.2.1 Environmental factors and human health effects

As the interviews progressed the consequences to human health related to climate change and environmental instability expressed by participants included direct and indirect health effects as well as the social and cultural context in which these health-effects manifest.

4.2.1.1 Environmental pollution

One of the most frequently cited health effects mentioned by the majority of educators was respiratory illness secondary to air pollution.

> "I guess in relation to air pollution, that's a big thing – especially in cities with poor quality of air - it affects people who already have underlying health issues being around this air pollution." (Educator 11, Female, Junior, Clinical, Surgery)

For two participants, when the initial question regarding educator knowledge of health effects was posed, this was the first example that sprang to mind. Seven participants in total specifically made reference to air pollution as a concerning health-effect related to climate change and environmental instability.

> "You're actually conscious of the air that you breathe. Even standing at the bus stop you can literally almost feel that the poor air quality coming into your lungs" (Educator 7, Male, Dept. lead, Clinical, Medicine)

Educators made reference to the possibility of having had a subjective experience in relation to air pollution and the tangible nature of the effects of air pollution in perceiving its negative effects.

Further to this, participants made reference to notion that there is a strong existing evidence base for air pollution and, as such, they endorsed air pollution as a potential negative health effect. This perception of a broad evidence base around the health-effects of air pollution may account for the position of prominence that that this particular health effect had during the semi-structured interviews.

> "Air pollution; I've done research on that both in terms of short-term and long-term air pollution, as much as it affects not just respiratory, cardiovascular and neurodegenerative diseases but others as well." (Educator 8, Male, Junior, Clinical, Medicine)

> "The data on asthma exacerbations on days in London when levels of particulate matter are particularly high and low -
> it's clear. I think that airways disease just makes sense." (Educator 10, Female, Junior, Clinical, Medicine)

In the case of disease related to toxic particulate matter in the air, participants drew links between this health effect and the issues of increasing urbanisation and biodiversity loss resulting in increased air pollution which ultimately results in diverse negative health outcomes for human beings. Multiple participants made reference to the increased risk that pertains to living in an urban environment and the potential for negative health outcomes.

> "I think what will be shown, over time, is the city pollution and the effects it could have on respiratory illnesses." (Educator 3, Female, Senior, Clinical, Medicine)

Aside from air pollution, environmental pollution in general secondary to an increasing human influence over our natural world was acknowledged by participants in conjunction with the health effects associated with this. Participants acknowledged that environmental pollution present in many of the earth's ecosystems represents a grave threat to human health, whether

inadvertently, through disruption of the systems we rely on such as our food chain, or directly - through an increased risk of developing cancer or other pathology due to exposure to human pollutants in our environment.

"We're looking at things that are contributing to climate change, that have an impact on health: things like pollution, air quality and their impact on health. Studies have shown that people who live in cities where there's a high level of air pollution are more likely to have a stroke or more likely to have respiratory illnesses and just general poor health because of poor air quality" (Educator 1, Male, Junior, Clinical, Medicine)

Finally, a further point raised by a number of participants is the impact that increasing environmental pollution has on our general psychological health and wellbeing. This educator made the point that the co-morbidities associated with increased exposure to environmental pollution would constitute a psychological burden, particularly with respect to individuals who were more aware of the detrimental health sequelae that could manifest following exposure:

"So exposure to smoke and chemicals and things like that - I also think there's probably some mental health issues with that.. I think a lot of people these days are talking about climate anxiety and then the next generation who are probably a bit more in tune with issues around climate control, seem to be having a lot more mental health related issues around what's going to happen in the future in terms of climate control." (Educator 3, Female, Senior, Clinical, Medicine)

4.2.1.2 Health effects as a result of a changing climate

Another commonly occurring theme that emerged during the semi-structured interviews was the acknowledgement of a perceptibly changing climate and associated global warming.

"Not that we have extreme weather, but we certainly seem to be having less rain and some drier summers [in Ireland]" (Educator 12, Female, Senior, Non-clinical, Health sciences)

Apart from the perceived more gradual experience of warmer and drier seasons here in Ireland, participants also explicitly outlined a variety of direct, indirect and eco-system mediated health effects directly resulting from our changing climate.

During the interviews, participants voluntarily drew connections between these different climate-change-provoked health-effects, demonstrating an understanding of how they intersect and relate to each other. Catastrophic weather events secondary to changes in climate were considered a worrying cause of potential adverse health events by many educators. An increasing global propensity towards unpredictable global weather events such as flooding/drought/hurricanes were cited as worrying causes of ecosystem mediated outcomes such as food insecurity and reduced crop yield.

"..what might be called natural disasters, are impacted by climate change - things happening in the environments like the floods that have washed away villages, washed away people's livelihoods.." (Educator 5, Male, Department lead, Clinical, Medicine)

Interviewees discussed that this disruption of the food-supply chain and natural resources has the potential for harm to human health both at the local level at the point of disruption and internationally.

"..you think of people in developing countries and climate change; droughts and the impact on the food supply chain income…. And I'm sure that impacts on the food chain and on food supply in terms of people in our lands [Ireland]." (Educator 12, Female, Senior, non-clinical, health sciences)

"I think the food insecurity due to rainfall changes and rainfall unpredictability is really on a fairly big scale.." (Educator 2, Male, Department lead, Clinical, Medicine)

Issues of food and water security could also be instigated by increased rainfall and flooding. Malnutrition, population displacement and increasing global conflict all serve in greatly increasing the likelihood of adverse health outcomes for those affected:

"..Mirasmus/ Kwashionkar - children susceptible to a lot of death and disease because they don't have enough food." (Educator 2, Male, Department lead, Clinical, Medicine)

A couple of participants acknowledged that an increasing prevalence of infectious disease was a health effect that could be influenced by other direct or indirect health effects of climate change and environmental instability, particularly with respect to a changing climate and extreme weather events.

"I'm looking at the obvious, which is the catastrophic [weather] events that obviously lead to huge epidemics within countries. If you have somewhere that's been affected by a massive flood and their access to fresh water is therefore curtailed - you could have cholera epidemics, infectious disease." (Educator 1, Male, Junior, Clinical, Medicine)

When a fundamental component of social infrastructure like access to clean water is disrupted due to an extreme weather event such as flooding or drought – hygiene and sanitation also becomes a major concern. This in turn leads to the potential for the spread of infectious disease.

"I think transmissible diseases, any type of transmissible disease, whether it's malaria or something like cholera. If you were living in a prolonged monsoon season in a country where buildings aren't even as structurally stable as they would be elsewhere, you'd imagine the spread of transmissible diseases would be much worse." (Educator 10, Female, Junior, Clinical, Medicine)

Climate anxiety and the modern preoccupation with global warming can also have deleterious effects on mental health. In recent years, the pervasive narrative in the media of rising temperatures, degenerating atmospheric ozone layer and melting polar ice caps can provoke a climate neurosis and pessimism about the state of the earth that will be inherited by future generations.

"So exposure to smoke and chemicals and things like that - I also think there's probably some mental health issues with that. I think a lot of people these days are talking about climate anxiety and then the next generation who are probably a bit more in tune with issues around climate control, seem to be having a lot more mental health related issues around what's going to happen in the future in terms of climate control." (Educator 3, Female, Senior, Clinical, Medicine)

Another participant supported the notion that younger generations would be more susceptible to the deleterious effects of planetary health issues on mental health and psychological wellbeing:

"Certainly there are reports of it [global warming and environmental instability] impacting mental health in terms of anxiety around climate change. So what are the impacts on mental health? I don't think we know and I don't think there's a lot of evidence for that yet. But there certainly is anecdotal evidence, particularly among young people" (Educator 12, Female, Senior, Non-clinical, Health sciences)

Although this educator did point out their belief that there is, at present, insufficient evidence to definitively support this idea.

Beyond mental health ramifications amongst younger people, one participant also acknowledged the potential for climate-related stress amongst the population in general, and made reference to the insidious manner in which this could manifest:

"I think that [climate change] also has a big impact on people without them realizing it. I think that it definitely probably contributes to stress. " (Educator 11, Female, Junior educator, Clinical, Surgery)

4.2.1.3 Ecosystem instability

As outlined in the methodology, when posing the question to participants regarding their understanding of health effects related to planetary health issues the choice was made to frame the question in the context of "climate change and environmental instability" rather than "planetary health" issues. Although there is significant overlap between these issues, many respondents focused on topics that aligned more closely with the issue of climate change, rather than specifically addressing the topic of environmental instability. As such, often the topic of ecosystem disruption and environmental instability was alluded to as part of a broader discussion rather than being explicitly outlined or addressed.

However, some participants did specifically acknowledge the disruption of ecological systems and environmental infrastructure as a consequence of human growth and industrial development. Primarily participants recognized that the cost of human expansion, resource consumption and economic growth is often exacted on the environment in which we reside and expressed concern about the impact this would have on human wellbeing.

"Probably more so in developing countries, the changing ecosystems that are happening in certain countries; the rainforests in South America or certainly in parts of Southeast Asia where the human population is overwhelming the ecosystem that they're currently residing in" (Educator 6, Female, Senior Educator, Clinical, Surgical)

One participant made the point that humans have a symbiotic and co-dependent relationship with our habitats and as this relationship shifts more and more towards the exploitative and destructive, we are undermining the natural systems that support us and run the risk of increasingly detrimental effects on human health.

"..from the life in the sea and how they've [animals] been affected [with climate change], the deep deprivation of those animals affects the whole circle of life." (Educator 4, Senior educator, Clinical, Surgical)

As one participant pointed out, a changing climate/rising global temperatures and the disruption of normal ecosystem patterns have a synergistic detrimental effect for human beings - for example, it can lead to the propagation of certain insect species with can also manifest as a threat to food security:

"..access to clean water and the impact of people having access to hygiene and the impact on people's likelihood being affected by locusts…. East Africa and Pakistan at the moment are having their crops wiped out by locusts." (Educator 5, Male, Department lead, Clinical, Medicine)

The ecosystems that support us are complex and complementary. Disrupting the natural balance and harmony at a single point along that system can have unexpected and far-reaching consequences.

"..Whether that's in the air that we breathe, whether it's in the built environment or the natural environment, whether it's the water that we drink or whether it's in the microbiome, the organisms that inhabit our bodies, and that we come in contact with every day." (Educator 5, Male, Department lead, Clinical, Medicine)

4.2.2 Relevance to medical education

4.2.2.1 Global issue, global doctors

A particularly interesting theme emerged throughout the analysis of the semi-structured interviews, when discussing any of the myriad health effects mentioned above; participants would acknowledge the importance of viewing them through the lens of their geographical or economic context. For example, how these health effects manifest in low-income countries or countries more vulnerable to the effects of climate change and environmental instability due to an underdeveloped national infrastructure.

"There would seem to be a whole host of negative health consequences due to climate change, particularly in the developing world, where it [climate change and environmental instability] can really make an impact… climate change appears to effect the poorest people the worst in the world" (Educator 12, Female, Senior, Non-clinical, Health sciences)

This belief that the residents of more resource-poor countries with less robust national infrastructure systems were disproportionately affected in terms of the negative health effects related to planetary health issues was striking in that it was held and spontaneously mentioned by over half the participants interviewed.

"I think some of the countries that are heating up fastest are ones that already have problems with drugs, with famine, et cetera." (Educator 3, Female, Senior, Clinical, Medicine)

The reality is that medical students are an international cohort who will have to practice medicine in different international settings with varying social/systemic and health issues beyond what is seen in Ireland. Many

physicians of the future will be faced with a practice setting situated within the systemic challenges prevalent among low-resource countries.

> "..particularly because we have such an international cohort of students and as a result we will have what will be a very international cohort of doctor".
> (Educator 10, Female, Junior, Clinical, Medicine)

This participant acknowledged that medicine is a dynamic and international profession that necessitates awareness of the role of the physician as operating within the context of global network and equips them to do so:

> "The globalisation of medicine is something that's really important – the fact that we practice different medicine in different parts of the world and adopt adaptable medical practices..
> It's about creating a new type of doctor, isn't it? One that isn't just very knowledge heavy and book smart, but someone who is aware of the world around them and aware that they only function as a doctor within a network." (Educator 3, Female, Senior, Clinical, Medicine)

Supporting this idea, throughout the interviews, participants indicated a good awareness of the different ways in which discrepancies in resource and global inequalities could amplify the negative health-effects associated with climate change and environmental instability.

The importance of a strong national infrastructure was emphasized as a mitigating factor in relation to these health effects:

> "..they [resource-poor countries] have essential health risks that compound any kind of actual natural disaster risk, infrastructural cost on top of that, not having the correct infrastructure to be able to remediate some of those issues.." (Educator 1, Male, Junior, Clinical, Medicine)

Countries in which there are efficient and robust systems of waste management, agriculture and food security, sanitation, social support and financial viability are in a better position to absorb the negative impact of environmental change and ecosystem impairment.

If observed purely from a financial perspective; even if the agriculture resources or food security of a high-income nation is jeopardized through an extreme weather event or crop failure secondary to an environmentally-mediated phenomenon like desertification, their greater financial stability relative to a low-income nation would allow them to manage the health impacts on their population through the importing or purchase of necessary resources.

> "And many of those poor countries don't have the sort of ability to cope in the way that [we do], if our agriculture production declines for Europe, we can borrow 30 million or a billion on the bond markets relatively cheaply and easily and feed our population with that 30 billion rise. Developing countries can't do that." (Educator 2, Male, Department lead, Clinical, Medicine).

Further to this, the point was made that nations that have experienced a more recent increase in economic growth are often dependent on environmentally detrimental industries or have experienced a developmental surge due to investment in these industries. In countries that have undergone rapid economic growth due to these industries, the requisite systemic infrastructure to aid in attenuating the environmentally toxic by-products of this industrial expansion may not have yet been developed.

"..especially countries with a lot of recent economic growth where they've had, a surge in industry and the economies have improved, but they don't have the history of managing waste" (Educator 7, Male, Dept. lead, Clinical, Medicine)

Furthermore, the countries often most vulnerable to the more overt effects of climate change and environmental instability from a geographical perspective are often resource-poor nations with a less developed national infrastructure. These are often nations residing within areas with a traditionally dry, arid or tropical climate - in which issues like an increasing proclivity towards climate and ecosystem-dependent issues like extreme weather events, high temperatures and desertification would be more acutely felt.

"So the biggest impact, I think, is happening in developing countries, particularly sub-Saharan Africa, where we're seeing climate change lead to desertification gradually increasing southward over the last 20 - 30 years" (Educator 2, Male, Department lead, Clinical, Medicine)

As the problems of climate change and environmental instability escalate, these issues will become more prevalent, not just in resource-poor settings, but all around the globe - with worsening health outcomes internationally. This participant highlighted the imperative that medical students are equipped with the knowledge base necessary to prepare them for these issues.

"I think it is important, particularly with our particular cohort of students who are and going to various different parts of the world and for climate change which may have even a greater impact [globally] than it's having in Ireland" (Educator 12, Female, Senior, Non-clinical, Health sciences)

It is interesting to note, some participants suggested that in Ireland the effects of climate change and environmental instability would be more subtle than in other countries and inferred from this that in Ireland they would represent less of an issue.

"I think if you're living somewhere that is noticeably affected by climate change for the worse [it's an issue], because obviously in Ireland, we think we never had seasons before. Now we have seasons. That's very different than in Bangladesh or if you're living in India." (Educator 10, Female, Junior, Clinical, Medicine)

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"[Health effects] are more clear to see in those areas of the world that are perhaps being more directly affected or more evidently affected, [than] the more subtle ways in which we would see it in the parts of the world that we live in." (Educator 5, Male, Department lead, Clinical, Medicine)

Given the extent of recognition amongst the educators interviewed of planetary health as global issue with far-reaching consequences that are heavily influenced by the social and infrastructural context in which they occur, it is unsurprising that a number of participants felt that medical education should strive to produce doctors who are citizens of the world – practitioners with an involved understanding of global issues and how their practice fits into global health systems:

"There is certainly a push about recognizing the fact that we're not just teaching doctors who are going to practice here in Ireland, but we're teaching doctors who are going to

practice world- wide. And for a lot of them, they're going to face more of these issues on a day to day than necessarily we are here cloistered in Dublin" (Educator 6, Female, Senior Educator, Clinical, Surgical)

4.2.2.2 Cultivating skills and unique competencies

A further theme that emerged from the semi-structured interviews was the idea that enabling medical students to understand their role as global practitioners encourages the development of essential skills and competencies. The point is made that these skills and competencies would help fulfil their future responsibilities as doctors operating as part of a complex health network, that expands beyond the health setting into the wider domestic and international communities.

As the following quote highlights, when developing an appreciation for global issues, it is also necessary to train students to consider their broader social context and to cultivate a social conscience. Addressing the link between poor health outcomes related to planetary health and social disparity requires an insightful and compassionate outlook:

"We [doctors] have the opportunity through our education and training to come to some level of understanding of the impact that these issues are likely to have on others." (Educator 5, Male, Department lead, Clinical, Medicine)

Medicine is fundamentally a profession of care and social service. As this participant points out, much of the professional gratification in medicine is garnered from this feeling of righteous care and advocacy:

"Activism, I think, is very healthy for people's mental health. I think having a cause, getting involved, caring, having meaning is very, very helpful for people." (Educator 12, Female, Senior, Non-clinical, Health sciences)

Giving medical students the knowledge and skills to participate in this advocacy in an informed manner is a crucial facet of their training. As articulated below, undergraduate medical training should not just aspire to produce clinicians that have the ability to memorise and regurgitate exhaustive lists of facts and figures but also to critically-appraise the social structures and dynamics that influence human health:

"It's about creating a new type of doctor, isn't it? One that isn't just very knowledge heavy and book smart, but someone who is aware of the world around them and aware that they only function as a doctor within a network." (Educator 3, Female, Senior, Clinical, Medicine)

On analysis of the interviews, it was also felt by this participant that the study of planetary health topics in undergraduate medical training imparts additional learning outcomes beyond a broader capacity for compassion and social awareness:

"I think it's not just about knowledge related to climate medicine, but it's about developing skills that allow someone to be able to deal with the uncertain, introducing more emphasis on problem solving and the ability to change and to adapt." (Educator 3, Female, Senior, Clinical, Medicine)

Reflecting on the unanticipated impacts of climate change and environmental instability fosters analytical thinking and problem-solving skills. Planetary health topics represent complex issues that do not have a clear-cut solution.

Through the study of planetary health, students should be encouraged to cultivate an understanding of the interactive nature of health systems and issues, stimulating the need for creative and adaptable solutions in order to address these issues. Further to this, an understanding of planetary health serves an excellent model in illustrating the key concepts of preventative medicine:

"It [medical education] needs to be aligned to preventative medicine rather than to the practice of just 'how things are'. There needs to be a shift in thinking from 'I will treat you' to 'I will prevent what might or might not happen'. Prevention - it's something that's overlooked so much in schools." (Educator 1, Male, Junior, Clinical, Medicine)

Often, particularly in the later years of a traditional medical curriculum, the emphasis is placed on managing pathology at the point of presentation, within a tertiary care hospital setting. The study of planetary health would promote reflection on the determinants of disease and the influencing factors for human health further upstream. In the study of planetary health, there is a clear delineation between human action and reciprocal negative health outcomes for our population.

This participant echoed the sentiment that a focus on population medicine is crucial within medical education:

"..I feel quite passionately that it's important that our medical students realize that the solutions for health care often are much more cost effectively achieved at a population level and with an effort to get out of the unit of analysis of the individual, get up to the family, the community, the village, the nation." (Educator 2, Male, Department lead, Clinical, Medicine)

It is interesting to note that this notion of the importance of developing an awareness of preventative medicine was not something that was specifically mentioned by any other participant.

4.2.2.3 Sustainability through a clinical lens

Given that many of the educators interviewed were practicing clinicians at the time of interview, it is unsurprising that during the course of the interviews a number of participants made reference to the overall cost that climate change and environmental instability would exact on the health service. Ultimately, a higher prevalence of negative health outcomes within a population will lead to a greater burden on the health service in general.

"The cost, ultimately, that not addressing climate change will put on our health service [is great]." (Educator 1, Male, Junior, Clinical, Medicine)

Furthermore, poor waste management and lack of recycling of resources within the hospital setting and broader health-service both contributes to the greater issue of society creating an increasing environmental burden and compounds the financial pressures on the health service to accommodate for this.

"So you pick up your gas, your scope, you do one scope and you toss it in the bin. No, I think that that's a luxury of disposability. You know, that's unsustainable. There's not a

sustainable focus on the things we use and how we practise in our [clinical] setting" (Educator 9, Male, Departmental lead, Clinical, Surgery)

This deficit in awareness in regards to sustainability is both inherent to the healthcare systems in which physicians practice and present at an individual level. This negligence towards the proper processing of hospital waste and consideration of the sustainable use of resources represents a lack of education and a culture within clinical practice that does not consider the environmental impact of clinical actions, whether that be anything from the ordering of investigations to the consumption of clinical resources in delivering patient care:

"It's all well-meaning, but there is a huge amount of consumable waste. I think we're just not educated well enough on it, just ordering tests on patients that they don't need." (Educator 3, Female, Senior, Clinical, Medicine)

When delivering planetary health topics in medical curriculum, it is inevitable that these topics will be framed within the clinical setting. As the above educator points out, often unsustainable and environmentally negligent practice stems from a lack of education. Integrating planetary health topics into medical curriculum and clinical educator modelling of sustainable practice would facilitate systemic change within our health systems to promote better practices of sustainability and resource management.

4.2.3 Skepticism

A number of participants did voice opinions that were sceptical about the validity of health effects related to climate change and environmental instability and their relevance to medical education.

The validity of climate change as a predominantly unnatural phenomenon due to human activity was a source of such scepticism.

"Perhaps the planet would have climate change regardless of our actions. We don't know because we don't have a control group... I think that we definitely contributed to it, but I also think that it [climate change] may have occurred either way." (Educator 11, Female, Junior educator, Clinical, Surgery)

This educator supported this sentiment that climate change is not a phenomenon influenced by human activity and postulated that the climate has been changing naturally for millions of years. They felt that human beings understood very little about the forces that truly influence climate change:

"I think we shouldn't necessarily believe that we understand why the climate is changing. From history, as you know, even recent history - like 2000 years ago, there were mosquitoes on the Baltic - so climate has been changing for millions of years. I don't think we actually understand why? I suppose it's the ebb and flow of forces, of physical forces, of natural forces - beyond our current comprehension. I'd say it's about as deep as our public understanding of the corona virus" (Educator 9, Male, Departmental lead, Clinical, Surgery)

If one does not first acknowledge the influence that human endeavour and industry has had in altering the normal climate and ecosystem patterns on planet earth, it might then be difficult to accept the possibility of unanticipated

and grave health consequences for human beings secondary to this, subsequently this might impede support for the integration of these topics into medical curriculum:

> "[In regards to] The link between exposure to sunshine and melanoma..I have been operating on melanomas for close to 40 years and I never removed one from the face." (Educator 9, Male, Departmental lead, Clinical, Surgery)

If it is not accepted that that our own actions have triggered environmental changes that represent new and immediate threats to human wellbeing, it would be tempting to adopt a "business-as-usual" mindset and it is unlikely that medical curriculum reform to include education around these issues would be seen as a priority. However, although the above participants expressed dubiousness in relation to the extent that human activity has influenced climate change and environmental instability – they did not deny its existence as a phenomenon and did show support for measures to mitigate its effects:

> "..recycling and this kind of focus on renewability, you definitely see it as a necessity now as it was throughout history." (Educator 9, Male, Departmental lead, Clinical, Surgery)

Of the participants that expressed scepticism about climate change as a natural phenomenon, one of them also clearly articulated scepticism around the role of planetary health in medical education. Citing a perceived lack of relevance as a reason.

> "I know if somebody were to ask me to give a teaching session on climate change, I'd look over like, why the hell would you want me to do that? That's completely irrelevant". (Educator 11, Female, Junior educator, Clinical, Surgery)

The other participant that indicated scepticism that climate change is a man-made process made the point that they considered topics of climate change and environmental instability to be "more relaxing" topics, however despite this – they would still have a role in curriculum.

> "I think that, for the fuller human being, there absolutely has to be space and time set-aside for that [planetary health topics]... and I think, there has to be time for the more relaxing topic. It doesn't have to be - I don't have to go to lectures today because the topics are just waffle - I think that there should be taking part." (Educator 9, Male, Departmental lead, Clinical, Surgery)

This participant implies that planetary health might find a niche as a "soft science" compared to the other "harder" sciences taught elsewhere. However, they do insinuate their belief that students might not engage with the topic completely due to its perceived "soft" nature.

Both participant number 9 and number 11 allude to a perceived lack of relevance among students in relation to these topics as a significant barrier to their delivery; something that will be explored in more detail later on in the results.

Another participant also explicitly expressed doubts regarding the relevance of planetary topics in medical education. Although these topics may be seen as important generally speaking, it was suggested that these topics belonged

firmly in the realm of politics rather than medicine and was not something that needed to be covered to any great extent within medical curriculum:

> "I see that the bigger issues [planetary health topics] are really in the domain of politics and require political solutions by politics… It's not directly in the domain of medicine and health care… I don't see political engagement and political involvement as a necessary part of being part of the medical council or being on the Irish Medical Council's Register of doctors **…**that's not their job. That's the job of the politicians to balance the economic and social impact of the restrictive measures and efforts there as a public health advisory" (Educator 2, Male, Department lead, Clinical, Medicine)

No other participants articulated scepticism in regards to either the validity of climate change as a man-made phenomenon or the relevance of introducing planetary health topics into medical education. It is interesting to note, of the three sceptical voices found here; two are departmental leads – one in medicine and the other in surgery.

Another commonality in stakeholder demographic characteristics is that both of the educators that expressed doubts in regards to climate change being a man-made phenomenon were educators within the surgical department.

4.3 The practicalities of content delivery

4.3.1 Student engagement

4.3.1.1 The content vacuum

Throughout the course of the semi-structured interviews, many educators alluded to the fact that, from their experience, planetary health topics are not currently touched on in existing undergraduate medical curriculum to any great extent.

> "At the minute certain climate justice systems and climate change isn't emphasised really at all." (Educator 8, Male, Junior, Clinical, Medicine)

Although issues of sustainability, climate change and ecological vulnerability are growing within the public psyche, this is not reflected in established teaching at present. As per this educator, curriculum content from the perspective of planetary health has remained a non-entity, and a paradigm shift in this regard is overdue:

> "..as a student going through - the word climate change and climate and its impact was never mentioned as far as I can recall… certainly not at the level of final med where I did most of my teaching. … I think that ultimately all medical schools and medicine in general needs to change." (Educator 1, Male, Junior, Clinical, Medicine)

This current vacuum in the teaching of this subject matter represents a valuable opportunity. Through the systematic and organized integration of these topics into the curriculum, the potential exists to cultivate a knowledge and awareness of these topics in a structured and meaningful way. Given that the curriculum is a relative "blank slate" in relation to planetary health topics, this could enable thoughtful and meaningful introduction of relevant curriculum

content to medical students from the outset, which could foster a deep understanding of the subject matter:

"I think if it was taught [planetary health topic], I'd imagine that when our students come up to the clinical years that they'll be very much vested in the topic and they'll understand the topic and they would query issues around that within the clinical part of the curriculum." (Educator 4, Senior educator, Clinical, Surgical)

Changing attitudes and growing awareness towards planetary health topics amongst students and within the broader professional medical community should serve as a stimulus to reinvigorate and modernize existing curriculum to includes these topics. If integrated throughout teaching, this emphasis on a globally relevant topic would serve to engage students more deeply with the subject matter and enhance the validity of the broader curriculum in its entirety.

4.3.1.2 Clinical context

When discussing the optimum way to deliver planetary health content in medical curriculum, multiple participants were of the opinion that an emphasis on the clinical relevance of these topics to students would be of huge benefit in facilitating student engagement and investment in the material.

It is imperative that in order for these topics to avoid becoming academically abstract or peripheral within curriculum that they are clearly grounded in clinical context and clinical outcomes:

"It needs to be kind of in your face for students, I think if you can't make it extremely relevant for the students - you're going to lose them." (Educator 10, Female, Junior, Clinical, Medicine)

A precise delineation of planetary health topics as directly influencing human health and having specific clinical relevance needs to be demonstrated to undergraduate medical students in order to fully engage their interest and attention.

"I think if people don't see the relevance of this and see - How does that really impact me as a doctor? - they will lose interest." (Educator 4)

One suggested means of achieving this would be to integrate these topics into already existing clinical curriculum in order to demonstrate the links between planetary health topics and what are generally already accepted as established and essential curriculum-items in order to improve student buy-in:

"All the evidence which would suggest that you need to integrate these elements into the curriculum in a clinical sense, not just in an academic sense terms, but in terms of the hidden curriculum." (Educator 7, Male, Dept. lead, Clinical, Medicine)

As "Educator 1" highlights, in order to empower students as future physicians it is important to provide examples of the specific role that the health practitioner can play in mitigating the myriad detrimental outcomes related to planetary health issues:

"there needs to be a knowledge of its [planetary health] impact on what and how it relates to actual presentations to hospital…"(Educator 1, Male, Junior, Clinical, Medicine)

Explicit ties need to be drawn between environmental change and damage to the earth's ecosystems and the relevant health-effects. However, there is

danger in presenting the potential negative outcomes related to these issues without also offering practical solutions and clinical actions that can be taken to address them.

> "In order to make sure that they are a valued part of the curriculum [planetary health topics], it would have to be slanted toward the positive action that you can take as a medical student, doctor or practitioner in order to reduce health effects." (Educator 1, Male, Junior, Clinical, Medicine)

Further to this, in order to impress upon students the importance of these issues it is important that sustainable practices and a conscientiousness towards the ramifications of climate change and environmental instability are modelled by professionals working within the clinical setting.

> "If we don't place value on it [planetary health] as a system, if we don't place value in our society, you can't really expect students then to get behind it. I think it has.. you have to model what you want to see coming through the students." (Educator 10, Female, Junior, Clinical, Medicine)

4.3.1.3 Active engagement

A key method of promoting student engagement with planetary health related curriculum content suggested by clinical educators is through encouragement of the students to engage with the topics in a pro-active and participatory way.

One means of achieving this would be through the utilization of methodologies that allow students to adopt a more self-directed and exploratory approach to the course material.

Putting the onus on the student to formulate and rationalize the content themselves without necessarily being spoon-fed the material in a traditional, didactic manner encourages a deeper engagement with the material and a greater appreciation of the learning outcomes reached.

A number of different teaching activities were suggested to achieve this, suggestions put forward by educators included student presentations/ a reflective project or essay and student debates.

There is a danger that planetary health topics could fall into the realm of the abstract for students. Furthermore, for some students the topics within planetary health may be seen as contentious and some students may already hold strong conceptions or opinions about the nature of the material they would be presented with.

> "By giving them [medical students] a forum to articulate that [their opinions] to their peers, that engages their peers better than me droning on about it.. So in the past we have done debates.. the class ask questions and engage with that debate and maybe polarize a bit. That would be engaging the students as adults." (Educator 2, Male, Department lead, Clinical, Medicine)

The idea of a debate or conference in which students would be required to present was suggested by a couple of other participants.

> "I think a debate on these things is probably the best way to educate." (Educator 9, Male, Departmental lead, Clinical, Surgery)

If students are asked to process these topics independently and then to deliver the salient points to each other in a well-informed and thoughtful manner, it facilitates discussion and allows breathing room for the diversity of opinion that may be present around these issues.

> "Why not make a conference for them to present these topics? What a great opportunity. They're looking for things to help build their resumés as students and for clinicians in the future." (Educator 6, Female, Senior Educator, Clinical, Surgical)

Affording students some space to reflect on the curriculum content and develop their skills of articulation through the expression of their individual insights and conclusions on the significance of these issues enables a more egalitarian and frank discussion on all facets of the material, including elements that students may be more sceptical about. Ultimately, this will encourage greater participation and engagement through acknowledging the individual student's perspective:

> "Some form of reflective piece or some type of project where they're actually doing the bulk of the work and then they can appreciate it more" (Educator 6, Female, Senior Educator, Clinical, Surgical)

Another suggestion put forward by participants would be to root the learning of these topics into a form of collaborative action project, whereby students would be asked to create their own pro-active strategy as a group, to deal with some of the issues presented by climate change and environmental instability.

> "I remember from another degree I did, we did an action project - a project whereby you investigate or critically assess.. And putting into place a strategy of doing some kind of research whereby they would be linked with a community practice.." (Educator 1, Male, Junior, Clinical, Medicine)

This method of engagement with the subject could include collaboration with external or community groups and would serve to ground the topics in a wider context.

> "[Students can] collaborate with people that are working in a real way with addressing the climate change agenda, to look at the opportunities to collaborate, but also for the students to contribute - I think one thing we need to do better generally is seeing the students as a resource, not just as passive." (Educator 7, Male, Dept. lead, Clinical, Medicine)

Creating and delivering a successful action project would empower students and cultivate tools for addressing planetary health problems in a meaningful way.

4.3.2 The structure

4.3.2.1 Design a framework

Planetary health is an emerging field within the realm of medicine. The term "Planetary health" may be a term that neither undergraduate medical students nor educators have come across before. Furthermore, the various ideas that underpin its attempt to define a discipline that encompasses the nuanced

interface between issues of sustainability, climate change, environmental stability and human health may also not be familiar to either of these groups. As such, when advocating for the inclusion of planetary health topics in the medical curriculum, the importance of providing a clear education framework was emphasised during the semi-structured interviews:

"So I think in terms of getting buy-in from people [educators] you need to be clear what the ask is from people like me if I was to be facilitating session – who clearly doesn't know anything about climate change - I think somebody needs to script some session [for educators]." (Educator 12, Female, Senior, Non-clinical, Health sciences)

This participant argues that, in order to improve educator buy-in, instruction should be provided to educators in how to deliver this salient content in order to achieve prescribed learning outcomes.

4.3.2.2 Expert/external educator input

In developing an education framework for the delivery of this content, one of the methods suggested in order to ensure that this is done in an informed and considered manner was to recruit an expert(s) in the field of planetary health.

"I think probably we need an expert in the area who could visit to do a workshop as well." (Educator 3, Female, Senior, Clinical, Medicine)

As this educator points out, providing the students with input from an individual or group who has interfaced with planetary health issues and has experience of dealing with planetary health-related health effects in a community setting would significantly bolster student learning and aid cultivating a contextual understanding around this issues:

"So one way that you might want to try and introduce this topic would be for someone who actually practices in East Africa [for example] and sees the impact of these issues in their day-to-day practice and in their life, who could then present to the students." (Educator 5, Male, Department lead, Clinical, Medicine)

This would be of particular relevance when educating on the areas of planetary health that pertain to environmental stability or with health consequences that may be more overt within a resource-poor settings.

If it were possible to recruit an educator with first-hand experience of dealing with these issues in the community who could then use this experience to provide a context for students when educating on planetary health topics, this would serve to deepen student understanding regarding the broader global consequences of planetary health issues:

"I think that that's where it's at best, that idea of meeting the people within the community, the idea of preventative medicine. That's where you're going to affect the most change when you see somebody in the hospital… you'd have people who are expert in the area come in and discuss what's going on." (Educator 1, Male, Junior, Clinical, Medicine)

The importance of creating planetary health curriculum content that is clinically relevant for the students has been highlighted previously and the notion of identifying an educator with the expertise necessary to place these topics into a clinical context would doubtlessly aid with this. Contribution from an individual or group who has first-hand experience of the clinical ramifications of global warming and environmental instability while also

possessing the academic skills and educational experience necessary to advise on the delivery and design of planetary health curriculum would provide optimum benefit and insight:

> "Somebody with an interest in both or that kind of straddles the two [public health and clinical medicine]. That is crucially not a physician and not a surgeon, but falling somewhere in between. You do need somebody who can speak about the topic in a way that they're passionate about. Then also they have to be informed, critically." They have to be informed." (Educator 10, Female, Junior, Clinical, Medicine)

In addition to recruiting expert input for the delivery and creation of curriculum content within the university setting, there would also be great benefit in allowing students to learn about these topics in the external setting itself:

> "Put into place a strategy of doing some kind of action project whereby they would be linked with a community practice" (Educator 1, Male, Junior, Clinical, Medicine)

4.3.3 Content integration

4.3.3.1 Embedding the content

When it comes to the question of which modules or areas of curriculum planetary health topics would best fit in, a range of opinions were expressed by clinical educators during the semi structured interviews.

Given the far-reaching and multi-faceted nature of planetary health issues within medicine, many educators make the argument that these topics should be embedded into a wide range of modules and subjects across the curriculum.

> "This [planetary health] should be implicitly included in the curriculum for all medical schools as part of the integration that we would seek to develop... these types of issues wouldn't necessarily have a one-hour lecture at some point or workshop or a tutorial, but that the important concepts and principles which are aligned with issues like this should definitely be identifiable within the curriculum as part of the more general topics that we would be teaching." (Educator 5, Male, Department lead, Clinical, Medicine)

Participants suggest that students should be coached to recognize the relevance of planetary health issues across all their clinical encounters and, as such, the concept and principles behind the topics should permeate all teaching. As this educator articulates, these topics should be woven into student learning so that - when it comes to the clinical years - they would be embedded into all clinical interactions.

> "It has to be indoctrinated into every aspect of your practice. So every time you see a patient, you think about - what are the bad environmental risk factors that that person has? What are the planetary health implications of the practice that I am going to potentially use for that patient?" (Educator 3, Female, Senior, Clinical, Medicine)

This concept of planetary health teaching permeating all aspects of curriculum was echoed by another educator, who felt that they would envision these topics as becoming embedded into any clinical encounter and as such, that they would be suited to any medium of teaching delivery:

"It's embedded as part of what you do in every history you take. What you do in every interaction you have with a patient. It's just part of having you interact with them…. so I think that if you have a comprehensive curriculum moving through all the areas, you can basically do all the types of teaching interaction" (Educator 1, Male, Junior, Clinical, Medicine)

There is a danger that if these topics were to be taught within a silo within curriculum, students would not grasp the nuanced ways in which issues of climate change and environmental stability interface with human health at a variety of different levels. When addressed in isolation, planetary health might become tokenistic rather than fulfilling sincere learning needs broadening student understanding of the complex, interconnected relationship that humans have with our environment and the natural systems that support our health.

"Because it's not integrated, it might actually lose the importance of what it actually is. So it's quite possible that a lecturer somewhere is teaching this, and we don't know because it's not integrated - It's not spiralled into the curriculum." (Educator 4, Senior educator, Clinical, Surgical)

The health effects related to planetary health pertain to a diverse range of pathologies across a broad array of organ systems. The impact of these health effects can be demonstrated from anywhere from a cellular/molecular level to a structural/anthropological one:

"The theory of it needs to be introduced in year one or year two. Then it's further brought into the curriculum later on - the importance of this in relation to, say, microbiology or pathology; identifying the diseases that exist, and then bringing it into medicine and surgery - into the investigations and management, how to actually treat it." (Educator 4, Senior educator, Clinical, Surgical)

As such, introducing planetary health topics to students early in the curriculum, would allow them to draw connections between issues of climate change and environmental stability to human health which can later be built on in a sequential and layered manner as the undergraduate years progress.

Spiralling these topics within curriculum in this manner provides an opportunity to reinforce previous learning so that the essential scaffolding introduced at the outset ultimately produces a deep and comprehensive understanding of the subject material in the graduating student:

"I think ideally, you spiral something so that you have elements of it or you learn the principles of it in in your first year and then it becomes more applied as you move through the curriculum." (Educator 10, Female, Junior, Clinical, Medicine)

4.3.3.2 Teaching in a silo

An opposing opinion to suggestion of spiralling planetary health topics also emerged during the course of the semi-structured interviews, with some participants expressing the belief that the best home for much of the teaching of planetary health topics within the curriculum would be at specific points temporally within the curriculum. A number of participants felt that these topics would fit most neatly in the earlier years of medical curriculum.

"I think it's a good way of engaging students early on [planetary health]. I think the early years can be quite dry with basic sciences. And this is a good way of bringing some of the medicine and epidemiology into it." (Educator 8, Male, Junior, Clinical, Medicine)

There is a perception that the subjects taught in the early years of undergraduate medical education can be “dry” or stodgy and that by integrating planetary health topics into teaching during these years, it might break the monotony of these subjects for students and aid in student engagement overall. Furthermore, another educator foresaw a lack of perceived relevance among students in the later years as a possible barrier to introducing planetary health topics in the clinical years. As such, they felt the topics would be more at home in the earlier years:

> “In the clinical years I think that it may be completely disregarded, because from the student's perspective - it is not going to help them take a history or do an exam.” (Educator 11, Female, Junior educator, Clinical, Surgery)

Contrary to this – addressing the issue of perceived relevance in the clinical years again – one educator expressed the opinion that it is for this very reason that planetary health topics should be taught in the clinical years rather than the earlier years. The students might have developed more analytical skills at this stage and would be better equipped to engage in a “nuanced discussion” about a complex topic such as planetary health that deals with “integrative cases”. If these topics were confined to the early years they would dismiss the material out of hand as they lack the proper context to make the connections between the topics being taught and clinical medicine:

> “I find that in the earlier years, sometimes the students don't fully understand why they're being taught things that they don't see directly relate to medicine.” (Educator 12, Female, Senior, Non-clinical, Health sciences)

In addition to opinions expressed regarding the suitably of planetary health teaching to be delivered in isolation in the earlier vs. later years, some participants expressed the opinion that the ideal home for this teaching would be in the epidemiology or public health modules. There are differing opinions on whether this topic would only be suited to integration into other existing teaching or whether planetary health would lend itself to its own overt module. Some participants expressed this belief that these topics would fit nicely within an epidemiology or public health course, they were also quick to point out that a stand-alone module would not be an effective way to deliver this teaching and that a more integrated approach would be optimal.

> “I think they should have been created as part of an epidemiological curriculum and the public health curriculum [planetary health topics]… but now that we're moving to more case-based teaching there's scope for that to be integrated across the disciplines - so probably the natural home for it would be epidemiology and public health - but certainly it's not limited to that I think.” (Educator 12, Female, Senior, Non-clinical, Health sciences)

4.3.3.3 Advantages/disadvantages of different methodologies

A number of different approaches were endorsed as suitable for the delivery of planetary health content. Case-based learning was suggested as an ideal approach in that it would foster a learning environment that would promote collaboration and interaction amongst the students. Case-based learning allows the students to explore these topics in prescribed scenarios that can illustrate the various connections that planetary health has with clinical medicine and human health.

"By integrating this into, for example, case-based learning we're able to draw some of these themes into actual real-life cases. And so the students will be discussing all of the aspects of those cases, including, for example, the impact of climate change… they will come back to a group environment and then share what they find. And that's a much more effective way of learning than just sitting listening to lectures or reading a textbook." (Educator 5, Male, Department lead, Clinical, Medicine)

Case based learning allows students to explore and discuss the nuances and complex challenges often inherent to real-life cases within clinical medicine in a controlled environment and develop the skills necessary to recognise and deal with the impact that planetary health has within these cases.

"And cases that are complex and multifactorial. Cases where there aren't necessarily perfect answers because that's the reality of medicine…" (Educator 3, Female, Senior, Clinical, Medicine)

One participant also suggested that these topics benefit from being taught within a small-group learning context. A smaller number of participants would encourage a more open discussion between peers and allow students to learn from each other:

"To help facilitate [teaching], you could direct small group peer Learning in order to try to get the big topics cemented into the consciousness of the students." (Educator 1, Male, Junior, Clinical, Medicine)

Planetary health is a topic in which students can hold vastly different perspectives. Delivering this content in smaller groups provides an opportunity for these different perspectives to be voiced, thereby promoting a more textured conversation around the subject and a deeper learning experience.

"..getting some small group tutorials would be particularly useful and allow space for discussion of these issues." (Educator 8, Male, Junior, Clinical, Medicine)

As discussed previously a key theme that has emerged on analysis of the qualitative interviews is the necessity of involving students in their own learning in a pro-active way. Teaching activities such as a student debate or action project have been mentioned as ways to achieve this and would fit well into a small-group or case-based learning format.

More traditional teaching methods such as didactic teaching or dedicating an overt module to the subject of planetary health were ideas endorsed by some educators.

Given that traditional lectures and a teaching delivered using a didactic format might be more familiar to students, delivering planetary health using these methods could help to validate these topics and establish their prominence in curriculum, particularly in the early years of curriculum:

"Not necessarily at the end, but certainly at the beginning an overt module would work." (Educator 1, Male, Junior, Clinical, Medicine)

Despite a perceived reluctance to rely on didactic teaching methods, didactic teaching could be employed in a blended fashion with other teaching modalities to establish the content in the earlier years of medical education,

particularly if there was an element of student-delivery as part of these sessions – to promote student engagement:

"I know a lot of people hate hearing about didactic sessions, but I think there's no harm in that in the initial beginning.. I do think there should be some element of a mix of didactic sessions where topics are broached and I do think it'd be really important that the students themselves be involved in presenting ideas." (Educator 6, Female, Senior Educator, Clinical, Surgical)

However, as this participant alludes to, singularly consigning this teaching to a didactic format could limit student understanding of the nuances inherent to the subject material and the broad points of interface that planetary health shares with the other subjects and medical specialities throughout the rest of the curriculum:

"So even if we're a bit stuck for room with some of the didactic teaching, there's a whole world of more complex things that you can bring into cases and case-based teaching where you can get students involved in really self-directed learning, facilitated learning and allowing them to see the links between what they may see initially as unrelated topics." (Educator 12, Female, Senior, Non-clinical, Health sciences)

Although there are various advantages/disadvantages to the teaching methods discussed here, it is important to note that if the ultimate aim is to incorporate this teaching within the student curriculum so that it would inform the approach that medical students take towards their clinical encounters, these topics might be suited to any medium of established teaching delivery

"It's embedded as part of what you do in every history you take; what you do in every interaction you have with a patient.. so I think that if you have a comprehensive curriculum moving through all the areas, you can basically do all the types of teaching interaction"(Educator 1, Male, Junior, Clinical, Medicine)

4.4 Barriers and facilitators

4.4.1 Barriers

4.4.1.1 Perceived lack of relevance among students

The most commonly cited potential barrier to implementing a planetary health curriculum that emerged from the interviews is the perceived lack of relevance towards these topics that students might hold.

"My experience of students over eight years is there's a real "so what" factor for them.." (Educator 3, Female, Senior, Clinical, Medicine)

Some educators felt that topics of planetary health and sustainability might be seen as "soft" and as such, the students would not engage with them as seriously. Students are often motivated to learn the subjects that they believe will most benefit them in their future clinical practice. Students need to clearly identify the links between what they are taught to human health:

"[They think] this is not going to benefit me at 3 o'clock in the morning when somebody comes in with X, Y and Z condition." (Educator 1, Male, Junior, Clinical, Medicine)

Any subject that does not demonstrate a clear clinical relevance with obvious ties to human health will not engage those students who do not already have an established interest in global health topics.

"They're all jazzed up when it's a tutorial and there's going to be a patient there. It's a much harder sell to come at them from a global healthcare perspective... It would be the soft lecture at the end of the day that no one shows up to, which you don't want." (Educator 10, Female, Junior, Clinical, Medicine)

As discussed previously, the necessity of making teaching ostensibly clinically relevant to students, lest they lose interest, was a theme highlighted almost unanimously by the educators interviewed.

"If you're teaching them [medical students] subjects that they think are a bit abstract to what they would deal with on a day-to-day basis, it's very difficult to contextualize why it's important." (Educator 3, Female, Senior, Clinical, Medicine)

"I think if people don't see the relevance of this and see - How does that really impact me as a doctor? - they will lose interest." (Educator 4, Senior educator, Clinical, Surgical)

There is a danger that planetary health topics would be seen as superfluous and a topic strictly confined to the realm of global/public health in the minds of the students. Unless students have a pre-existing interest in global health or public policy, learning planetary material might become a tick the box exercise without meaningful engagement and the content covered would be forgotten about when the teaching ends.

"One of the problems of the past - and I'd certainly know this from my medical education many years ago - is that things like public policy are not terribly interesting to medical students by and large." (Educator 5, Male, Department lead, Clinical, Medicine)

Unless an effort is made to clearly highlight to students the ramifications that planetary health issues hold for all aspects of human health, across a wide range of subjects in medicine, these topics could be dismissed out of hand.

"It [public health topics] seemed dry and irrelevant to what you wanted to do, which was to get on to practice medicine and to learn about technical medicine." (Educator 5, Male, Department lead, Clinical, Medicine)

Another point made is that demographic characteristics in regards to country of origin within the student body might also influence the perceived relevance of the topics. If students have been brought up in a country that places less emphasis on planetary health issues culturally or politically, or a country whose predominant source of wealth stems from industries that would exacerbate these issues, these students might find it more challenging to see the relevance of these topics to medical education:

"A large proportion of RCSI students come from foreign countries, we're largely recruiting [students] from countries in which it's probably fair to say that, it's not foremost on their minds." (Educator 7, Male, Dept. lead, Clinical, Medicine)

4.4.1.2 Perceived lack of relevance among staff

It was also evident from the interviews that many educators foresaw a lack of perceived relevance in regards to these topics amongst faculty as a potential barrier.

In conjunction with the risk that students could perceive these topics as “soft” and a departure from “hard” medicine there would also be a risk that established educators with a more traditional view of education would perceive these topics in the same way:

> “I think that those who have grown up with the traditional curriculum consider this a very soft science and it's touchy feely and isn't part of the sort of transfer of knowledge model... that's the biggest barrier by a long shot.” (Educator 3, Female, Senior, Clinical, Medicine)

Planetary health is a field that is still in its relative infancy and the issues it deals with represent modern problems that have only garnered significant public recognition in the last decade. Established medical curriculum and the topics within it are often comprised of paradigms that have been entrenched for much longer. The conceptual shift necessary to include a new topic like planetary health into this established educational framework might prove challenging for educators with a more conservative and traditional perspective:

> “Well, there's always going to be a be a barrier putting anything new in - there probably would be an ideological barrier. There are so many people who wouldn't want it emphasised.” (Educator 8, Male, Junior, Clinical, Medicine)

This conceptual difficulty with the relevance of planetary health within medical education was apparent at times throughout the course of the semi-structured interviews. One educator stated that they would find it difficult to deliver any teaching on these topics as they did not personally see the relevance:

> “[Planetary health] it's a waste of my time and a waste of their [students] time because they don't really care.” (Educator 11, Female, Junior educator, Clinical, Surgery)

Certainly, a feedback loop exists between educator and student that is self-fulfilling. If the educator believes that the students are not buying into the topic they well be less inclined to deliver and engage with it themselves. Conversely if the students sense that the educator has not fully committed to the teaching and does not completely endorse it, it will influence their perception of the teaching’s relevance and further impact their own engagement.

General scepticism around issues of climate change and sustainability amongst educators might also influence their perceived relevance of these topics in education. Posing the question to educators on whether or not they think that planetary health has a role in medical education is predicated on the assumption that they actually accept the fundamental tenets of planetary health; that climate change and environmental instability are directly influenced to human activity and that the repercussions of this increasing human burden on our environment will have significant negative consequences for human health.

"I would imagine, given that the medical community represents to some degree, percentages of the general population, that there would be some people who maybe think it's not an important issue. I would hope that's not the case, given that most of us are scientists to some degree and can understand that." (Educator 6, Female, Senior Educator, Clinical, Surgical)

4.4.1.3 Lack of knowledge amongst educators

Educators might not have sufficient familiarity with the concept of planetary health or insight into issues of climate change and environmental instability to be equipped to deliver teaching on these topics. Planetary health is a nascent field and the term itself may not be familiar to many medical educators let alone the detail of what it pertains to.

When pitching the idea of planetary health integration to policy makers or senior educators, a lack of comfort and familiarity with the topic may lead them to be dubious of its relevance from the outset:

"I think that people are unaware of the huge impact that this [planetary health] has. That will be one of the primary barriers. The idea of finding cause with climate change as a mechanism for poor health outcomes is in its infancy."
(Educator 1, Male, Junior, Clinical, Medicine)

Due to a lack of knowledge and education amongst the educators themselves there may be a feeling that planetary health represents esoteric and abstract issues and that educators/clinicians may not feel that it is within the scope of their practice to address them. This in turn would further compound the potential barrier of a lack of perceived relevance in relation to this topic both among students and educators.

"There's a perception that we can't change those things [planetary health issues] and that we as a profession have very little role in it. So I think that that's a perceptual problem. What can I do about that anyway? I can't really control climate change or I can't adopt my practice to include issues like this?"
(Educator 1, Male, Junior, Clinical, Medicine)

If it is accepted by policy-makers that planetary health merits inclusion in the curriculum, a lack of knowledge of the topics within planetary health could prove to be a barrier to its correct and comprehensive teaching:

"We might have staff running the sessions, who don't really know what this bit about climate change is and who don't fully engage with it or facilitate the session in a way that brings out the things that are important. So I think it's buy-in; not just for students, but also from staff." (Educator 12, Female, Senior, Non-clinical, Health sciences)

If staff are asked to facilitate teaching sessions on sustainability and planetary health and don't buy-in to what they are teaching due to lack of knowledge or perceived relevance; the teaching will not be as effective.

Particularly in the clinical years, the informal teaching that medical students receive from practicing clinicians has a significant impact on their learning and perceptions. There is a high chance that many clinicians who are not affiliated with a university in a teaching or academic capacity would be even less familiar with planetary health as a concept and may not even be familiar with "Planetary Health" as a term.

"I think it's the recognition of this as a topic itself. I think if you pulled someone from the NCHD population, I don't know that people would necessarily be able to tell you what planetary health is." (Educator 6, Female, Senior Educator, Clinical, Surgical)

4.4.1.4 Overcrowded curriculum

Another prominent predicted barrier that emerged on analysis of the semi-structured interviews is the perceived lack of space within an already crowded medical curriculum. Curricula in medical universities are already extremely full, when introducing new topics or concepts into a curriculum the perception is that in order to add something new, some existing content needs to be sacrificed.

"Something has to give..because the curriculum is very packed." (Educator 4, Senior educator, Clinical, Surgical)

Due to this perception, educators in certain areas may be resistant to the addition of new material out of a sense of protectiveness about their area of speciality:

"Curricula are already massively packed and everyone is just fighting a turf war to ensure that their specialty is represented well." (Educator 3, Female, Senior, Clinical, Medicine)

The perceived relevance of these topics again plays a crucial role in determining the extent to which an overcrowded curriculum will become a barrier to the integration of planetary health topics. If these topics are perceived as additional "dry" or abstract material that is going to further overload the students, then it will be much harder to make a case for their inclusion.

"The curriculum is already overloaded with too much theoretical, academic knowledge and there is not enough clinical practicality within climate change issues. That would be a barrier." (Educator 2, Male, Department lead, Clinical, Medicine)

Furthermore, even if a large cohort of students and medical educators accept the relevance and necessity of these topics in medical curriculum, without the buy-in of senior educators it is unlikely that space will be made within an already full curriculum or that a strategy for integration will be put in place.

"There needs to buy-in from everybody, because what will happen if there's not buy-in from staff; the powers that be, when things come to get cut - It's the stuff that's seen as a nice add on that's not necessary." (Educator 12, Female, Senior, Non-clinical, Health sciences)

4.4.1.5 Lack of senior management support

A lack of support from senior management in the University towards the integration of planetary health in the curriculum could have the potential to be a crucial barrier in campaigning for the inclusion of these topics. As Educator 12 alluded to above, senior faculty support is essential in order to ensure the

propagation and proper incorporation of these topics into established teaching. A disconnect between the appetite amongst junior educators for curriculum and senior policy-makers could constitute a serious challenge in implementing meaningful change:

"I think it's probably at a more junior level who would be more enthusiastic. Especially in public health. I think that there is a real appetite because there are big problems." (Educator 8, Male, Junior, Clinical, Medicine)

Even if the integration of these topics enjoyed overall support from junior educators and students, without the support of policy-makers, any efforts to make a case for the inclusion of these topics would be greatly inhibited:

"The average medical educator, they're not going to keep hammering away at some climate change agenda if they feel that it's not being supported." (Educator 7, Male, Dept. lead, Clinical, Medicine)

Furthermore, in order to ensure that new curriculum in the form of planetary health topics are integrated in the most structured and effective way possible, senior management support would be key in coordinating the systems of implementation across different departments and synchronizing communication between these different departments. The crucial strategic decisions necessary to optimally integrate these topics will ultimately fall on policy makers – such as the 'who?', 'what?', 'why?' and 'how?' of implementation.

"So who's going to do it? Who's going to deliver it and who's going to follow up on it? I think those are your main barriers." (Educator 6, Female, Senior Educator, Clinical, Surgical)

Senior clinicians and policy-makers set the tone for what is considered salient teaching within the curriculum and, as alluded to previously, hold significant sway in determining the perceived relevance of any new material, both among other educators and the student population.

"When I'm talking about the people who will have resistance to coming onboard - it's more the clinicians and people at the higher level who already say - I'm head of my department and this is what I want to teach." (Educator 3, Female, Senior, Clinical, Medicine)

4.4.1.6 Lack of evidence base

A perceived deficiency in the existing evidence-base around planetary health topics and their health effects was cited as a potential barrier during the course of the semi-structured interviews. Evidence-based-medicine is the mantra instilled into students from the outset at university. Planetary health is a budding field and given the relative unfamiliarity that may exist around the term within the medical sphere, it might be assumed that it does not have an adequate evidence base to support its theories.

"I think that the strong evidence base might not be there yet either. So with anything like this [planetary health], it's slightly newer in its thinking and the ground swell of evidence isn't necessarily there or hasn't been scrutinized." (Educator 1, Male, Junior, Clinical, Medicine)

Ultimately, physicians are making informed decisions in their practice based on science and if the reassurance of a perceived adequate evidence base is

not present in relation to a given topic, it would serve as a significant barrier to the acknowledgement of that topic by both clinicians and educators.

There are other factors that might sow seeds of doubt in relation to the scope and validity of evidence surrounding the topic of planetary health. The dissemination of information in the modern world is characterised by the ease at which individuals can access a diverse range of opinions and data from different sources online. As this educator points out, with contradictory headlines around topics of climate change and environmental instability it is understandable that educators might have a degree of confusion or caution about what to accept as factual and evidence-based:

> "I think with social media the way it is, it's easy to create doubt about any facts or figures that are put out there. There's a certain element of - people may not know what's real - what is the actual impact that something's having." (Educator 6, Female, Senior Educator, Clinical, Surgical)

Without a clear body of credible evidence that supports and promotes the relevance of planetary health and its role in medical curriculum, the importance of these topics could easily be dismissed out of hand as sensationalist and pandering to what is "trendy" and part of the zeitgeist without proper consideration for the long-term value for student learning within curriculum:

> "I think lots of curricula fall foul of finding what's trendy and shoving a few lectures about those trendy subjects into their curriculum." (Educator 3, Female, Senior, Clinical, Medicine)

An overt display of the evidence supporting planetary health and its inclusion in curriculum when campaigning for its integration would likely greatly aid in mitigating scepticism in relation to these topics.

4.4.2 Facilitators

4.4.2.1 Demand from students

A significant facilitator which would greatly bolster a campaign for the inclusion of planetary health in medical curriculum is the increasing demand from medical students. Issues of climate and sustainability are emerging as some of the most pressing issues for younger generations. Medical students now are more aware of these issues than ever before and as such have a curiosity and appetite for education on these topics:

> "The next generation is eager to be part of this discussion [planetary health].." (Educator 1, Male, Junior, Clinical, Medicine)

There is a feeling among younger generations that they will have to shoulder much of the health burden caused by issues within planetary health, as such they are eager for education on these topics so that they can participate in a discussion on these issues in an informed way:

> "There is a generational issue there. The newer generation and younger [people] are much more aware of them than people of my age because the stakes are higher." (Educator 7, Male, Dept. lead, Clinical, Medicine)

Ultimately, undergraduate medical students will have to use the skills they develop in university throughout their careers, if they feel that a topic is necessary for their professional development and the enhancement of their core skillset, it will promote greater investment amongst the student body in the learning material for that topic. As this participant articulates, universities respond to feedback from the student body, the inclusion of topics that may be perceived as “softer” by established academics or educators is often directly as a result of student demand.

> “These softer skills are not softer skills, but are based on the feedback that we're getting. So if we go with changes in the world, changes with the students, changes in populations, then we should incorporate changes in global health.” (Educator 4, Senior educator, Clinical, Surgical)

The student body wields enormous power, both in their capacity to influence change in an immediate sense and in their potential to become professionals with the ability to enact even greater change in the future. This educator supported the assertion that student voices have the ability to drive reform within university:

> “I think it would be a very powerful message if students and trainees were to bring that message back to the senior management, to the drafters of the programmes… I think that's why the university is such a powerful place. I think many, many a good idea was born over a pint of Guinness.. Students have led an awful lot of the world's most important movements.” (Educator 9, Male, Departmental lead, Clinical, Surgery)

Providing students with a proper academic grounding in the complex issues that planetary health encapsulates empowers them to build and reflect on this education with the potential for creative and progressive solutions to its myriad problems.

As one educator reflected; issues of climate change and environmental instability are already so overt for students that they are likely already aware of their ramification on future clinical practice and have begun discussions on these topics. Harnessing and promoting this existing interest through the encouragement of student groups and bodies would amplify the student voice in promoting these topics within the university and facilitate their inclusion in medical curriculum:

> “I think there are student groups that are already building from this, and I am sure they would be very much behind it…
> we're already teaching it [planetary health], we just want to reflect on it more… the surgical society, why not the Planetary Health Society?” (Educator 6, Female, Senior Educator, Clinical, Surgical)

University students represent the policy-makers of the future, if there is already a demand among their cohort to address planetary health issues, equipping them with the tools necessary to do this through an informed and structured curriculum could produce graduates with the requisite skillset and potential to enact positive change.

4.4.2.2 Demand from physicians and faculty

In addition to an increasing demand from among the student body there is also a sense that demand for inclusion of planetary health topics is growing

amongst physicians and faculty. There is an increasing awareness of the extent and gravity of planetary health issues among medical professionals and educators, which would facilitate the integration of these topics into curriculum.

> "I find that educators are generally accepting of this [planetary health] as being an increasingly important thing for doctors to do." (Educator 5, Male, Department lead, Clinical, Medicine)

This openness amongst educators is encouraging in that it would enhance the delivery and ease of integration of these topics into curriculum should a strategy for their implementation be instigated.

At a practice-level, practicing physicians have also demonstrated an awareness around these topics and an appreciation for the link between climate change, environmental instability and human health. Acknowledgement of this connection necessitates a conversation on adaptation of clinical practice to address this.

> "There are loads of doctors out there who would be knowledgeable and aware and be willing to work on changing practice with regard to climate change." (Educator 1, Male, Junior, Clinical, Medicine)

This acknowledgement within clinical practice has profound implications on the discussion of medical student education as, as discussed previously, often curriculum is informed by standard clinical practice and the perceived relevance of a topic to clinical practice. If the professional sphere were to model an appreciation of planetary health issues within their practice, it would significantly enhance the buy-in towards this topic amongst both medical students and educators and act as a facilitator towards its inclusion in medical curriculum.

4.4.2.3 Senior management support

Just as a lack of buy-in from university policy makers would represent a significant barrier to the integration of planetary health topics in medical education, conversely, during the course of the semi-structured interviews, many educators expressed the opinion that there would be an open-ness amongst senior policy-makers at the university towards these topics being brought into medical curriculum and that senior buy-in would act as a significant facilitator.

Senior buy-in could be achieved and built upon in a number of ways. If it was highlighted to senior faculty members that this content is already being taught to a certain extent it would promote this content in a way that encourages the development of existing material. The idea of building on existing material is more appetizing than the challenge of shoe-horning new content into an already crammed curriculum and having to design and structure brand new course content.

> "I actually can't see it as a problem, especially if you brought it with the fact that we're already teaching this to some extent… I think certainly if you have the people higher up on

board, then it makes it much easier." (Educator 6, Female, Senior Educator, Clinical, Surgical)

As this participant comments; senior management at RCSI have a track-record for displaying open-mindedness and adaptability in order to optimize learning for the students. Ultimately, those in positions of seniority at RCSI will seek to align the medical curriculum with what they believe has been demonstrated to produce the most competent, qualified and well-rounded medical graduate. As such, if policy-makers are presented with a cogent and clear case for changes within curriculum with a view to achieving this aim, they would be amenable to these changes:

"The most senior people in RCSI are very much open to us showing them where we think there is added value for students. If you make the case well to them, they tend to be really supportive." (Educator 3, Female, Senior, Clinical, Medicine)

Indeed, many of the values inherent to planetary health would also be inclusive as part of the philosophy of many senior faculty at RCSI, through their own campaigning at a community and political level, which would also indicate an amenability to a discussion on further integration of these topics into the existing curriculum:

"So I could point to lots and lots of senior leaders within RCSI who'd been shaping the population level parameters and giving advice to the politicians to try and make health better in Ireland. I think that's really important work for our students." (Educator 2, Male, Department lead, Clinical, Medicine)

Senior and junior harmony on initiatives to change curriculum would be synergistic and provide the best chance of meaningful curricular reform becoming enacted.

"If you could get somebody who is in a very senior position to do it and do it well, I think it might inspire other people to follow along." (Educator 10, Female, Junior, Clinical, Medicine)

This theme of the capacity for a single passionate individual to galvanise change within an institution emerged at other points throughout the semi-structured interviews, and is picked up again later on.

With senior departmental or university support, individual efforts or enthusiasts amongst the wider faculty will inevitably feel encouraged in their efforts to integrate planetary health content into curriculum and this will undoubtedly inspire further initiatives and strategies for improvement of the university from the ground-up.

"I think there has to be a top-down element to it. You could be very hard working and passionate, but you could be a voice in the wilderness within the department. You can't just have champions of change in a particular direction within any given department. There has to be a coherence. It has to be visibly enacted." (Educator 7, Male, Dept. lead, Clinical, Medicine)

4.4.2.4 Green champions/academic advocacy

A factor mentioned by over half the participants which would greatly facilitate the successful integration of planetary health topics into medical curriculum

would be the presence of a designated individual or group within the university with the capacity to concentrate a significant amount of energy on advocacy for the inclusion of these topics. This could take the form of a “green champion” or a “green committee” of passionate advocates who would campaign in the university for inclusion of these issues in established teaching.

> “We need a champion for it [planetary health] and somebody who's at these curriculum meetings speaking up..I think the main thing is to have somebody leading it and then buy-in from whoever is in charge of the curriculum.” (Educator 12, Female, Senior, Non-clinical, Health sciences)

Consistent concentrated effort from an individual possessing the knowledge and enthusiasm necessary to make a coherent case for the inclusion of planetary health topics in curriculum would be of particular benefit in the nascent stages of such a campaign.

> “It would be easier at the start if there are one or two people who were responsible for it to get it on its feet and get it going… I think Champion is actually the right word for it.” (Educator 6, Female, Senior Educator, Clinical, Surgical)

This idea of a “champion” or committee who could take responsibility for the design and strategizing of the practical implementation of these topics in curriculum would demonstrate to senior faculty that there are already existing manpower resources that can be called upon in the design and development of such a campaign and this would greatly facilitate their willingness for implementation:

> “I suppose the biggest barriers you'll have is when you have lack of structure - if you had a group or once again a committee that could say, actually, this is important and needs to be included” (Educator 4, Senior educator, Clinical, Surgical)

The presence of a committee or designated bodies would also demonstrate to policy-makers that there is an existing structure which can be called upon to streamline and support implementation, thereby facilitating its implementation into curriculum.

This educator emphasizes that the power of a single motivated individual operating with enough energy and enthusiasm cannot be underestimated as a force for instigating change:

> “I think it really requires one really passionate person in a position of semi-power. I think within RCSI that’s how it works.” (Educator 11, Female, Junior educator, Clinical, Surgery)

However, as mentioned previously, there is also risk in relying on a single person or a couple of people to achieve the desired outcomes, especially if they are exhausting their efforts and time in the face of senior faculty who are not already sympathetic to their cause.

As such, an effort should be made to encourage a number of different like-minded champions, working in tandem. Incentivisation of efforts within the faculty to promote planetary health learning or planetary health ideals amongst the students or within the university at large could be a powerful motivator in promoting the championing of these topics within faculty:

> “I think you do need some sort of champions within the heart of the faculty.. If there was a communication to staff that there are teaching awards within the area of climate

change, which were going to be considered particularly competitive, I think that would help people get engaged." (Educator 3, Female, Senior, Clinical, Medicine)

Identifying individuals with the traits and interests necessary across a wide range of departments might also be a tactic in inspiring a number of "green champions' across faculty. This could help to establish a network of like-minded advocates for planetary health across the university landscape and assuage the risk that an individual champion might become isolated within a single department and inefficiently campaigning within a silo.

"It might be useful to think about champions within a department , to identify faculty members that are genuinely excited by the prospect of bringing these changes in, and then they in turn, provide leadership. There's good evidence that students are influenced by role models within faculty." (Educator 7, Male, Dept. lead, Clinical, Medicine)

Having multiple advocates across various departments would also maximise student exposure to these topics and provide a greater chance for role-modelling by these champions towards the student body.

In order to maximise the potential of a green champion or committee as an agent for change within curriculum it is important that they approach their campaign with the right traits and sensibilities. An effort to advocate that is too aggressive or confrontation might ultimately harm the chances of a campaign's effectiveness. This educator stressed the importance of having a champion with the requisite diplomatic skills to campaign for inclusion of these topics in a non-confrontational way:

"The key thing is to have individuals who believes that these are important topics and is prepared to do the work to produce material that's engaging for students… not the sort of champion who comes along and demands that a particular topic should have a particular percentage of the curriculum or whatever. A champions who recognises that in order to get messages across - there are certain ways of doing that. You need to work effectively with your colleagues to do this in integrated way." (Educator 5, Male, Department lead, Clinical, Medicine)

4.4.2.5 Dynamic curriculum revision

A key facilitator unique to RCSI is that at the time of interview the RCSI was at the beginning of a complete curriculum restructuring. Although, this curriculum re-drafting was actively underway at RCSI at the time of interview – curriculum evolution, editing and redesign are a constant feature at all medical Universities. In order to stay relevant and competitive with the international standard for medical education, Universities need to vigilantly revise and re-revise their curriculum in this manner, opening the door for opportunistic conversations around optimizing existing content and the potential for adding curriculum elements reflect the most globally relevant and modern topics in medicine.

"I think if you look at medical schools within Ireland anyway, RCSI seems to have a really, truly dynamic curriculum in the sense that they revise and revise with the times and with technology, and we change it [the curriculum]. So they are very dynamic in their curriculum." (Educator 4, Senior educator, Clinical, Surgical)

At RCSI, during the time of interview the core competencies required of the medical graduate was under scrutiny. This curriculum overhaul

represented a unique opportunity to capitalize on the rebuilding of the core curriculum in order to advocate for the inclusion of planetary health:

" I think that, a huge amount of the knowledge-based curriculum that we currently have is defunct because the knowledge changes so quickly that there's not much point in spending a huge amount of time on transfer of just volumes, volumes of knowledge." (Educator 3, Female, Senior, Clinical, Medicine)

Not only was the curriculum content under review, but the teaching approaches and best-established practices for content delivery were also being completely reconstructed.

"I think the new curriculum would allow us to integrate material and bring home to the students that they need to take a wider view of health." (Educator 12, Female, Senior, Non-clinical, Health sciences)

The constant cycle of change and improvement within medical curriculum forces conversations on the value of its established paradigms. Medicine is a field that is constantly growing and adapting to the latest developments within the field of science and research, this educator makes the point that RCSI have an ethos that embraces this culture of change:

"So I would say innate conservatism in our society [was a barrier]. We've been able to break out of that because in the last two or three years, we're doing so much change and we're really cherishing change [in curriculum] and we're really going for a new transforming health education program. (Educator 2, Male, Department lead, Clinical, Medicine)

As such, curriculum needs to reflect modern developments and paradigms in order to stay relevant and contemporary for the students. The goal should be to produce medical graduates with the ability to hold their own in a world of increasing globalization, in which there is a growing appreciation for the interconnected nature of human health and the forces that influence health outcomes.

"Do we want all our graduates to work in the Mayo Clinic or do we want our graduates to work in resource constrained settings that are actually going to do an awful lot more for health care in the world in the future?" (Educator 7, Male, Dept. lead, Clinical, Medicine)

4.4.2.6 Enhances the university brand

A further motivating factor for Universities to maintain a medical curriculum that deals with the most cutting-edge and relevant topics in the field of medicine is the desire to maintain and promote the status of the university as a centre of excellence and innovation.

"If you look at medicine now, medicine has changed significantly. And, not only has medicine changed significantly, the world has changed significantly. The world we live in is a different health system and hence we need to go with the time." (Educator 4, Senior educator, Clinical, Surgical)

Exploiting the desire of institutions to be competitive with other universities on and international scale and to be at the forefront of medical education would be a powerful facilitator when campaigning for the inclusion of planetary health topics into medical curriculum:

"Showing RCSI admires, is always a good start.. showing that actually this is something that is important and that other medical schools are taking it seriously.. that other places do it [planetary health], other places that this is something that's coming down the tracks or something that's going to be medical curriculum standard in 10, 15 years or so, or less." (Educator 12, Female, Senior, Non-clinical, Health sciences)

Ultimately, a university with the reputation for a medical curriculum that is dynamic and at the cutting-edge for what is topical will attract more student interest and greater competition for entry. As the participant below suggests, as the political will to address issues of planetary health continues growing, there could be opportunities for financial gain in the form of funding or grants if a university is seen to be training graduates that are in a position to deal with the complex and evolving health issues related to planetary health, which are likely to escalate in their severity for coming generations:

"..how will the world or other universities see RCSI because they have planetary health as part of their curriculum… What does it mean? Will you attract more students? Which universities will compete with you because you have that? Would you get more funding?" (Educator 4, Senior educator, Clinical, Surgical)

During the course of the semi-structured interviews there was recognition from participants that this desire to develop the most innovative and well-rounded curriculum possible and to be at the forefront in this regard relative to other Universities could prove to be a significant facilitator at RCSI in particular.

"RCSI - I think quite rightly - wants to change, wants to gets better, wants to improve, wants to advance, wants to do things differently. And certainly it is not the situation of just sitting back on our laurels and saying, let's just do the same thing the next 10 years." (Educator 2, Male, Department lead, Clinical, Medicine)

This culture of adaptability and ambition to compete in the top tier of medical institutions globally incentivizes an open-minded and dynamic attitude towards medical curriculum development.

"They've bought into this lifestyle change agenda (RCSI). They're bringing these guest speakers who talk about wellness and positive psychology, they obviously want to identify with that and promote that as part of the RCSI brand - if you want - and that's fine. But, I think the green agenda would fit nicely with that." (Educator 7, Male, Dept. lead, Clinical, Medicine)

4.4.2.7 Evidence base

As alluded to previously, inherent to medical curriculum is a necessity to adapt and evolve to the latest finding within the realms of scientific research and academia. "Evidence-based medicine" is the foundation on which clinical practice is built. As such, clinicians and medical academics are hardwired to respond when faced with a convincing and verifiable body of evidence in relation to a given subject.

"I would bombard them with data. I think that there is an education piece for faculty to say - well, look, we know X percentage of disease has an element of climate health involved" (Educator 3, Female, Senior, Clinical, Medicine)

When making a case to senior management at the university for the inclusion of planetary health in medical curriculum, reference to credible data and a comprehensive research base supporting the importance of these topics and their relevance to human health would be very difficult to ignore:

"I think evidence of the science showing that actually this stuff is important for doctors to know is always a winner in the context of the field of medicine." (Educator 12, Female, Senior, Non-clinical, Health sciences)

The body of evidence outlining the ramifications of climate change has been long established and is impossible to dismiss, and there is a progressive stream of research that addresses planetary health as a concept and the impacts of environmental instability on human health. However, research in these areas constitutes a vital tool for leverage when advocating for the inclusion of planetary health in medical curriculum and as such, it is essential to continue diligently supporting and seeking research on these topics.

"There needs to be a deluge of research that just says - this is the impact of the climate on human health. So there's a better understanding there" (Educator 1, Male, Junior, Clinical, Medicine)

4.4.2.8 Covid-19 pandemic

At the time of writing this thesis, the world is struggling with the COVID-19 global pandemic. The fight to contain coronavirus has brought the importance of the field of global and public health to the forefront of public awareness. Efforts have been made to coordinate quarantine, testing and vaccination distribution on an unprecedented scale. The crucial role of public health in the choreographing of these efforts has become very transparent and will have given medical students an insight into its importance as a speciality.

"Public health is definitely a career option that you never think about in undergraduate medicine because we don't talk about what they do in their day-to-day. I think it's come onto people's radar a bit more because of Covid - 19, what they do." (Educator 10, Female, Junior, Clinical, Medicine)

Furthermore, broader questions in relation to the global health implications of this pandemic have been prompted; such as the origin of the virus and the factors that influenced its initial dissemination. Questions around the social determinants that influence the severity and spread of the infection are also being asked, as well as geopolitical issues in containing the virus and vaccine access discrepancies between wealthy and resource-poor nations. Reflection on the pandemic through a global health lens and the greater appreciation and awareness that this entails around the environmental triggers for its proliferation could prove to be a powerful facilitator in introducing topics of planetary health into undergraduate medical curriculum.

"If you had said [previously] that you wanted to put more public health epidemiology and telemedicine into medicine, you'd be laughed out of the room because they were all wishy-washy. But now, post covid- 19, they have become crucial… I think that climate change in general is very much a valued topic for a majority of people in the age group of the students." (Educator 3, Female, Senior, Clinical, Medicine)

4.5 Overarching concepts and final themes

Following the analysis of the qualitative data detailed above, the figures below represent the final overarching concepts, themes and subthemes identified (figures 5, 6 & 7).

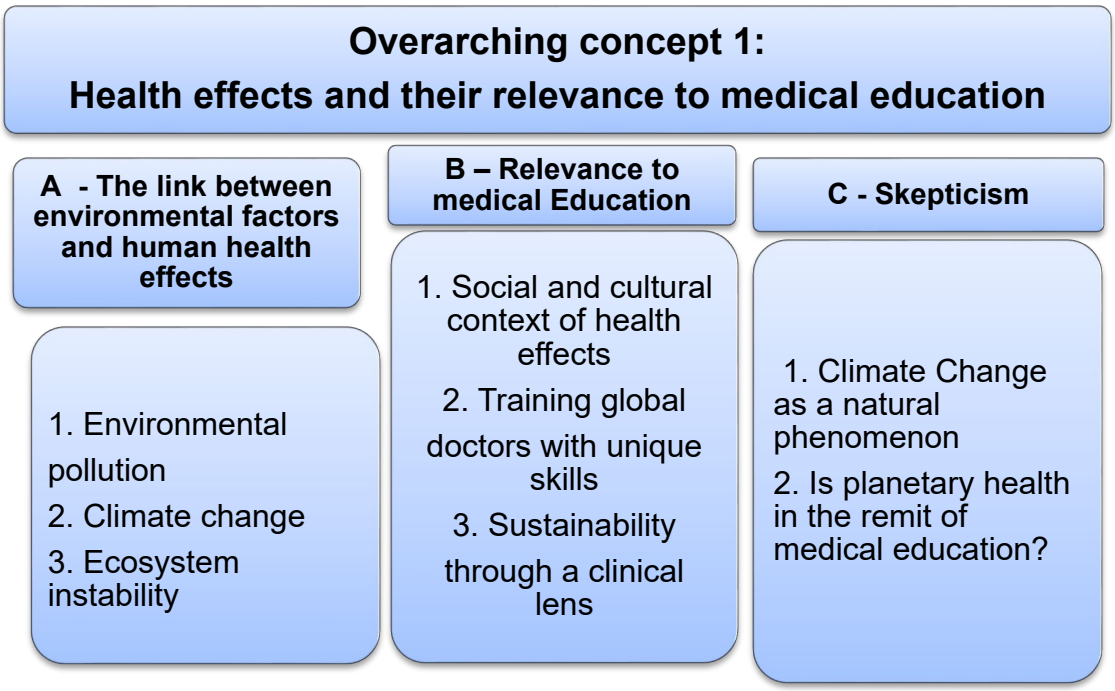


Figure 5 - Overarching concept 1: health effects and their relevance to medical education

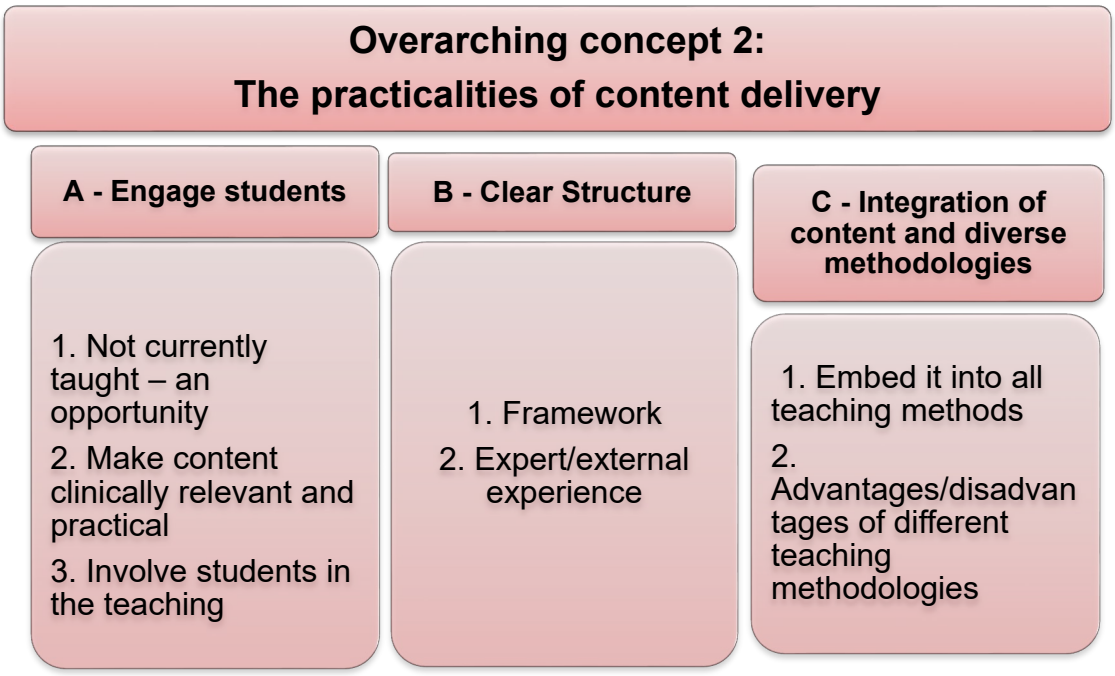


Figure 6 - Overarching concept 2: the practicalities of content delivery

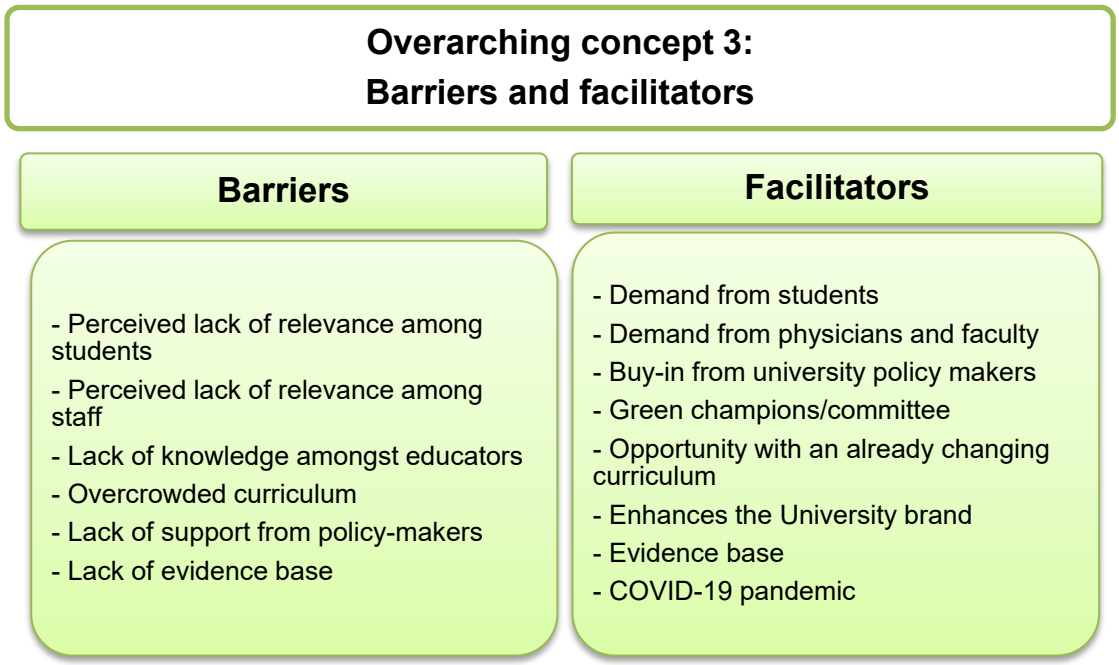


Figure 7 - Overarching concept 3: barriers and facilitators

Chapter 5

Quantitative results

5.1 Demographic characteristics

281 students participated in the survey. Of these 281 students, not all completed every component of each question. When analysing the data, responses from respondents who had not fully completed each individual section of the survey were included in the analysis, with omitted questions marked as missing data.

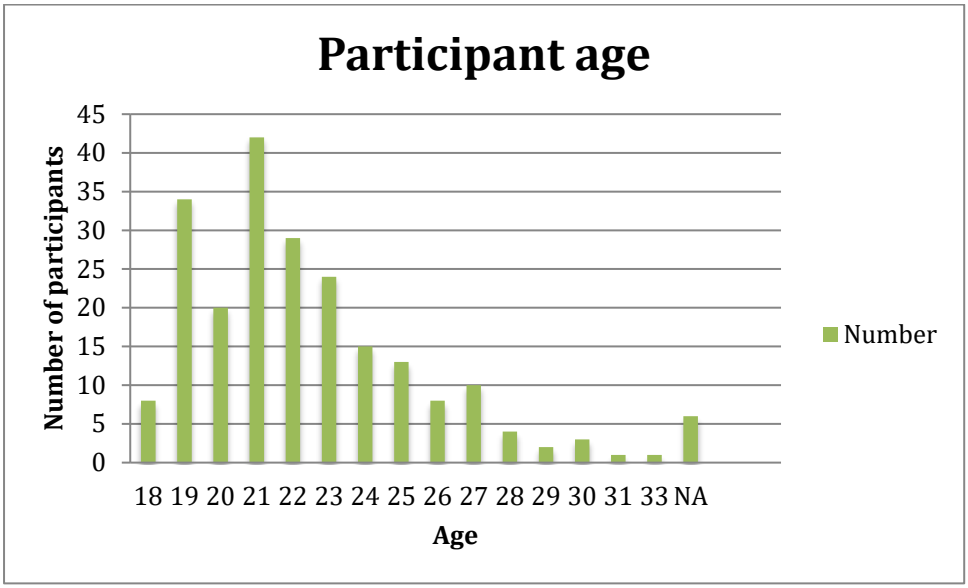


Figure 8 - Demographic characteristics: age (number of responses 214, skipped: 67)

Of note, 4 students indicated they were over the age of 40 (figure 8). Given that the survey invite was distributed to undergraduate medical students and these ages far exceed the expected maximum age of a student in this cohort, they were assumed to be typos and assigned to the NA group.

With this adjustment, ages of respondents ranged from 18 – 33. The mean age of respondents was 22.2 (95% CI 21.8 to 22.6) and the median was 22 years of age.

Table 4 - Demographic characteristics: gender (answered:224, skipped: 57)

Gender	% of Total	Counts
Male	39.7%	89
Female	59.4%	133
Non-binary	0.9%	2
Prefer not to say	0.0%	0

A larger proportion of female students (N=133, 59.4%) participated in the survey compared to male students (N = 89, 39.7%). Two students (0.9%) identified themselves as non-binary (Table 4). There is a difference here when

compared with the gender distribution of total undergraduate students enrolled at RCSI at the time of survey. 744 Male (48.3%), 797 (51.7%) female undergraduate students were enrolled in undergraduate medicine across all years at RCSI at this time.

Table 5 - Demographic characteristics: ethnicity (answered: 224, skipped: 57)

Ethnicity	% of Total	Counts
Asian	24.6%	55
Arab	24.1%	54
Black/African-American	1.8%	4
Caucasian	37.1%	83
Hispanic	0.5%	1
Caribbean	2.2%	5
Pacific Islander	0.0%	0
Prefer not to say	3%	7
Other	6.7%	15

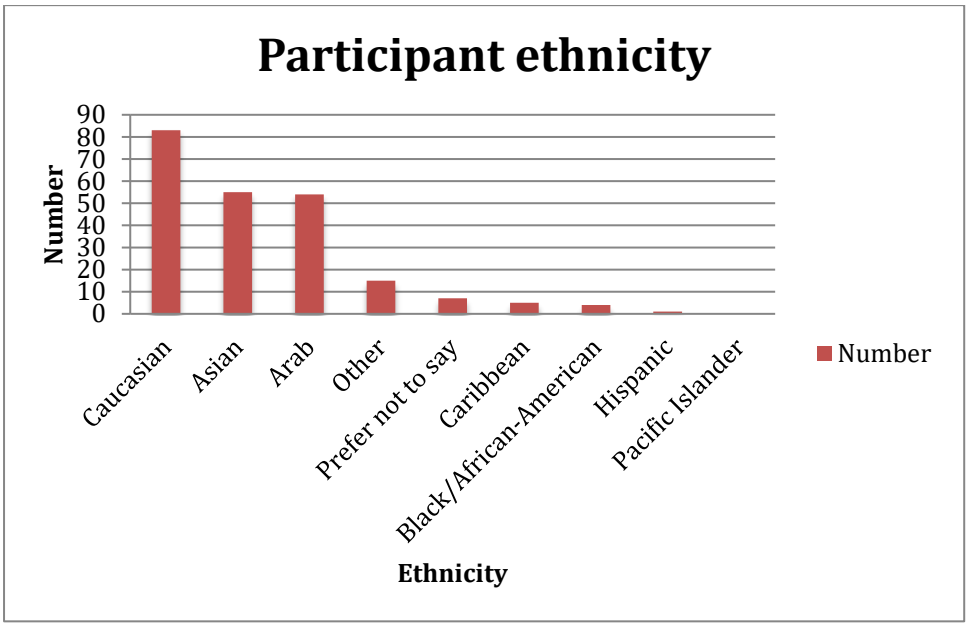


Figure 9 - Demographic characteristics: ethnicity

The original respondent responses with respect to ethnicity are displayed above (Table 5, Figure 9). The categories for ethnicity were chosen based on the racial categories outlined by the United States Office of Management and Budget (USOMB) (108). This was chosen in lieu of the Irish Central Statistics Office (109) census ethnic categories or other racial category tools as it was felt to offer a wider range of more specific ethnicities that aligned more closely to the international student cohort at RCSI and the perceived ethnic representations at the university.

The five minimum categories outlined by the USOMB are White, Black or African American, American Indian or Alaska Native, Asian, Pacific

Islander. Due to the partnership RCSI in Dublin has with RCSI in Bahrain, many students of Arab descent enrol at RCSI in Dublin. As such, the ethnic category of “Arab” was added to this survey. Furthermore, the American-Indian/Alaska native categories were omitted as they were deemed less relevant for the representation of ethnic groups in Ireland. The ethnic groups of “Hispanic” and “Caribbean” were also added in order to broaden student options and allow a wider sensitivity in determining the ethnic characteristics of this student cohort. The option of “other” was given as a means of allowing students the possibility of indicating an ethnicity outside the scope of designated ethnic categories. For students that selected “other”, the survey provided an option to manually type in the ethnicity that the student identified with.

Caucasian students constituted the most widely represented proportion of respondents (N = 83, 37.1 %), followed by Asian (N = 55, 24.6%) and then Arab students (N = 54, 24.1 %). Caribbean students constituted 2.2% (N=5) of the cohort and 1.8 % (n=4) of the students indicated “Black/African – American” as their ethnicity. Only one student (0.5%) identified as Hispanic and no students selected Pacific Islander as their ethnicity. Fifteen students (6.7%) selected “other” and seven students (3%) preferred not to state their ethnicity.

For the purpose of facilitating comparative analysis through nominal logistic regression, on the advice of the DSC, ethnic categories were simplified further into 4 categories (Table 6): 1. Asian 2. Caucasian 3. Arab and 4. Other.

The manually typed responses of the “other” section in the original survey responses were scrutinized and were assigned to one of these four categories, where possible i.e. if a respondent had free-typed “Indian”, this response was transferred to the “Asian” category etc.

Table 6 – Demographics; simplified ethnicity frequencies (total = 217)

Levels	Counts	% of Total	Cumulative %
Arab	55	25.3 %	25.3 %
Caucasian	84	38.7 %	64.1 %
Asian	55	25.3 %	89.4 %
Other	23	10.6 %	100.0 %

Table 7 - Demographic characteristics: continent of birth (answered:220, skipped: 61)

Continent of birth	% of Total	Counts
Asia	44.6%	98
North America	19.6%	43
South America	0.9%	2
Europe	32.3%	71
Africa	0.9%	2
Australia	0.0%	0
Prefer not to say	1.8%	4

In conjunction with investigating participant ethnicity, the questionnaire also posed the question to students: “What is the continent of your birth?”. This component of the survey was added to aid in the analysis of participant responses related to their cultural context. Simply asking about ethnicity does not account for the diverse international backgrounds and different origins that might exist within the student population. Following analysis of the responses to the above question on continent of birth, this proved prudent, with responses not aligning as one might expect when compared with responses from the ethnicity question (Table 7).

While the largest represented ethnicity amongst the student cohort was “Caucasian” (N = 83, 37.1 %) with students identifying as Asian was second most common (N = 55, 24.6%), the most frequently selected continent of origin was “Asia” (N = 98, 44.6%). A likely explanation for this lack of correlation between the most widely selected ethnicity and continent of origin is that the student group that selected “Arab” as their ethnicity likely chose “Asia” as their continent of origin (N = 54, 24.1 %). The second most selected continent of origin was Europe (N = 71, 32.3%) and in third North America (N = 43, 19.6%). South America and Africa were both selected by two respondents (0.9%, respectively). No students selected Australia and four students (1.8%) preferred not to indicate their continent of birth. The findings here are notable in relation to the international nature of the students who responded, with 65.9% of students originating from outside Europe.

For the purposes of comparative analysis, as with the responses relating to ethnicity, the response groups in this section were also simplified to aid input into a logistic regression analysis (Table 8). Given that the overwhelming majority of respondents responded with “Asia”, “Europe” and “North America”, the remaining responses were combined into a group entitled “Other” (see below).

Table 8 – Demographic characteristics: simplified frequencies of continent of birth ***(total = 216)***

Levels	Counts	% of Total	Cumulative %
North America	43	19.9 %	19.9 %
Europe	71	32.9 %	52.8 %
Asia	98	45.4 %	98.1 %

Levels	Counts	% of Total	Cumulative %
Other	4	1.9 %	100.0 %

Table 9 - Demographic characteristics: current year of study (answered:219, skipped: 62)

Year of study	% of Total	Counts
Foundation year	0.5%	1
Year 1	22.8%	50
Year 2	24.7%	54
Year 3	19.6%	43
Year 4	16.9%	37

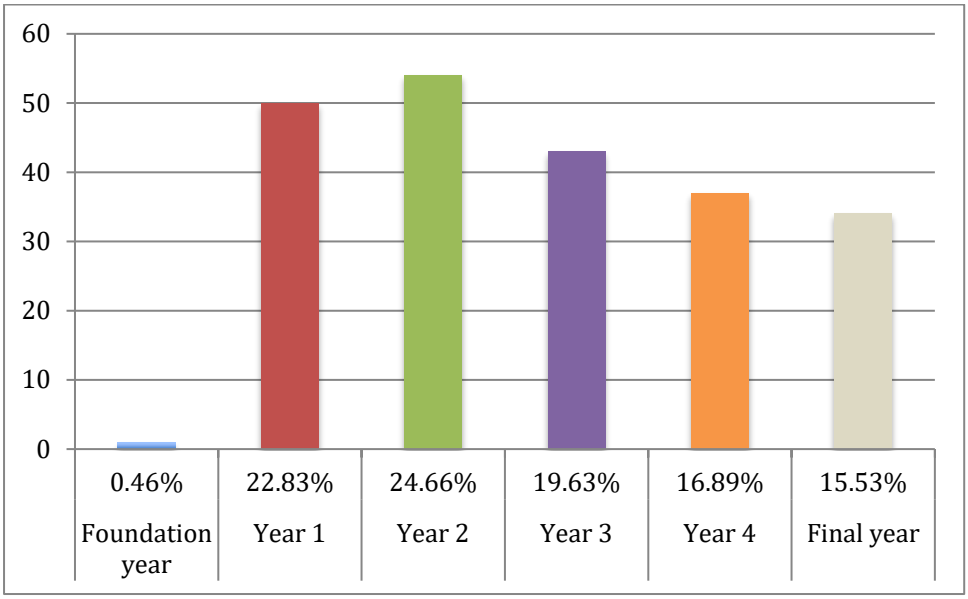


Figure 10 - Demographic characteristics: current year of study

Year 2 students were the most represented year amongst the participant population with 54 students responding to the survey (24.7%) (Table 9, Figure 10). Students from first year were the next most represented group with 50 respondents (22.8%). 43 (19.6%) third year students participated and 37 (16.9%) fourth year students participated. Only one (0.5%) foundation year student participated in the survey.

Table 10 - Demographic characteristics: preferred student speciality (answered: 200, skipped: 81)

Speciality	Count	% of Total
		8.5 %
General Surgery	17	8 %
ED	16	8 %
GP	16	7 %
Unsure	14	6.5%
Orthopaedics	13	6 %
Psychiatry	12	6 %
Neurology	12	5.5 %
Cardiology	11	5 %
General Medicine	10	5 %
Neurosurgery	10	5 %
Paediatrics	10	4.5 %
Ob/Gyn	9	4 %
Anaesthetics	8	2.5 %
Oncology	5	2.5 %
Cardiothoracic	5	2. 5 %
Dermatology	5	2 %
ENT	4	2 %
Radiology	4	1.5 %
Vascular Surgery	3	1 %
Plastics	2	1 %
Ophthalmology	2	1 %
Infectious Disease	2	1 %
Pathologist	2	0.5 %
Paediatric Surgery	1	0.5 %
Endocrine	1	0.5 %
Administrative Medicine	1	0.5 %
Gastro	1	0.5 %
Public Health	1	0.5 %
Immunology	1	0.5 %
Resp	1	0.5 %
Haematology	1	

Table 11 - Demographic characteristics: simplified preferred student speciality (answered: 200, skipped: 81)

Speciality	Number of Students	% of Total
Medicine	127	65.3 %
Surgery	55	27.5 %
Other	18	9 %

Student speciality of interest was the final question in the demographic component of the quantitative analysis (Table 10). Following the question "What medical speciality do you think you would most like to pursue in your career e.g. cardiology/general practice/vascular surgery/orthopaedics etc.?" was a free-text box in which students were invited to manually type in their answer. During analysis of the results individual responses were reviewed and grouped accordingly. The responses are displayed in tables 10 and 11 above.

Responses were subsequently re-simplified into broader categories of 1. Medicine (N = 127, 65.3%); 2. Surgery (N = 55, 27.5%) and 3. Other (N = 18, 9%) (Table 11).

5.2 Environmental attitudes of respondents (NEP)

The eight even–numbered items in the NEP scale, indicate a pro-ecological world-view or an endorsement of the NEP by the participant if they agree with these items. The seven odd-numbered items inversely represent a rejection of the NEP and an endorsement of the dominant social paradigm (DSP) and a less environmentally sympathetic world-view (102). When coding the responses; the seven odd-numbered pro-DSP items on the scale were reverse scored. The eight even-numbered pro-NEP items were coded as 1 = Strongly disagree, 2 = Mildly disagree, 3 = Unsure, 4 = Mildly agree and 5 = Strongly agree.

A high average score on the eight even-numbered questions indicates a greater acceptance of the new ecological-paradigm and a more environmentally sympathetic world-view. A higher average score on the seven-odd numbered items taken together indicated a perspective that is in concordance with the DSP and more anthropocentric [1] in nature.

In this way, it possible to have a high score in both the DSP-aligned and NEP aligned questions. This would result in an overall NEP score that is more neutral.
NEP scores were calculated as an average of all the scores on the individual scale items. Average scores over 3 are generally seen as being representative of the participant having a more pro-ecological worldview (see NEP for definition of Pro-ecological world-view). Conversely, average scores of less than 3 indicate a worldview that is less ecologically sympathetic or anthropocentric (110).

The mean score from all participant responses from the full NEP in this study is 3.7 (Table 12). This would indicate that respondents in this study generally

[1] regarding humankind as the central or most important element of existence, especially as opposed to God or animals. Oxford dictionary 2021.

hold a more pro-ecological world-view. The mean score on the seven pro-DSP items was 3.2. The mean score on the 8 pro-NEP items was 4.1.

Female respondents had a higher NEP score on average compared to male counterparts (3.82 vs. 3.51) (Table 13). Minimal difference was noted in the NEP score of respondents when categorized by their specialty of interest (Table 14). Students that indicated a medical specialty of interest had an average NEP score of 3.73 and those that indicated a surgical specialty had an average score of 3.76.

The average NEP scores by ethnicity were collated (Table 15). “Asian” had the highest average NEP score of 3.77, followed by “Caucasian” with 3.75 and “Arab” had the lowest score at 3.64.

Table 12 – NEP score overall

	Average NEP score
N	279
Mean	3.70
Median	3.73
Standard deviation	0.522

Table 13 – Average NEP score by gender

	Gender	**Average NEP score**
Mean	Female	3.82
	Male	3.51
	Non-binary	3.93
Median	Female	3.87
	Male	3.60
	Non-binary	3.93
Standard deviation	Female	0.434
	Male	0.602
	Non-binary	0.377

Table 14 – Average NEP score by respondent area of interest

	Area of interest	Average NEP score
N	Surgical	62
	Medical	120
	Unsure	15
Mean	Surgical	3.76
	Medical	3.73
	Unsure	3.60
Minimum	Surgical	2.60
	Medical	2.27
	Unsure	2.13
Maximum	Surgical	4.60
	Medical	4.73
	Unsure	4.33

Table 15 – Average NEP score by respondent ethnicity

	Ethnicity	Average NEP score
N	Arab	55
	Caucasian	82
	Asian	54
	Other	23
Mean	Arab	3.64
	Caucasian	3.75
	Asian	3.77
	Other	3.73
Minimum	Arab	2.13
	Caucasian	2.27
	Asian	2.53
	Other	1.73
Maximum	Arab	4.53

Table 15 – Average NEP score by respondent ethnicity

Ethnicity	Average NEP score
Caucasian	4.93
Asian	4.67
Other	4.73

5.3 Acknowledgement of climate change & ecological instability

5.3.1 Attitudes towards climate change

Question 16 of the questionnaire was included as a means of assessing student awareness of climate systems and its resilience in the face of human industry. 243 respondents answered this question and 38 respondents skipped it. Students were asked to choose one of five statement options that they felt best represented their understanding of how climate systems work. 5% (N = 13) of respondents felt that “Climate shows a delicate balance. Small changes will have abrupt and catastrophic impacts.” 60% (N = 145) of respondents chose the option “Climate is stable within certain limits. If the changes are small, climate will return to equilibrium, if they are large, there will be abrupt and catastrophic impacts” as the option that best represented their views. 33% (N = 79) of respondents selected “Climate is slow to change. Climate change will gradually lead to dangerous impacts.”
2% (n = 5) of respondents felt that the option – “Climate is random. We do not know what will happen.” – best represented their perspective on the nature of climate systems.

Only one participant (<1%) chose the option: “Climate is very stable. Climate change will have little to no impact.”

In questions 17, 18, and 19; respondents were given a statement and were asked to indicate their agreement on a five-point Likert- like scale ranging between “strongly disagree” to “strongly agree”.

In question 17, respondents were given the statement: “Climate change is a completely natural phenomenon, uninfluenced by human behaviour”. 243 students answered and 38 students skipped this question. 87% of respondents in total disagreed with the statement (“Strongly disagree”; N = 140, 57.6% and “Mildly disagree”; N = 71, 29.2%). 11% of respondents

agreed with this statement (“Strongly agree”; N = 11, 4.5% and “Mildly agree”; N = 15, 6.2%). The remaining 2.5% (N = 6) were unsure.

In relation to question 18 - Please indicate your opinion on the following statement: Climate change is ultimately harmful; 78% of respondents agreed (“Strongly agree”; N = 111, 45.7% and “Mildly agree”; N = 78, 32.1%) with the statement that “Climate change is ultimately harmful”, while 14% disagreed (“Strongly disagree”; N = 10, 4.1% and “Mildly disagree”; N = 24, 9.9%). 8.2% (N = 20) of respondents were unsure in regards to this statement. 243 students answered and 38 students skipped this question.

In relation to question 19; the vast majority of respondents agreed with the statement that “Environmental change will have negative health effects for human beings”, with 89.7% of respondents indicating agreement (“Strongly agree”; N = 150, 62% and “Mildly agree”; N = 67, 27.7%). 3% of respondents indicated disagreement with this statement (“Strongly disagree”; N = 2, 0.8% and “Mildly disagree”; N = 5, 2.1%). 7.4% (N = 18) of respondents were unsure. 242 students answered and 39 students skipped this question.

5.3.2 Planetary health in curriculum

Questions 20 and 21 are aimed at exploring the attitude that students have towards the integration of planetary health themes into curriculum, in terms of the potential value or harm that this action might have.

Question 20 asked respondents to indicate to what extent they felt that addressing the potential health-related impacts of climate change through medical practice is worthless or valuable; 75% of respondents felt there would be value in it (“Valuable”; N = 96, 39.5% and “Likely to be of value” N = 85, 35%). 15.2% (N = 37) of respondents were unsure and 10% of respondents indicated that they felt there would be of limited to no value (“Worthless” N = 10, 4.1%, “Unlikely to be of value” N = 15, 6.2%).

Question 21 asked respondents to indicate to what extent they felt that addressing the potential health-related impacts of climate change through medical practice is harmful or beneficial. The majority of respondents (78.3%) indicated that they felt this would be a beneficial endeavour (“Beneficial”; N = 96, 39.6% and “Likely to be of benefit” N = 94, 38.7%). 14% (N = 34) of respondents were unsure as to whether the incorporation of these topics into the curriculum would be harmful or beneficial and 7.9% of respondents felt that the addition of planetary health topics into medical curriculum would be “harmful” (N = 7, 2.9%) or “likely to be of harm” (N = 12, 5%).

The final four questions of section 2 directly assessed the attitude of students in relation to planetary health topics and the undergraduate medical curriculum (Table 16). When asked, 48.6% (N = 118) of respondents indicated that they felt they already had a good level of knowledge about the “potential health-related impacts of climate change”, although only 18 students (7.4%) strongly agreed with the statement, while 100 (41.2%) selected “mildly agree”. 14.8% (N = 36) were unsure and 36.6% (Mildly

disagree"; N = 62, 25.5% and "Strongly disagree"; N = 27, 11.1%) indicated that they felt they did not currently have a good level of knowledge.

When asked, 86% (N = 209) of respondents indicated that they felt that "medical students should have a good understanding about the potential health-effects of climate change". 49.8% (N = 121) of students strongly agreed with the statement, while 36.2% (N = 88) of students mildly disagreed. 7.4% (N = 18) of students did not agree that medical students should have a good understanding. 4.9% (N = 12) of students mildly disagreed while 2.5% (N = 6) of students strongly disagreed. 6.6% (n = 16) of students were unsure.

When asked to indicate their level of agreement with the following statement – "It is important to make environmental change and its health-effects a part of medical curriculum" – 75.6% (N = 179) of respondents were in agreement, with 38% (N = 90) of respondents selecting "strongly agree" and 37.6% (N = 89) of respondents selecting "mildly agree". 14.8% (N = 35) of respondents were unsure and 9.8% (N = 18) of respondents did not agree ("Mildly disagree"; N = 16, 6.8% and "strongly disagree"; N = 7, 3%).

Furthermore – in response to whether or not respondents felt that "students at RCSI currently get enough teaching about the health effects of climate change" – 14.4% (N = 34) of students felt that they did, with 3.8% (N = 9) of respondents strongly agreeing with the statement and 10.6% (N = 25) of students mildly agreeing. 65% (N = 154) of respondents felt that students don't get enough teaching, with 32.9% (N = 78) of students mildly disagreeing and 32.1% (N = 76) of students strongly disagreeing. 20.7% (N = 49) of students are unsure.

Table 16– Summary of questions addressing respondent attitude towards planetary health in curriculum

Statement	Agree	Unsure	Disagree
Q. 22 I have a good level of knowledge about the potential health-related impacts of climate change?	48.6% (n=118)	14.8% (n=36)	36.6% (n=89)
Q. 23 Medical students should have a good knowledge of the health-effects of climate change	86% (n=209)	6.6% (n=16)	7.4% (n=18)

Q. 24 It is important to make environmental change and its health-effects a part of medical curriculum	75.6% (n=179)	14.8% (n=35)	9.8% (n=18)
Q 25 Students at RCSI currently get enough teaching about the health effects of climate change	14.4% (34)	20.7% (n=49)	65% (n=154)

5.3.3 Demographic predictors

Ordinal logistic regression was performed on questions 20 – 24 to evaluate the relationship between participant demographic characteristics and student perspectives towards the integration of planetary health topics into medical curriculum in addition to perceived current understanding of these topics. Likert-items in questions were assigned a number from 1 to 5, with 1 being assigned to the response that indicated the least sympathetic perspective towards planetary health in curriculum and 5 being assigned to the answer that indicated the most sympathetic perspective. Taking question 20 as an example: students that answered “Valuable” in response to the question “To what extent do you feel that addressing the potential health-related impacts of climate change through medical practice is worthless or valuable” were assigned a score of 5, these numbers were assigned in descending order along the Likert-scale with students answering “worthless” receiving a 1.

Questions 20,21 and 24 revealed significant findings relative to demographic characteristics. Level of significance was set at $p = < 0.05$.

On testing the null hypothesis that student gender/ethnicity/speciality of interest and continent of birth is not associated with responses to question number 20 (Table 17)- “Please indicate to what extent you feel addressing the potential health-related impacts of climate change through medical practice is worthless or valuable.” – significance was noted in relation to gender and continent of origin. The p-value in relation to gender = < 0.001. Examination of the odds ratio of the multivariable analysis shows that male students are 68% less likely to respond positively to this statement than their female counterparts.

Furthermore, evaluation of the “Continent of Birth” category also reveals significance. Students from Europe were used as the reference. A p-value of 0.004 and 0.003 is noted when comparing the answers of students from North America and Asia with those of Europe, respectively. The confidence interval does not cross 1 in either of these pairings, on multivariable analysis. The odds ratio informs us that students born in North America are 72.9% less likely to respond positively to the statement than their European counterparts. Students from Asia are 68.4% less likely to respond positively.

Table 17 – Responses to Q. 20 by demographic variable

	Univariable Analysis			*Multivariable Analysis*		
	OR	*95% CI*	*P-value*	*OR*	*95% CI*	*P-value*
Sex						
Female (reference)	1.00			1.00		
Male	0.393	0.236 to 0.648	<0.001[a]	0.302	0.1572 to 0.571	< 0.001[a]
Ethnicity						
Arab (reference)	1.00			1.00		
Caucasian	1.545	0.814 to 2.94	0.184	1.010	0.4487 to 2.263	0.981
Asian	1.739	0.848 to 3.59	0.990	2.105	0.8866 to 5.089	0.094
Other	0.777	0.295 to 2.05	0.609	1.079	0.3310 to 3.640	0.901
Speciality of Interest						
Surgical (reference)	1.00			1.00		
Medical	1.34	0.743 to 2.43	0.328	1.461	0.7420 to 2.878	0.271
Continent of Birth						
Europe (reference)	1.00			1.00		
North America	0.478	0.2330 to 0.975	0.043[a]	0.271	0.1113 to 0.648	0.004[a]
Asia	0.450	0.2516 to 0.796	0.006[a]	0.316	0.1451 to 0.669	0.003[a]

Other	0.459	0.0828 to 2.752	0.369	0.509	0.0588 to 5.431	0.544

OR= Odds Ratio; CI=Confidence Interval. [a] denotes values that were statistically significant. Statistical significance calculated using Ordered logistic regression.

Significant findings were also noted when reviewing the results of analysis on question 21 (Table 18). Similar to question 20 p-values of less than 0.05 were noted within the "Gender" and "Continent of Birth" categories. A p-value of 0.05 is present when comparing the answers of male students to those of female students. The confidence interval on multivariable analysis does not cross 1. The odds ratio indicates that male students are 60.6% less likely to answer positively to the statement: "Please indicate to what extent you feel addressing the potential health-related impacts of climate change through medical practice is harmful or beneficial".

Further to this, when comparing the answers between students born in Asia/ North America with those born in Europe, in both cases, findings were significant (p-value = 0.04 and 0.005 respectively).

The odds ratio would suggest that students born in North America are 70.9% less likely to respond positively to the statement in question 21 and that students born in Asia are 54.8% less likely to respond positively.

Table 18 – Responses to Q. 21 by demographic variable

	Univariable Analysis			*Multivariable Analysis*		
	OR	*95% CI*	*P-value*	*OR*	*95% CI*	*P-value*
Sex						
Female (reference)	1.00			1.00		
Male	0.493	0.297 to 0.814	<0.006[a]	0.394	0.204 to 0.750	0.005[a]
Ethnicity						
Arab (reference)	1.00			1.00		
Caucasian	1.38	0.721 to 2.63	0.333	0.876	0.393 to 1.983	0.744
Asian	1.83	0.883 to 3.84	0.106	1.971	0.814 to 4.861	0.135
Other	1.72	0.674 to	0.261	1.930	0.623 to	0.263

		4.46			6.331	
Speciality of Interest						
Surgical (reference)	1.00			1.00		
Medical	1.3	0.720 to 2.34	0.385	1.327	0.676 to 2.602	0.41
Continent of Birth						
Europe (reference)	1.00			1.00		
North America	0.4	0.1966 to 0.806	0.011[a]	0.291	0.122 to 0.681	0.005[a]
Asia	0.453	0.2499 to 0.812	0.008[a]	0.452	0.2095 to 0.958	0.040[a]
Other	0.230	0.0440 to 1.208	0.076	0.248	0.0349 to 1.785	0.153

OR= Odds Ratio; CI=Confidence Interval. [a] denotes values that were statistically significant. Statistical significance calculated using Ordered logistic regression.

Table 19 reveals the result of the ordinal logistic regression performed to test the null hypothesis that student gender/ethnicity/speciality of interest and continent of birth is not associated with responses to question number 24 - "It is important to make environmental change and its health-effects a part of medical curriculum". Student gender is the only statistically significant category on both univariable and multivariable analysis. As per the OR on multivariable analysis, male students are 60% less likely to respond positively to the question than their female peers.

Table 19 - Responses to Q. 24 by demographic variable

	Univariable Analysis			*Multivariable Analysis*		
	OR	*95% CI*	*P-value*	*OR*	*95% CI*	*P-value*
Sex						
Female (reference)	1.00			1.00		
Male	0.412	0.247 to 0.684	<0.001[a]	0.4	0.208 to 0.758	0.005[a]
Ethnicity						
Arab (reference)	1.00			1.00		

Caucasian	0.997	0.519 to 1.91	0.994	0.893	0.402 to 1.977	0.781
Asian	0.995	0.474 to 2.09	0.990	1.326	0.560 to 3.163	0.522
Other	0.619	0.241 to 1.58	0.315	0.813	0.261 to 2.563	0.720
Speciality of Interest						
Surgical (reference)	1.00			1.00		
Medical	0.931	0.512 to 1.69	0.815	0.897	0.460 to 1.740	0.749
Continent of Birth						
Europe (reference)	1.00			1.00		
North America	0.412	0.204 to 0.828	0.013[a]	0.477	0.202 to 1.113	0.088
Asia	0.449	0.249 to 0.799	0.007[a]	0.444	0.212 to 0.914	0.029[a]
Other	0.816	0.125 to 6.802	0.835	3.668	0.352 to 84.296	0.307

OR= Odds Ratio; CI=Confidence Interval. [a] denotes values that were statistically significant. Statistical significance calculated using Ordered logistic regression.

5.4 Climate change health effects and medical curriculum

Section 3 of the survey gave the students a list of direct and indirect health-effects which may be associated with climate change.
It asked them to think about whether each of these issues:

A. Has already increased due to climate change
B. Will increase in the next 20 years due to climate change
C. Poses a significant health-risk to human beings, globally
D. Is on the medical curriculum here at RCSI
E. If not, should this be included in the curriculum at RCSI

Responses to the questions were on a 5-point Likert-scale from “strongly agree” to “strongly disagree” or required students to indicate agreement/disagreement through the options “Yes”, “No” or “ I Don’t know”. For the purpose of the comparative analysis of the results, the answers were simplified into “positive response” (combining “strongly agree” and “mildly

agree" or "Yes"), "Neutral" ("I don't know" or "Unsure" responses) and "Negative response" (combining "strongly disagree" and "mildly disagree" or "No").

Figures 11 and 12 compare student responses to these statements relative to the different health effects.

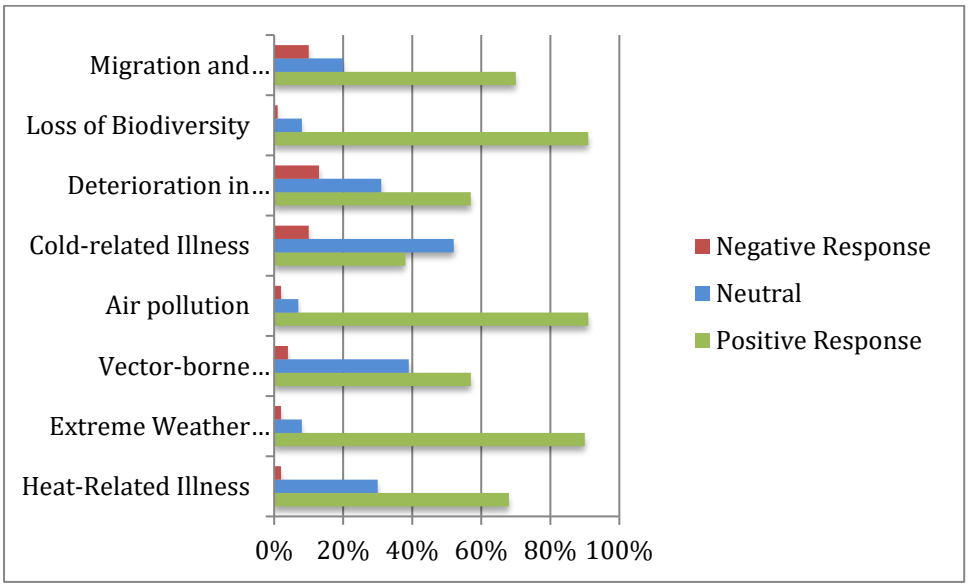


Figure 11 – Responses to the statement "Has already increased due to climate change & ecological instability" in relation to health-effects

When posed the question as to which health effect had already increased the most due to climate change & ecological instability (Figure 11), the health-effects that received the largest positive responses were "Air pollution" (N = 205, 91%) and a "Loss of biodiversity" also with 91% (N = 201) of respondents in agreement with the statement. Only four students (1.8%) indicated disagreement with this statement in relation to "Loss of Biodiversity" and 8.1% (N = 18) said that they were unsure. In relation to the recognition of the worsening of "Air pollution" 6.7% (N = 15) of students selected "Unsure" and 2.2% (N = 5) of respondents indicated disagreement. The third most recognized health effect was "Extreme Weather Events" with 90.4% (N = 207) of students agreeing that extreme weather events had increased in frequency due to climate change and ecological insecurity. Only 1.8% (N =4) of students were in disagreement with the statement and 7.9% (N = 18) indicated that they were unsure.

The health-effect that generated the largest negative response to the statement was "Deterioration in Mental Health" with 12.1% (N = 27) of respondents selecting either "Strongly disagree" (N = 8, 3.6%) or "Mildly disagree" (N = 19, 8.5%). Just over half the respondents did still answer positively to this question, however (N = 127, 57%).

The health effect that the highest number of students were unsure about in relation to its increase secondary to climate change and ecological instability was "Cold-related Illness". 50.9% (N = 113) of students selected "Unsure" in relation to this, greater than the number of students who were both in agreement (N = 95, 42.8%) and in disagreement (N = 14, 6.3%). In no other health-effect had the majority selected agree vs. disagree.

“Vector-borne illness” was the health effect with the second highest representative proportion of “Unsure” answers (N = 89, 39.2%).

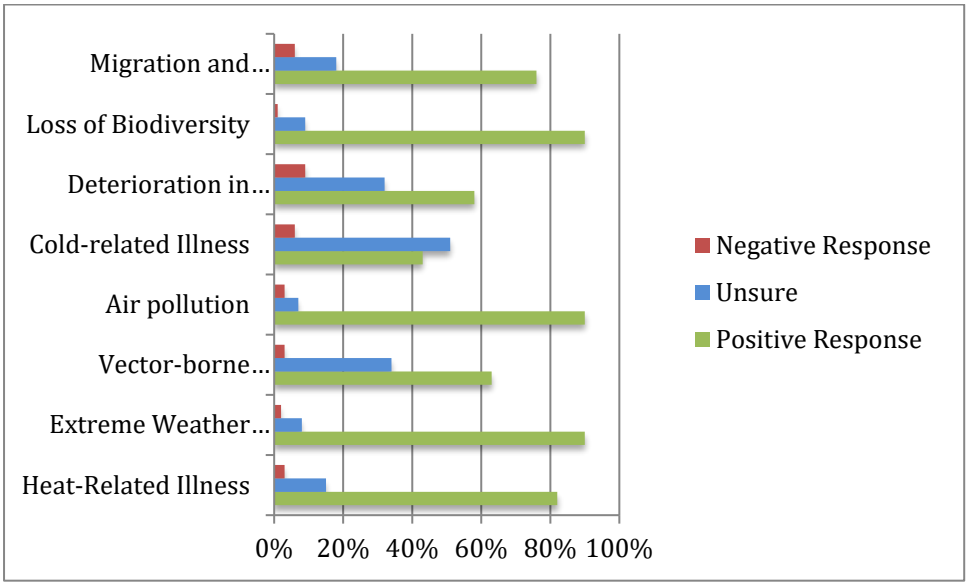


Figure 12 – Responses to the statement “Will increase in the next 20 years due to climate change” in relation to health-effects

Students were asked to consider whether various health effects were likely to increase in the future due to climate change and ecological instability (Figure 12). Similar health-effects were recognised as being most at risk for further escalation in the next 20 years as had been selected in the previous question. “Loss of Biodiversity” (N = 163, 73.1%), “Air pollution”(N = 224, 99.6%) and “Extreme Weather Events” (N = 207, 90.4%) all received the highest proportion of positive responses.

Interestingly, the health-effect “Heat-related illness” had an increase in their positive responses when compared to the previous question. “Heat-related illness” increased in the number of positive responses from 67.7% (N = 157) when asked about health-effects that had already increased to 81.6% (N = 190) when students were asked to indicate health effects they felt would increase in the next 20 years. The number of students that chose “Unsure” in relation to “Heat-related illness” dropped from 30.2% (N = 70) to 14.6% (N = 34) between the two questions. The difference in the number of students that disagreed with the statement was 2.2% (N = 5) and 3.9% (N = 9) between the first and second statements, respectively.

Following the trend of the previous question; the health-effect “Deterioration in Mental Health” was the least anticipated health-effect to increase in the next 20 years and provoked the highest proportion of negative responses (N = 22, 9.9%) although these were still outweighed by the positive responses (N = 129, 57.9%) and students who selected “Unsure” (N = 72, 32.3%).

The highest proportion of “Unsure” responses in relation statement that a given health effect will “increase in the next 20 years due to climate change” was in the context of the health-effect “Cold-related Illness”, compounding the findings of the previous question. 50.9% (N = 113) of respondents selected “Unsure” in relation to this health-effect. More students responded positively

to this health effect than negatively however in relation to this statement; 42.% (N = 95) were in agreement and 6.4% (N = 14) were in disagreement in relation to this statement in the context of the health-effect “Cold-related Illness”.

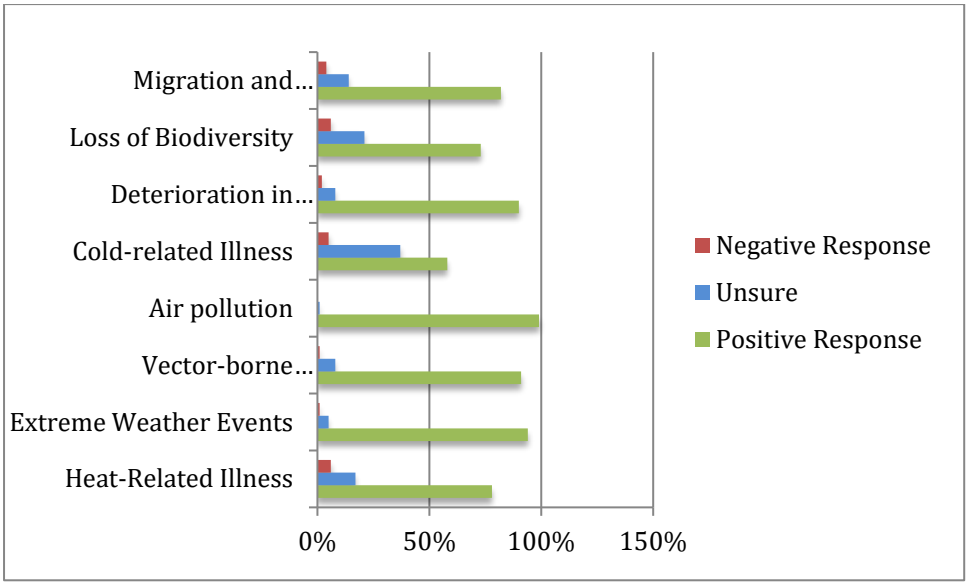


Figure 13 – Responses to the statement “Poses a significant health-risk to human beings, globally” in relation to health-effects

The third statement that students were asked to consider in relation to health-effects due to climate change and ecological instability was “poses a significant health risk to human beings, globally” (Figure 13). Of all the statements posed to students, respondents were most in concordance with this one, in relation to the various health effects. No students disagreed with this statement in relation to the health-effect “air pollution”. 99.6% (N = 224) of students indicated agreement with this question with 89.3% (N = 201) selecting “Strongly agree” and 10.2% (N = 23) selecting “Mildly agree”. Only 1 (0.4%) of respondents selected “Unsure” for this health effect.

Only 2 (0.9%) respondents selected “Mildly disagree” for both the health-effects “Extreme weather events” and “Vector-borne Infectious Diseases”. No respondents selected “Strongly disagree” in response to the statement for either of these health effects.

93.9% (N = 215) of respondents responded positively in relation to “Extreme Weather Events” with 68.1% selecting “Strongly agree” (N -= 156) and 25.8% (N = 59) selecting “Mildly agree”. 5.2% (N = 12) of respondents said that they were “Unsure” if “Extreme Weather Events” pose a significant health-risk to human health, globally.

91.2 % (N = 206) of respondents were in agreement with the above statement in the context of “Vector-borne Infectious Diseases”. 69.5% (N = 157) of respondents strongly agreed with the statement and 21.7% (N = 49) mildly disagreed. 8% (N = 18) of respondents selected “Unsure” in relation to this health-effect.

“Loss of Biodiversity” and “Heat-related Illness” received the highest proportion of negative responses in relation to this statement. 4.3% (N =10) of respondents selected “Mildly disagree” for this this statement in relation to “Heat-related Illness” and 0.9% (N = 2) selected “Strongly disagree” totalling

5.2% (N = 12) of responses in disagreement. 17.2% (N = 40) of respondents selected “Unsure” for this health-effect.
5.9% (N = 14) of respondents indicated disagreement in relation to the health-effect “Loss of Biodiversity” in the context of this question. 1 (0.5%) student selected “Strongly disagree” and the remaining 5.9% (N = 13) selected “Mildly disagree”. 20.6% (N = 46) of students were unsure in relation this this health-effect.

The majority of respondents were still in agreement in relation to both these health-effects “Loss of Biodiversity” and “Heat-related Illness” however with 73.1% (N = 163) of respondents responding positively in relation to “Loss of biodiversity” and 77.7% (N = 181) responding positively to “Heat-related Illness” in the context of this statement.
“Cold-related Illness” elicited the largest proportion of uncertainty again in relation to this statement with 36.8% (N = 82) of students selecting “Unsure”. However, in contrast to the previous two questions, the positive responses outweighed the “Unsure” responses on this occasion; 57.6% (N = 129) patients were in agreement in relation to this health-effect in the context of this question. 5.5% (N = 12) of respondents responded negatively.

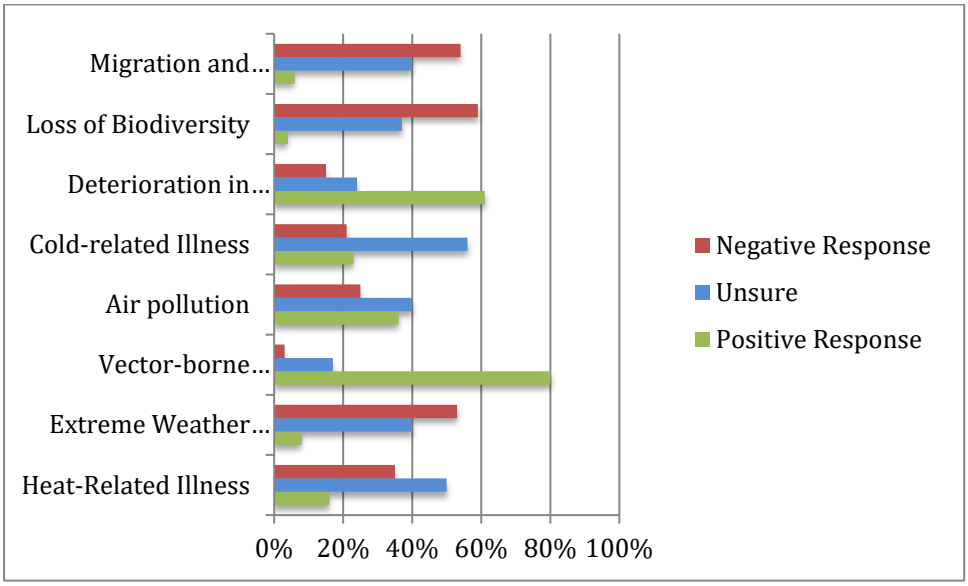


Figure 14 – Responses to the statement “Is on the medical curriculum here at RCSI” in relation to health-effects

When examining the answers in relation to the various health-effects in the context of the fourth statement (“Is on the medical curriculum here at RCSI”) in Section 4 of the quantitative survey (Figure 14); it is striking in that the proportion of students who answered positively are outweighed by the cumulative proportion of students that selected “Don’t know” and “No” across most of the health-effects.

The only two health effects to which this observation does not apply are “Deterioration in Mental Health” and “Vector-borne Infectious disease” in which the percentage of positive responses outweighs the sum of the percentage of respondents that answered negatively or in which respondents were unsure.
60.7% (N = 136) of respondents answered “Yes” when posed this question in relation to “Deterioration in Mental health” while 14.7% (N = 33) answered

"No" and 24.6% (N = 55) answered "Don't know"; Equalling 39.3% (N = 88) in total.

In relation to "Vector-borne Infectious Diseases" 79.8% (N = 182) of respondents answered "Yes" while 3.1% (N = 7) answered "No" and 17.1% (N = 39) of students answered "Don't know". The sum of the percentages for "No" and "Don't know" in this case is 20.2% (N = 46).

In three of the health effects "Don't know" represented the highest percentage out of the optional answers in relation to the statement. These three health-effects were "Cold-related Illness", "Heat-related Illness" and "Air Pollution" with 56.1% (N = 125), 49.4% (N = 115) and 39.4% (N = 89) demonstrating uncertainty in relation to the presence of these topics in curriculum at RCSI, respectively.

"Loss of Biodiversity", "Migration and Increasing Global Conflict" and "Extreme Weather Events" provoked the highest proportion of "No" responses with 58.7% (N = 131), 53.8% (N = 120) and 52.8% (N = 121) of students responding negatively to each of these health-effects, respectively.

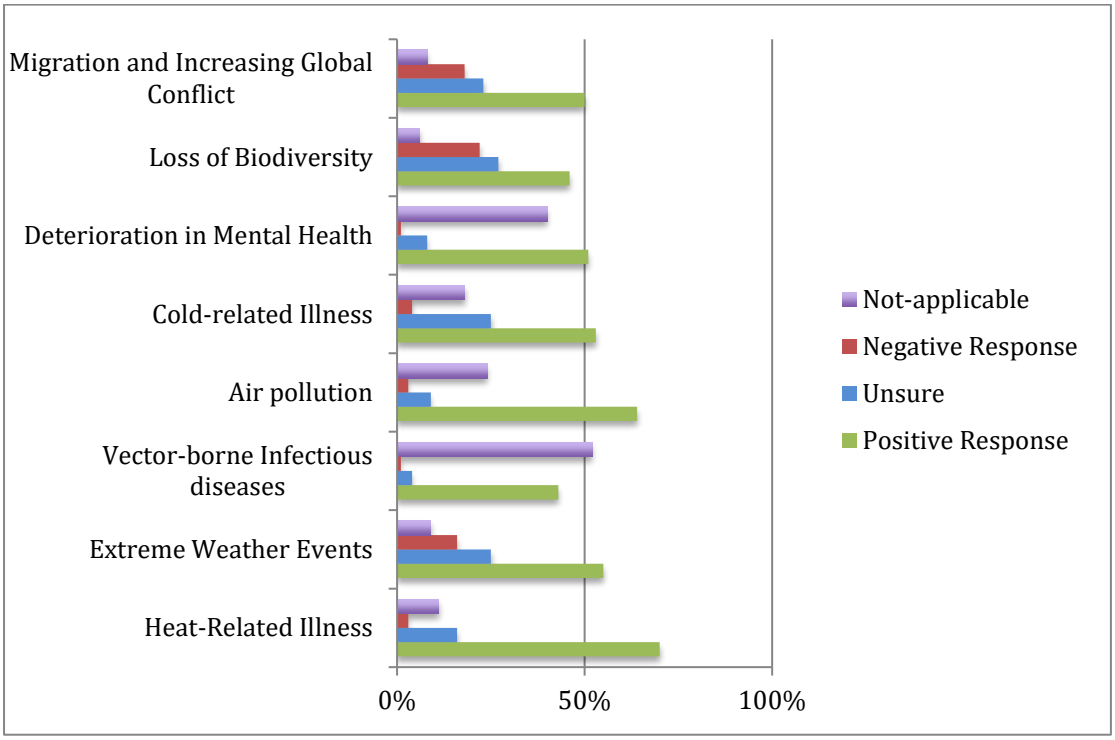


Figure 15 – Responses to the question "If not, should this be included in curriculum at RCSI?" in relation to health-effects

Following a question on whether or not the various health effects were currently a feature of curriculum at RCSI, the follow-up question posed to students; "If not, should this [health-effect] be included in curriculum at RCSI" (Figure 15). A "Not-applicable" option was given to students in this final question to allow for the possibility that they had already indicated that a given health-effect was a component of the curriculum at RCSI in the previous question.

The two health-effects that had received the largest proportion of positive responses ("Vector-borne Infectious Disease" and "Deterioration in Mental Health") in relation to the previous question were also the health-effects that received the highest proportion of "Not-applicable" responses in this question, which is consistent with the design of the questionnaire.
52.2% (N = 119) of the "Vector-borne Infectious Diseases" responses were "not-applicable" outweighing the responses for "Yes" (43.4%, N = 99), "No" (0.4%, N = 1) and "Don't know" (4%, N = 9).
40.2% (N = 90) of the "Deterioration in Mental Health" responses were "not-applicable". However, this was surpassed by the 50.5% of respondents who stated "Yes" (N = 113). 1.3% (N = 3) of respondents responded "No" and 8% (N = 18) responded "Don't know" in relation to this health-effect in the context of this question.

The proportion of negative responses did not outweigh the proportion of positive responses when comparing the responses to the different health-effects. The three health-effects that received the largest proportion of negative responses were "Loss of biodiversity", "Migration and Increasing Global Conflict" and "Extreme Weather Events".
21.6% (N = 48) of students responded "No" when asked if "Loss of Biodiversity" should be included in curriculum at RCSI. 45.5% (N = 101) answered "Yes" and 27% (N = 60) selected "Don't know". The sum of the "No" and "Don't know" answers (48.6%, N = 108) was greater than the proportion of participant's who answered "Yes".

18.5% (N = 41) of respondents felt that the topic of "Migration and Increasing Global Conflict" should not be on the curriculum at RCSI. 22.5% (N = 50) of students selected "Don't know" and 50.9% (N = 113) of respondents responded positively.

15.7% (N = 36) of students selected "No" in relation to the health-effect "Extreme Weather Events". 55.4% (N = 127) of students selected "Yes" and 19.7% of students selected "Don't know".

"Air pollution" and "Heat-related Illness" were the health effects that received the highest percentage of positive responses.

"Heat-related Illness" received 162 (69.5%) "Yes" responses while only 3.4% (N = 8) of respondents responded negatively. 15.9% (N = 37) of respondents responded "Don't know" to the question in relation to this health-effect.
63.7% (N = 144) of students felt that "Heat-related Illness" should be on the medical curriculum at RCSI. 2.7% (N = 6) responded negatively and 9.3% of students responded "Don't know".

5.5 Open-ended question – recommendations for implementation

The last question in of the quantitative survey offered respondents a free text box and gave respondents the chance to answer in their own words. Respondents were posed the question "Please indicate how you think the topics of climate change and ecological instability would best be integrated

into curriculum at RCSI". Respondents were advised that they could write "as little or as much as they like". No character limit was placed on the text box.

The primary themes that emerged on analysis of student responses are displayed below (Table 20). When analysing the themes present in the student responses, a tally was assigned each time a theme emerged in the student's answer. In some of the student responses; more than one theme was touched on. As such, the total tally of responses in support of each theme is greater than the total number of respondents who answered the question (Total tally of responses endorsing each theme = 194, Number of students that responded = 153). Furthermore, the percentages displayed here delineate the percentage out of the total number of suggestions, rather than the percentage of the total number of participants.

Table 20 - Student recommendations for integration (number of responses 153, skipped: 128)

Student recommendation	Counts	% of Total
Integration across existing teaching/Systems-based	39	20%
Lectures	31	16%
As part of public health/EBM module	26	13%
Specific planetary health module	25	13%
Pre-clinical	15	8%
Field-trip/workshop/Elective	15	8%
Clear link to health and the role of healthcare	10	5%
Not of benefit	9	5%
Small group tutorials	5	3%
Awareness-building on campus	4	2%
Don't know	4	2%
Needs to be examined, worth marks	4	2%
Curriculum too crowded	3	2%
Problem based learning	3	2%
Case-based learning	1	1%

As displayed, a wide range of suggestions for integration were voluntarily suggested by respondents. The suggestion which was endorsed by the highest number of respondents was for "Integration across existing teaching/Systems-based integration" (N = 39, 20%). "Lectures" were the second most popular means for integration amongst students (N = 31, 16%). The third suggestion most frequently suggested by respondents was "As part

of public health/Evidence-based medicine (EBM) module" (N = 26, 13%), a "Specific planetary health module" was suggested by 25 respondents (13%). 9 Participants (5%) indicated that they felt that integrating planetary health into medical curriculum would not be of benefit.

Due to time constraints, a deeper qualitative analysis of the free-text question in the quantitative survey was not possible. However, further analysis of the open-ended question is planned for future publications.

5.6 Summary of findings

The mean score in the NEP from all respondents was 3.7, indicating a generally pro-ecological worldview amongst the cohort.
Female respondents scored higher on the NEP than male students (3.82 vs 3.51).

Students who selected "Asian" as their ethnicity scored highest on the NEP (Mean = 3.77). Caucasian students scored a mean of 3.75 and "Arab" students had the lowest average mean at 3.64

In relation to question 16; Respondents had mixed perspectives on the resilience of climate systems in the face of human activity. 60% (N = 145) of respondents chose the option "Climate is stable within certain limits. If the changes are small, climate will return to equilibrium, if they are large, there will be abrupt and catastrophic impacts" as the option that best represented their views.

11% of students agreed with the statement in Q. 17: "Climate change is a completely natural phenomenon, uninfluenced by human behaviour".
78% of respondents agreed with the statement in Q. 18: "Climate change is ultimately harmful".

90% of respondents agreed with the statement "Environmental change will have negative health effects for human beings.

In relation to Q. 20; 75% of respondents felt there would be value in addressing the potential health-related impacts of climate change through medical practice.

In relation to Q. 21; 78.3% of respondents felt there would be benefit in addressing the potential health-related impacts of climate change through medical practice.

Gender and continent of birth were predictors in respondent answers to questions 20, 21 and 24. Female students and students born in Europe were more likely to respond sympathetically towards the integration of planetary health topics in medical curriculum than the other groups.

When asked about specific health-effects, the majority of respondents felt that they had already increased or would increase in the next 20 years due to climate change and environmental instability.

When asked if these health-effects are currently on the curriculum at RCSI; the proportion of students who answered positively are outweighed by the cumulative proportion of students that selected “Don’t know” and “No” across six of the eight health-effects.

In relation to whether or not missing health-effects should be included on the curriculum at RCSI, the positive responses outweighed the negative and “Unsure” responses in relation to five of the eight health effects. The three health-effects that received the largest proportion of negative responses were “Loss of biodiversity”, “Migration and Increasing Global Conflict” and “Extreme Weather Events”.

The free-text answers to the prompt question “Please indicate how you think the topics of climate change and ecological instability would best be integrated into curriculum at RCSI” offered a varied array of suggestions with “Integration across existing teaching/Systems-based integration” being the most frequently occurring themes suggested and “Lectures” being the second most frequently occurring theme. Examples of other suggestions included a specific planetary health module, a field-trip/workshop/elective and small-group and integration into the existing public health or evidence-based medicine modules.

Chapter 6

Discussion

6.1 Discussion of qualitative findings

6.1.1 Educator knowledge

The analysis of the interviews revealed that clinical educators are generally aware of a broad-range of health effects related to climate change and environmental instability. Educators independently volunteered many of the health-effects outlined in the report commissioned by the Rockefeller foundation – published by the Lancet commission on planetary health: *"Safeguarding human health in the Anthropocene epoch"* (27), demonstrating a generally nuanced and well-developed knowledge of the health effects related to climate change and environmental stability, overall. The health effects mentioned spanned direct health effects such as an increased risk of cancer and disease secondary to exposure to pollutants and indirect or ecosystem-mediated health effects such as increased risk of infectious disease, water/food security risk and mental health.

Of the direct health effects mentioned by participants, adverse health outcomes related to environmental pollution and in particular, air pollution, were volunteered by a high proportion of educators. The place of prominence that respiratory illness holds in the minds of participants when questioned about this topic could be due to a number of factors. One consideration is that the physiological mechanism by which respiratory pathology can be triggered or exacerbated by air pollution is something that is easily conceptualized. In terms of pathophysiology, the interface between your lungs and the air you breathe is something that is easily understood and would constitute a basic anatomical and pathological understanding imparted to all medical students at university. For example, the role of regular cigarette use in the development of lung disease is common knowledge among the general public and rudimental knowledge for undergraduate medical students. Conceptually the similarity between cigarette smoke as a pollutant and toxic environmental particulate matter in the air is something that is easy to grasp.

The relationship between air pollution and the development of disease is well recognized in the scientific literature and is often highlighted in both commercial and scientific publications (111-113). This broad evidence base likely contributes to the position of prominence that that this particular health effect had during the semi-structured interviews.

Further to this, participants are more likely to have had a subjective experience of the negative effect of air pollution. Visually, it is possible to identify when air pollution is present, for example in the form of smog or fumes, particularly in densely populated urban areas. Whether it is as a result of experiencing a chronic cough as a smoker or a fit of coughing following the inhalation of noxious exhaust fumes when cycling through a city, experiences like this are commonplace and have been felt or observed by most city-dwellers (114).

The issue of air pollution is particularly relevant when viewed through the lens of our social and cultural context. Given that the vast majority of the western population live in cosmopolitan/urban areas (115) – areas that suffer from the

largest degree of particulate matter pollution – media outlets are more likely to highlight this as a topic of public concern (116), thereby generally increasing anxiety around these topics. In this sense, a discussion on air pollution yields a clear and accessible example of how the initial escalation of human pressure on the immediate environment can result in human disease.

Naturally, the co-morbidities associated with increased exposure to environmental pollution would constitute a psychological burden. However, studies have shown that the direct effects of air pollution can trigger a decline in mental health (117, 118). In a more indirect way, interfacing with an environment that is visually and sensorily detached from our natural world, causes anxiety and discomfort (119). Due to the fact that the reality of adverse health effects associated with pollutants tends to be widely accepted, this leads to a hyperawareness and subsequent unease when forced to exist in an environment in which you are frequently exposed to them.

Participants also touched on a number of other health effects, indicating an awareness of direct health effects, indirect health effects and the environmental changes that trigger these outcomes. In particular, participants alluded to issues such as reduced food yields, increased infectious disease risk and adverse effects on mental-health. Participants also articulated an awareness of the various ecosystem impairments that influence these issues and how they can exacerbate and contribute to each other i.e. climate change and global warming causing wetlands degradation and damage and resulting in diverse health consequences and livelihood loss. Interestingly, in quantitative studies that have been undertaken with undergraduate medical/nursing students; students are more likely to demonstrate an awareness of direct health–effects related to climate change and environmental instability versus more complex or multifactorial indirect health effects (77, 78). Although environmental pollution was often the first example of a health effect that sprang to mind for participants in the semi-structured interviews, overall this finding in the literature was not reflected in this study's analysis of interviews with undergraduate medical educators; with most participants offering examples of diverse and wide-ranging health-effects.

Another of the most prominent themes that emerged from the interviews was that resource-poor countries would be worst affected by planetary health issues. The widespread acknowledgement of the social determinants that exacerbate planetary health issues indicates a sensitivity towards the global health ramifications and population factors that impact on these problems amongst the undergraduate medical educator cohort.

However, although the opinion that the impact of climate change and ecosystem instability would be most keenly felt in resource-poor nations was reasonable and rationalized, a number of participants asserted that here in Ireland the negative effects would not be as apparent; perhaps this is representative of a denial or reluctance in acknowledging the existing impact of climate change and environmental instability locally and a perception that planetary health problems are less likely to be an issue for western countries.

This is a cognitive trend that has previously been identified in the literature (120).

A couple of educators did express some scepticism around the assertion that climate change and environmental instability were directly linked to human activity. However it is important to highlight that although these educators were sceptical of the influence that human beings have had on climate change and environmental instability, they did not refute its existence as a phenomenon, nor the health-effects linked to it. Of note there is some recent evidence to suggest that if information regarding climate change is presented accurately to students – the personal beliefs of the educator will do little to influence student attitudes (121) - although it must be noted that the study described was performed with second-level (secondary school/high school) rather than undergraduate university students.

In terms of the effect of participant demographic characteristics on level of knowledge regarding planetary health issues, there was generally a broad level of knowledge demonstrated by educators between genders, level of seniority and department. Although, both educators that indicated scepticism in relation to the validity of climate change as a man-made phenomenon were educators within the surgical department. One was male and one was female. One was a departmental lead and one was a junior educator. Both were involved in clinical teaching. As such, their situation within clinical teaching and the surgical department were the only characteristics that they had in common.

6.1.2 Recommendations for Implementation

When discussing the relevance of planetary health topics in medical education - the necessity of nurturing a sense of social responsibility and fostering an awareness of complex global issues amongst medical graduates was one of the most prominent arguments made. Furthermore, educators highlighted that through the training necessary to deal with planetary health issues, students would develop and refine broader competencies such as adaptability and increased health-systems awareness. Reference has been made to the importance of this multiple times in the literature (31, 44, 122, 123). It is evident that a medical student with a firm grasp on social and global issues will aid in producing a more conscientious, responsible and capable graduate.

Endorsement for an increased focus on preventative medicine and the leveraging of planetary health content to emphasise this field was a point articulated during the semi-structured interviews. This echoes the sentiment expressed by Logan et al. 2019 in their paper "Golden Age of Medicine 2.0: Lifestyle Medicine and Planetary Health Prioritized." (30) in which the call is made for a paradigm shift within medical education to acknowledge the nuanced ways in which human actions are influenced by the social, cultural, political and natural environment. This, in turn, can result in profound effects on human health.

A further key discussion point stemming from the analysis of the semi-structured interviews is the importance that participants placed on modelling sustainable practice within the clinical setting. This was an area in which clinical educators could testify to a poor emphasis on environmental awareness both at an individual level (in relation to practicing clinicians) and at a systemic level. There are examples in the literature that highlight the importance of clinical placement in consolidating student learning and cultivating future practices (124), (125). Role-modelling of good sustainable practice by clinical educators within the clinical setting is crucial, as the influence of the actions of educators within these settings is significant in relation to the effective development of student competencies (126).

The old adage of “see one, do one, teach one” often rings true in the context of medical education, particularly in the later years when students find themselves immersed in clinical practice. When on their clinical placements, if students were to witness health practitioners demonstrating a sensitivity to planetary health topics through their clinical practice it would impart a greater weight to the inclusion of these topics in curriculum and promote student engagement with this content. In addition to role-modelling within clinical practice, educators also raised the point that planetary health content should be delivered with a clear emphasis on clinical relevance.

On analysis of the interviews, educators frequently emphasised the importance of allowing the students to pro-actively engage with this material and to facilitate student involvement in their own teaching as much as possible. Further to this, the necessity of making this content clinically relevant to students was a theme discussed by many clinical educators. This consolidates findings made by Tun et Al. 2019 (41) in their interviews with sustainable healthcare educators across the United Kingdom; overt clinical relevance is essential in ensuring subject retention amongst medical students (127).

Clinical educators endorsed a broad range of possible teaching modalities as potentially suitable for the delivery of this content; including case-based teaching, didactic teaching and clinical presentations. The use of student-led conferences/debates and presentations was noted amongst educators as a potential modality that could pro-actively engage students in the teaching.

A number of educators also commented on the capacity for these topics to be embedded across all/a range of teaching modalities. This would enable the concepts and skills relevant to planetary health to pervade all theoretical frameworks and clinical competencies that students are taught. Mirroring findings in the literature (43, 44) educators also suggested the possibility of external experts from different backgrounds contributing to the delivery of this content to undergraduate medical students. This would encourage an informed, resourceful and transdisciplinary approach to teaching delivery.

This notion of embedding teaching across all teaching modalities addresses the “where?” question regarding this teaching, however - it is also linked closely with a major theme that emerged when discussing the “when?”

question of placing this teaching. The idea that these topics be spiralled through curriculum rather than designated to a specific component of a course or module was suggested during the course of the interviews. This idea of vertical integration for planetary health topics is one that has been mentioned and endorsed at multiple points throughout the literature (57), (44), (58), (50), (41).

On review of the literature; the possibility of harnessing e-technologies in the delivery of planetary health content was presented by a number of papers (46, 66, 67). However, during the course of the semi-structured interviews this suggestion was noticeable in its absence.

6.1.3 Barriers and facilitators

6.1.3.1 Barriers

One of the key barriers that emerged during the integration of planetary health topics in undergraduate medical curriculum on analysis of the semi-structured interviews is a perceived lack of relevance amongst both students and faculty.

On the contrary, on examination of the existing literature, in similar studies which have explored educator attitudes on this topic; participants have generally expressed very little scepticism around the necessity of including these topics in formal education (34-38, 44). Similarly, there is evidence in the literature of health professionals calling for this content to be incorporated into curriculum (40, 128).

In addition, it is worth noting that, within the literature, the majority of studies that examine student perceptions indicate an openness amongst undergraduate medical students towards the integration of these topic in curriculum (51, 76-79, 82).

Furthermore, although a perceived lack of relevance amongst educators was cited as a conceivable barrier by a small number of participants, this perspective was not evident amongst the cohort of educators interviewed from this study, with all but a couple of educators acknowledging the necessity of these topics within medical curriculum.

On review of the literature, although a perceived lack of relevance amongst medical educators was articulated by a couple of papers (52), (53), a similar predicted barrier that was more evident within the literature was the possibility of poor educator knowledge as potentially inhibiting the inclusion of these topics in curriculum (29, 41).

A lack of knowledge amongst educators around these topics was also independently highlighted by participants during the semi-structured interviews. However, as discussed previously, from the qualitative analysis performed in this study, educators displayed a broad range and depth of knowledge around planetary health issues, overall. As a follow up to their 2019 study (43), Tun et al. ‘s 2020 study “Faculty development and partnership with students to integrate sustainable healthcare into health professions education” emphasises of the importance of faculty development and training in assuaging this potential barrier.

Another barrier apparent from analysis of the interviews was the concern that medical curriculum is already overcrowded and that it would prove difficult to find space for additional content. This potential barrier has been recognized previously in the literature (35, 41).

In order to successfully make the case for the inclusion of new content in the curriculum in the form of planetary health topics, it would have to be done in a way that indicated it would not be done at the cost of existing essential content. The inclusion of planetary health content should be billed as complementary, with a view to enhancing current curriculum in a way that is progressive and structured, rather than through the annexation of already previously established content (45, 59, 60).

A further effective way to combat the obstacle of an overcrowded curriculum would be to employ a diverse range of pedagogies in delivery of this content (50) – a notion supported by participants in this study, as highlighted previously.

6.1.3.2 Facilitators

Educators indicated that demand from both students and faculty within the university would be a powerful catalyst for change.

Fostering a culture within an institution that allows students to have an involved role in curriculum development enhances their buy-in to the material learned and engages them further as active participants in their teaching (129).

Demand from students and student feedback would be a significant driver in any reform of practice or departure from the normal within medical curriculum. Certainly, within the literature there is already evidence of student voices calling for the inclusion of planetary health topics in curriculum (46, 84-86). If the university responds to a groundswell of interest from undergraduate medical students in a topic with attempts to include it, it is a clear display of respect and consideration for the students' voice and demonstrates a healthy interface between the student body and the university faculty.

Faculty voices and input can also play a core role in the development of a dynamic and progressive curriculum that adapts to evolving learning needs, a notion supported by the literature (130),(131), (132). As such, significant demand from faculty to integrate planetary health topics into medical curriculum could also serve as a potent facilitator.

A compelling facilitator that emerged during analysis of the semi-structured interviews is the concept of a "green champion" or the enabling of a driven advocate within the educational institution who would be well placed to advocate for the inclusion of planetary health topics. The presence of a "champion" within an institution has been proven to be a positive force when instigating change (133) and the concept of "eco-ethical leadership" in particular is a notion whose virtues have been discussed by McKimm et al. 2020 (134). Although, similar to comments made by participants in this study, they stressed the importance of these green champions being "politically savvy" and to have what Hanson and Middleton (2000) term "green

Machievelism" (135), as opposed to taking on the role of disruptive firebrand within a department.

Certainly, as educators pointed out during the course of the semi-structured interviews, the efficacy of facilitators such as "demand from faculty/students" or the presence of a "green champion" can be compounded through by leveraging within a context that is likely to convey maximum benefit. Given that RCSI was undergoing a curriculum revision at the time of the interviews, educators identified situations of dynamic curriculum revision such as this as opportunities which could be capitalised on to advocate for the inclusion of new topics in curriculum. Particularly if the case for inclusion is presented in light of the evidence base for these topics and with evidence of other high-ranking institutions taking steps for inclusion.

Planetary health issues are gaining significant momentum both in the wider public perception and within the field of academic research (136), (137), (138). In terms of public branding there is an expectation that large institutions make an effort to display sustainable policies and a conscientiousness towards global environmental issues. Universities want to be seen to be responding and adapting to the growing body of evidence that recognizes issues of climate change and environmental instability as legitimate and serious public health concerns. Particularly, if other international institutions were to adopt a policy of addressing these issues in their curriculum and university ethos, it would not be beneficial to the prestige and branding of a university to be left behind or seen as regressive on this matter.

Senior management support appeared in the semi-structured interviews as both a potential barrier and a facilitator. Greater policy-maker and senior faculty support would incentivize and improve buy-in towards these topics amongst the faculty overall. However, without senior management support the opposite would be true. If there is a clear example set by senior members of faculty that the curriculum is open to adaptation and the inclusion of planetary health topics, it nurtures a culture of progression and growth within the university. The importance of senior management support delivered in the right manner is reinforced by the literature (30, 41, 48, 53).

A further significant facilitator mentioned during the interviews is the growing awareness around public and global health issues in light of the COVID-19 pandemic. There is a wealth of research pointing to the fact that fundamental planetary health issues such as biodiversity loss, ecosystem instability and increasing urbanisation are crucial factors that influenced both the emergence and propagation of the COVID-19 pandemic (139), (140), (141), (142). Educators pointed out that these reported links between the COVID-19 pandemic and the field of planetary health could serve as an opportunity and catalyst to broaden the discussion around planetary health and deepen undergraduate medical student awareness in relation to its impacts on human health.

6.2 Discussion of quantitative findings

6.2.1 Environmental attitudes

The first objective of the quantitative survey was to measure the ecological attitudes of undergraduate medical students at RCSI. This was done using the theory-based instrument; the “New Ecological Paradigm” Scale (143). Analysis of the results overall revealed an above average endorsement of the NEP among students (3.7) indicating that attitudes amongst the sample cohort align more closely with a pro-ecological worldview.

When the mean NEP is compared with similar studies in the literature; the ecological perspective of the sample student cohort from RCSI is situated somewhere in the middle. This reflects a more positive attitude than that reported by Cruz et al. 2018 (79) in their study involving undergraduate nursing students in Saudi Arabia, but with a lower relative environmental attitude score than found by Sayan & Kaya 2016 (81) in their study examining environmental attitudes amongst nursing students in Turkey.

With a view to establishing a broader context in which to situate the results of this study, the mean NEP for this student cohort is compared with findings amongst the wider literature that utilises the NEP to evaluate environmental attitudes outside of the medical/nursing student cohort. When compared with similar studies performed internationally such as in Nigeria (2.95 – Ogunbode et al. 2013) (144) ,the United Kingdom (3.31 – Pahl et al. 2005) (145), the United States (3.57 – Kortenkamp and Moore 2006) (146), Australia (3.96 – Blaikie 1992) (147), Turkey (3.5 – Erdoan 2009) (148) and Brazil (3.55 – Schultz et al. 2005) (149), the mean NEP score from all participants in this study is relatively high (3.7).

When examining NEP scores relative to demographic characteristics amongst the sample, differences are noted in the scores relative to the gender of those sampled, their area of interest within medicine (medical speciality of interest vs. surgical) and student ethnicity. Female students scored more highly on the NEP scale than their male counterparts (3.82 vs. 3.51). This echoes similar findings in the study carried out by Sayan & Kaya 2013 (81) amongst others (78), (51) which also indicate that female students generally score higher in environmental awareness scales than male students. Students who indicated a surgical speciality of interest scored marginally higher than students who indicated a medical speciality of interest (3.76 vs. 3.73). Students of Arab ethnicity had the lowest scores (3.64), while students of Asian and Caucasian ethnicity both had above average scores relative to the total group average (“Asian” = 3.77, “Caucasian” = 3.75). There are no other existing studies that compare NEP scores amongst undergraduate medical students based on speciality of interest. Demographic predictors and existing literature that examines the significance of nationality on environmental attitudes are discussed in section 6.2.3 below.

6.2.2 Planetary health in curriculum

Undergraduate medical students at RCSI in the majority indicated their belief that there is “value” and “benefit” to integrating planetary health topics into medical curriculum (75% agreeing that there was “value” and 78.3% of students agreeing that there would be “benefit”). The majority of undergraduate medical students surveyed also indicated that these topics should be included in medical curriculum (76%), although there is a discrepancy present in that a higher percentage of respondents agreed with the statement that medical students should have a good knowledge of the health-effects of climate change (86%). This demonstrated that although a large number of students feel that medical students should have a good knowledge of planetary health topics, a proportion of these students do not believe that this knowledge should be conveyed through formal medical curriculum.

There is a further disconnect between the desired level of knowledge amongst medical students in relation to planetary health topics and the level of knowledge they currently hold. Only 49% of respondents felt that they currently held a good level of knowledge and strikingly, only 14% of students felt that they were currently getting enough teaching on these topics. This would demonstrate that although the majority of medical students have an awareness of planetary health issues and see its relevance to medical education, at present their perceived subjective level of knowledge does not match this awareness.

This assertion is further supported when examining the respondents’ answers in relation to specific planetary health effects and their role in medical education.

In relation to the majority of health-effects, respondents had positive responses to the following questions:

1. “Has already increased due to climate change & ecological instability.”;
2. “Will increase in the next 20 years due to climate change”;
3. “Poses a significant health-risk to human beings, globally.”

This indicates a belief amongst the undergraduate student cohort that planetary health issues constitute a significant risk to human health.

However, when specifically asked if these health effects were currently part of the medical curriculum at RCSI, the responses were much more mixed, with positive responses outweighing the negative and neutral responses in only two of the eight health-effects mentioned (“Deterioration in Mental Health” and “Vector-borne Infectious Diseases”).

When asked “..should this be included in the curriculum at RCSI?” in relation to each of the health effects, the trend was once again overwhelmingly positive (although responses were more mixed with respect three of the health effects versus the others).

The pattern of support amongst undergraduate medical students at RCSI for the inclusion of planetary health topics in medical curriculum differs from a

similar study performed by Pandve et al. 2011 (76) in India, in which only 47% of 250 undergraduate medical students surveyed felt that climate change topics should be a priority in medical education. This is perhaps due to the age of the study, as perceptions towards climate issues may have significantly changed in the last decade. Geographical and cultural differences could also account for this – as evidenced by the findings of this study, continent of birth can play a significant role in determining the perspectives of medical students towards planetary health topics.

This disconnect between a high level of awareness in relation to planetary health issues and a low level of knowledge, however, echoed similar findings in the literature. Yang et al. 2018 (77), Liao et al. 2019 (51)and Nigatu et al. 2014 (78) all reported the finding that although medical students acknowledged climate change and environmental instability as significant threats to human health and the planet, they expressed a subjective lack of knowledge around these subjects.

Findings from this study relating to student knowledge of health reflects related to climate change and environmental instability reflected another trend noted in the literature; in that the health effects with a more complex or indirect relationship to climate change and environmental instability were less likely to be endorsed by students as necessary items for inclusion in medical curriculum (77), (51). When posed the question "..should this [health effect] be included in curriculum at RCSI?", the two health effects with the highest number of negative responses were "Migration and Increasing Global Conflict" and "Loss of Biodiversity", which both represent health effects with more nuanced and long-term consequences versus health effects with more overt and short-term outcomes e.g. "Air Pollution", "Heat-related Illness".

Interestingly, the health-effect "Cold-related Illness" often prompted the largest degree of uncertainty or neutral responses when faced with these questions. Perhaps this is due to some cognitive dissonance in rationalising the capability of the familiar linked concepts "climate change" and "global warming" to counter-intuitively cause negative health outcomes secondary to the cold.

It is also worth noting that - although some health effects ("Migration and increasing global conflict", "Loss of Biodiversity") prompted a more mixed response when students were questioned as to the appropriateness of their inclusion in the medical curriculum - when students were asked if each individual health-effect would "..increase in the next 20 years due to climate change", "has already increased due to climate change & ecological instability" or "poses a significant health-risk to human beings, globally," they overwhelmingly agreed with these statements. This would indicate that although the vast majority of medical students do not refute the validity or existence of planetary health issues, they are more uncertain as to whether these issues belong in an undergraduate medical curriculum.

6.2.3 Demographic predictors

On regression analysis a number of predictive factors were identified in relation to demographic characteristics amongst the student cohort and the likelihood of endorsing the inclusion of planetary health topics into undergraduate medical curriculum.

Question 20 and 21 asked respondents to indicate to what extent they felt that addressing the potential health-related impacts of climate change through medical practice is worthless/valuable or harmful/beneficial, respectively. Question 24 asked the students if it is "..important to make environmental change and its health-effects a part of medical curriculum?"

On analysis, only "Gender" and "Continent of Birth" showed any significance in determining how likely/unlikely it is that a student will respond to a question in a certain way. "Ethnicity" and "Speciality of Interest" had no significant bearing on the likelihood of a participant answering more favourably or unfavourably to a given question, on analysis.

In terms of gender differences, female students were more likely than their male counterparts to answer positively to each of the questions in relation to the inclusion of planetary health topics in the medical curriculum. This is perhaps unsurprising given the findings of the NEP scale in which female students scored higher on average than male students. A higher level of awareness around planetary health issues and concern in relation to its impacts is more likely to inspire an endorsement of a greater emphasis on education on these topics within curriculum (79). This gender gap in terms of the increased awareness that women have in relation to planetary health topics relative to men has been identified and discussed on numerous occasions within the literature (150), (151), (152), (153).

Furthermore, when comparing differences between continent of birth; students from Asia or North America were less likely than students born in Europe to respond favourably to any of the three questions. This is contrary to the findings of a study performed by Chen et al. 2020 (82) who found that Asian (Chinese) nursing students rated sustainability issues higher in importance than European (English) students. Other studies (83), (79) have identified differences in attitudes towards planetary health issues based on nationality, indicating that it is a significant predictive factor in understanding student attitudes towards planetary health in curriculum that warrants further research.

6.3 Integration

6.3.1 Demand from students and educators

A significant convergence was noted between the perspectives expressed by both the educator and undergraduate medical student cohorts in relation to the perceived relevance of planetary health topics to medical

education and the demand for inclusion of these topics. Overwhelmingly, both the majority of students asked and the majority of educators expressed an acceptance of the necessity of the inclusion of these topics in curriculum. A number of educators expressed that to the best of their knowledge, topics of sustainability and health were not currently in curriculum, however many felt that they should be. This was, in large part, concordant with opinions expressed by students in the survey: 77% of students agreed with the statement “It is important to make environmental change and its health-effects a part of medical curriculum”. Only 14% of students agreed with the statement “Students at RCSI currently get enough teaching about the health effects of climate change”.

Perhaps, this finding from analysis of the qualitative and quantitative components of the study belies the potential for the suggested barrier of a “perceived lack of relevance” amongst faculty and students to inhibit the inclusion of these topics in curriculum.

The qualitative and quantitative findings also converged in that, amongst both cohorts, a minority - but nonetheless significant proportion of participants expressed scepticism towards the relevance of the inclusion of planetary health topics in curriculum. Although it is worth noting, amongst both students and educators very few participants disputed the validity of planetary health phenomena and health-effects, but rather participant scepticism was directed more at the inclusion of these topics in medical curriculum.

Although the majority of the student sample questioned demonstrated a pro-ecological worldview and a positive attitude towards the inclusion of these topics into the medical curriculum, a significant subset indicated a sceptical perspective (9% of participants did not agree with the statement “It is important to make environmental change and its health-effects a part of medical curriculum” and 11% of students disagreed with the statement “Climate change is a completely natural phenomenon, uninfluenced by human behaviour.”) Of note, during the semi-structured interviews – scepticism emerged amongst clinical educators on similar themes: one educator expressed the opinion that climate change represented a natural phenomenon, subject to “..natural forces – beyond our current comprehension”. In terms of the relevance of these topics to medical education, one educator stated that they felt that these topics were the remit of the political realm and not the remit of medical education. The parallels between these perspectives expressed by students and educators indicate that these points of scepticism might represent more widely held beliefs amongst the larger student and educator cohorts.

6.3.2 Knowledge of health effects

On investigation of participant awareness of the health effects related to climate change and environmental instability - within the educator sample – a broad range of health effects were volunteered and a depth of knowledge was evident amongst educators around these topics on further discussion. In contrast, when questioned, over half of the student sample indicated that they

felt they did not have a good level of knowledge of these topics (48% of students indicated agreement with the statement “I have a good level of knowledge about the potential health-related impacts of climate change”).

There is an important distinction here in that assessment of educators’ knowledge of health effects was objective during the course of the semi-structured interviews in that participant knowledge was assessed by the interviewer. Conversely, students were asked to subjectively offer their impression of their knowledge base around planetary health health-effects. Another point of divergence between the findings of the qualitative components and the quantitative components is that educators volunteered an awareness of a broad range of health effects and gave insight into the complex ways they interact with each other. Conversely, when questioned on specific health-effects during the survey, students expressed more uncertainty in relation to health-effects that do not as intuitively align with concepts of climate change and environmental instability such as “Migration and Increasing Global Conflict”, “Loss of Biodiversity” and “Cold-related illness”.

6.3.3 Recommendations for implementation

Within the quantitative survey, when responding to the free-text question “Please indicate how you think the topics of climate change and ecological instability would best be integrated into curriculum at RCSI”, there are some interesting points of convergence between the suggestions made by students and recommendations put forward by educators during the qualitative interviews.

A recommendation endorsed to a high degree by both students and educators is the notion of integrated planetary health content delivery either through a spiral curriculum (with topics introduced in the early years re-visited and subsequently built-upon in the years that follow) and/or dissemination of the content with a wide array of already existing teaching.

Of note, a significant number of students endorsed the idea of a specific planetary health module, a topic that did not emerge with any prominence during the qualitative interviews.

Both medical students and educators endorsed lectures, problem-based learning, case-based teaching and small-group tutorials as methodologies for content delivery although there was a divergence in the amount of support for these methodologies between the two cohorts; lectures were suggested by a large number of students as an appropriate teaching methodology while only a couple of educators interviewed suggested this was as an option. Conversely, a larger number of educators suggested the alternate teaching methodologies mentioned, while only a handful of students volunteered these methodologies as suggestions. For instance, only one student suggested case-based learning as a potential teaching modality.

In the free-text answers of the quantitative survey, in which students were asked to make suggestions for the implementation of planetary health content in curriculum; ten students emphasised the importance of ensuring that any planetary health teaching should demonstrate clear clinical relevance. This indicated that both educators and students were of the consensus that planetary health topics should be taught in the context of a

clear link to human health. Furthermore, the idea of an external workshop or elective was a suggestion put forward by both students and educators.

6.3.4 Barriers and facilitators

Analysis of the quantitative results in light of these findings offers some interesting insight.

An opposing barrier and facilitator articulated during the qualitative interviews is a “perceived lack of relevance amongst students” versus “demand from students”. When these are observed in the context of the quantitative survey responses, there is reason to be optimistic that the prevailing attitude amongst the undergraduate medical student cohort is one of demand for the inclusion of these topics into curriculum. However, sceptical perspectives are certainly present within the undergraduate medical student cohort which demonstrates the importance of an awareness of the potential barrier of a “perceived lack of relevance” when advocating for the inclusion of these topics.

In the free-text answers of the quantitative survey, in which students were asked to make suggestions for the implementation of planetary health content in the curriculum; three students gave answers which suggested they felt the curriculum was “too crowded” for the successful inclusion of these topics, supporting the significance of the same “overcrowded curriculum” barrier that emerged during the qualitative interviews.

6.3.5 Integration of results: integration with the literature

Integration of the qualitative and quantitative arms of this study aligns well with existing findings within the literature and yields some pertinent new insights.

Findings from this study build upon previous mixed –methods studies in this area (48), (50), (68); supporting findings that there is an existing awareness amongst undergraduate medical educators and students in relation to topics of planetary health and a support amongst this cohort towards their inclusion in curriculum. This paper also builds on recommendations for implementation but forward by this literature, amongst others.

Observing the integrated findings of this study supports the assertion made by the literature review that there is a deficit in research that concurrently explores undergraduate medical educator and student attitudes and knowledge regarding the broader field of planetary health in conjunction with assessing perspectives in relation to curriculum integration.

6.4 Limitations

This mixed methods assessment of the barriers and facilitators related to the integration of planetary health into medical curriculum is the only study of its kind, to the best of the principal researcher’s knowledge. However, there were

some limitations to the study which puts constraints on the research and might limit the applicability of its findings.

The emergence of the COVID- 19 pandemic served as a significant limiting factor in the conduct of this study. Ethical approval for this study was granted by the RCSI Research Ethics Committee in February 2020. The principal researcher had been taking a break from clinical practice to work as a clinical educator and conduct research at RCSI at this time.

In the next month, the COVID-19 pandemic was beginning to disseminate around the world and within a couple of months had prompted profound and unpredicted changes in medical education and clinical practice.

Initially the research protocol had aimed to perform the quantitative survey first and then drawing upon the results of this to inform the semi-structured interview schedule for the qualitative interviews with undergraduate medical educators. However, the COVID -19 pandemic affected both the timing and research of this study for a number of reasons:

1. Exams for medical students were started much earlier than predicted, limiting access to student time. As such, the decision was made to disseminate the survey after most student exams had finished in June.
2. Medical educators were also extremely busy preparing for and facilitating the early implementation of student exams and as such the interviews were postponed until the earliest opportunity, also in June.
3. Many medical educators, including the principal researcher, returned to clinical work in order to bolster hospital-staffing numbers during the initial surge of the pandemic. In the case of medical educators, this further limited access to qualitative interview participants due to time-constraints. In the case of the principal researcher, the return to clinical work four months earlier than anticipated necessitated a re-design of the initial MSc time-frame and placed the conducting of the research under unanticipated time pressure.

A further limitation relates to the terminology of planetary health. Given that planetary health is a relatively new field, during the course of this study, the decision was made to frame questions amongst participants in the context of more familiar terms with a self-explanatory meaning e.g. “climate change”, “climate change and environmental instability”. Although these terms were used as synonyms for planetary health during this study, their meaning is not exactly the same. As such, there is a danger for misinterpretation amongst participants, particularly during the quantitative survey, as terms could not be clarified in-person, as they could be in the qualitative interviews.

In terms of the qualitative analysis, there is some homogeneity in relation to the cohort in that ten of the twelve educators interviewed are clinical educators and the remaining two are involved in the area of the health sciences.

In terms of the undergraduate medical student cohort in this study; this study was carried out at one institution with a high proportion of International students. Similar studies are required in different settings with different student populations.

Despite these limitations, the principal researcher believes this to be a unique study, which has provided useful data and results that can be built upon in future research.

Chapter 7

Conclusion

7.1 Meeting research objectives

1. *Appraise the existing literature regarding the integration of planetary health issues into medical curricula;*

There is a wealth of existing literature in the form of commentary pieces/ articles calling for the inclusion of planetary health topics in medical curriculum and extolling the potential benefits of its integration. In addition to this, there are numerous examples of case-reports that evaluate scenarios in which these topics have been implemented in curriculum and make suggestions or endorsements for future implementation.
There are a few examples of quantitative, qualitative and mixed-methods studies in the literature investigating the relationship between planetary health and undergraduate medical curriculum. There are three studies which detail a review performed of the literature relating to planetary health topics and undergraduate medical curriculum.

The vast majority of quantitative/qualitative studies pertain to an assessment of undergraduate medical/ nursing student perspectives in relation to the inclusion of these topics in medical curriculum.

There are a small number of quantitative/qualitative/mixed-methods studies that involve medical educators within their cohort when conducting their research.

Overall, much of the research makes recommendations for implementation or proposes learning objectives/learning outcomes in regards to these topics.

A couple of examples of studies exist that specifically seek to determine the barriers and facilitators towards the integration of planetary health topics into undergraduate medical curriculum.

However, there is no example in the literature that employs mixed-methods to do this: exploring the knowledge, attitudes and perspectives of both medical educators and undergraduate medical students in tandem.

2. *To identify and explain the current level of knowledge that undergraduate medical students and medical educators have towards planetary health issues;*

Medical educators objectively demonstrated a good breadth and depth of knowledge in relation to planetary health topics and health-effects throughout the qualitative interviews. In particular, educators placed emphasis on the importance of acknowledging the global context of planetary health issues; discussing these topics through a social, geographical and infrastructural lens. In contrast, on analysis of the quantitative survey, undergraduate medical students demonstrated a subjective deficit in regards to planetary health

issues and health-effects, this was indicated in the context of a higher level of awareness and acknowledgement for the potential for planetary health issues to cause harm to human health.

3. *To assess whether and how planetary health topics should be integrated into the curriculum from an undergraduate medical students and medical educator perspective;*

Medical educators on the whole endorsed the notion of the inclusion of planetary health topics into medical curriculum; expressing the opinion that, at present, there is a deficit in regards to this content in undergraduate medical curriculum.
However, scepticism was expressed by a minority yet significant proportion of both medical educators and undergraduate medical students towards the necessity of the integration of these topics into curriculum.

This scepticism primarily took the form of a perceived lack of relevance in relation to these topics, rather than a lack of acknowledgement towards the existence of planetary health issues and their potential impact on human health.
In regards to the undergraduate medical student cohort, there was a significant relationship between the demographic characteristics “Gender” and “Continent of Birth” in predicting environmental attitudes and the likelihood of support for the inclusion of planetary health topics in undergraduate medical curriculum.

4. *Make recommendations for implementing planetary health as part of an undergraduate medical curriculum, in the future*.

This objective will be addressed in the “Recommendations for future research” and the “Recommendations for the integration of planetary health into undergraduate medical curriculum” sections, below.

7.2 Recommendations for future research

There is undoubtedly scope for a large amount of future research in this area: In light of the barriers and facilitators formulated in this study, additional research is necessary in order to set priorities for future undergraduate medical curriculum modifications in order to optimise implementation through the maximisation of the stated enablers and inhibition of the predicted barriers. Further to this study, and in the context of similar studies in the literature, future research could focus on the formulation, delivery and piloting of planetary health curriculum content. Examples of this could take the form of

the development of learning materials, learning outcomes or an investigation into the efficacy of various pedagogies.

Building on the research done in this study, further mixed-methods studies could follow a similar template, incorporating a wider spectrum of perspectives and insight through a broadening of the student cohorts used; future studies could widen the scope of the study to include postgraduate medical students or the larger health care sciences group.

Identifying skills and competencies that endure post-graduation amongst newly qualified junior doctors would represent an important area to consider. Ultimately, health research should strive to influence policy and enact change in a way that modifies clinical and healthcare practices to improve health outcomes for the wider population. Delineating which skills and competencies are maintained from medical education into clinical practice and evaluating their efficacy in a planetary health context would greatly aid in informing the development of a successful planetary health curriculum.

7.3 Recommendations for the integration of planetary health into undergraduate medical curriculum

As this research suggests; there is substantial demand from academics, undergraduate medical students and medical educators for the integration of planetary health topics into the medical curriculum. In order to fulfil this demand, significant developments need to be made within existing curricula.

Based on this research and on reflection of the barriers and facilitators that have been identified; formulated below are 10 recommendations, which aim to guide the successful integration of planetary health topics into undergraduate medical curriculum.

In particular - with reference to the local context – the curriculum reform currently underway at RCSI represents a golden opportunity to meet the demands of students and educators in endeavouring to deepen the integration of planetary health topics into undergraduate medical into student learning. When doing so, the recommendations below would serve to inform the successful implementation of this process.

1. **Demonstrate clinical relevance:**
    - Clearly demonstrating the importance of planetary health to practical clinical practice and overt health outcomes will improve buy-in from both students and faculty.
2. **Focus on the possibilities:**
    - Articulate defined actions and steps that can be taken both from an individual and systemic perspective to mitigate planetary health issues.
3. **Elect a green champion(s):**

- Encourage and develop the role of a green champion or green committee with a mandate for planetary health advocacy and curricular development within the institution.

4. **Utilise pedagogies that inspire active learning:**
    - Involve students in their learning in a pro-active way, utilise pedagogies that encourage active participation, discourse and engagement.
5. **Leverage the university brand:**
    - Seek institutional backing and senior management support for the inclusion of planetary health topics into the medical curriculum through the potential for enhancement of university prestige and standing.
6. **Educate the educators:**
    - Cultivate educator learning and education in tandem with the students, highlight the existing evidence base for these topics.
7. **Embed into existing curriculum:**
    - Weave planetary health throughout existing curriculum content and incorporate it into the diverse array of existing teaching modalities employed in undergraduate medical curriculum.
8. **Spiral the curriculum:**
    - Establish fundamental concepts in the early years of undergraduate medical training and build upon these concepts in subsequent years.
9. **Role-model sustainability:**
    - Strive to promote sustainable practice and planetary health awareness both institutionally and individually within a clinical setting; demonstrating practice points that reflect a delivered planetary health curriculum.
10. **Aim to cultivate global physicians:**
    - Focus on global health systems and on the interconnected nature of human issues, internationally. Foster an ethos of compassion and nurture inquisitivity about the factors that drive healthcare disparities around the world.

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Appendices

Appendix A - Participant Information Leaflet (Clinical Educator)



Information Leaflet RCSI

Participant Information Leaflet (Clinical Educator)

Study title: *Exploring the barriers and facilitators to the integration of planetary health into the undergraduate medical curriculum: A mixed-methods study of the perceptions and attitudes among students and educators at the Royal College of Surgeons in Ireland.*

Principal investigator's name: **Dr. Oisín Brady Bates**
Principal investigator's title: **Clinical educator/MSc Scholar**

Telephone number of principal investigator: **014022100**

Supervisor/co-investigator's name: **Dr. Debbi Stanistreet**

Supervisor/co-investigator's title: **Dr. Aisling Walsh**

Data Controller's/joint Controller's Identity: **Royal College of Surgeon's in Ireland**

Data Controller's/joint Controller's Contact Details: **014022100**

Data Protection Officer's Identity: **Donall King**

Data Protection Officer's Contact Details: **014028554**

You are being invited to take part in a research study to be carried out at RCSI, Stephen's green, Dublin by Oisín Brady Bates.

Before you decide whether or not you wish to take part, you should read the information provided below carefully and, if you wish, discuss it with your family or friends. Take time to ask questions – don't feel rushed and don't feel under pressure to make a quick decision.

RCSI

You should clearly understand the risks and benefits of taking part in this study so that you can make a decision that is right for you. This process is known as 'Informed Consent'.

You don't have to take part in this study. If you decide not to take part it will not impact negatively in any way on your professional standing.

You can change your mind about taking part in the study any time you like. Even if the study has started, you can still opt out. You don't have to give us a reason.

Why is this study being done?

Global warming and the climate crisis are among the defining issues of the 21st century. It is predicted that, in the coming years, these issues will have a damaging impact on health. Across the world there have been calls to introduce these topics into the curriculum for undergraduate medical students.

This project aims to investigate factors which might prevent or aid in the introduction of these topics into medical curriculum. This will be done through an investigation of medical student and clinical educator attitudes or perspectives towards these topics.

It is hoped that a thorough investigation of these factors will inform the development of and delivery of medical curricula in the future.

Who is organising and funding this study?

This study is being conducted as part of an MSc by research. This study is self-funded and no external interest-groups are involved.

Why am I being asked to take part?

The attitudes and perspectives of clinical educators comprise and invaluable part of this study. Educator attitudes and motivations directly influence the manner in which curriculum is taught. Further to this, educators have unique insight into the barriers and facilitators that contribute to successful curriculum delivery.

RCSI

You are being asked to participate in this study because you are a clinical educator who is actively involved in teaching undergraduate students. You may also currently have a role in aspects of curriculum development at RCSI. As such, your opinion and insights are extremely valuable.

How will the study be carried out?

This collection of data for this component of the study is in the form of one-on-one interviews.
This interview will take place at a time convenient to you. The interview will last approximately 30-45 minutes.
It will take place over Microsoft teams at a scheduled time of your choosing.

What will happen to me if I agree to take part?

If you are happy that you understand the information provided to you about this study and you consent to continue, we will organise a time and date convenient to conduct the interview.

Audio recordings

There will be an audio recording of the interview, which will be transcribed for analysis. All data will be pseudonymised i.e. your responses will be assigned a code and will not be attributable to you specifically. The link connecting your identifiable data to your code will be held solely by the principal investigator.

You will be given the opportunity to review your transcript, which can be emailed to you through a password protected file. **What are the benefits?**

There will be no individual benefit to you from taking this study.

There may be a benefit to others, as undergraduate medical students could benefit from improved university curricula informed by the findings of this study. The study investigators will benefit from this study as the findings will help achieve an academic qualification (principal investigator) and may be published as research (all investigators).

RCSI

What are the risks?

As the data in this study is pseudonymised rather than fully anonymised there is a risk that the data will be confidentiality of the data could be compromised. However, every effort will be made to ensure the confidentiality and pseudonymisation of participant data. This process is explained below. Some of your personal time will be needed to participate in this study, approximately 30-45 minutes.

Will it cost me anything to take part?

As this is a self-funded study, there will be there will be no reimbursement offered for travel expenses incurred during participation in the study.

Is the study confidential?

This study is completely confidential. All responses you give will be pseudonymised. This means that your responses will be assigned a code rather than any personal identifying information e.g. name/address/date of birth.
The audio recordings will be stored and identified using these codes. The electronic files will also be identified by code. They will be encrypted and password protected.

Only the principal investigator will have access to the document connecting the code assigned to your responses and your identifying information. This document will also be encrypted and password protected. It will be stored on a secure RCSI server.

Your data will be used to inform the results of the study. Exploring the attitudes of clinical educators towards the topics of climate change and environmental instability is a key component of the project. As part of the study we are also interested in analysing broad themes amongst participant answers with respect to demographic characteristics, specifically: Age/gender/Ethnicity/Continent of birth/Current year of study/ Medical speciality of interest.

Results from this study will be used as part of the submission of the principal investigator's MSc by research thesis at RCSI. The results may also be used as part of poster or slideshow presentations in the future e.g. at an academic conference. We will also seek to have the study and its results published in a reputable peer-reviewed journal.

RCSI

Data Protection

1. The purpose or reason for processing your personal data.

We will be using your responses in the interview to assess broad themes amongst the attitudes and demographic characteristics of clinical educators with respect to the integration of climate change topics into medical curriculum.

2. The legal basis under which your data is being processed

Legitimate interests and for scientific research purposes – see Article 6 and 9 of the General Data Protection Regulation 2016.

3. Who are the recipients of the data

There are three data processors involved in this study who will have access to your data in its pseudonymised form. The link connecting your identifiable data to your code will be held solely by the principal investigator.

4. How long will the data be stored for and, if it is not possible to say, please give the criteria which will be used to determine that period.

As per RCSI data protection guidelines data may need to be stored for up to 5-7 years. https://www.rcsi.com/dublin/research-and-innovation/research/resources-and-facilities/research-ethics/data-protection-and-storage

5. You should inform the data subject of any risks and/or implications that might arise for the data subject as a result of the data processing

There is a risk that the opinions expressed by you in this interview could be linked to you personally by others. This could occur if there was a breach in confidentiality This may cause psychological harm to you if you wish your data to remain confidential.

6. That the data subjects have a right to withdraw consent.

RCSI

At any stage of the interview or the processing of your data you may withdraw your consent to be involved in this study. This may be done by contacting the principal investigator by phone or e-mail. When your data has been analysed and results formulated, it will no longer be possible to withdraw consent.

7. That the data subjects have a right to lodge a complaint with the Data Protection Commissioner.

   You have a right to lodge a complaint with the Data Protection Commissioner.

8. That the data subjects have a right to request access to their data and a copy of it, unless their request would make it impossible or make it very difficult to conduct the research.

You have a right to request access to your data and a copy of it, unless your request would make it impossible or make it very difficult to conduct the research.

9. That data subjects have a right to restrict or object to processing, unless their request would make it impossible or make it very difficult to conduct the research e.g. the data subject doesn't want their data shared but doesn't mind having it collected and stored.

   You have a right to restrict or object to the processing of your data.

10. That the data subjects have a right to have any inaccurate information about them corrected or deleted, unless their request would make it impossible or make it very difficult to conduct the research.

    You have a right to have any inaccurate information about you corrected or deleted.

11. That the data subjects have a right to have their personal data deleted, unless their request would make it impossible or make it very difficult to conduct the research. e.g. they wanted to delete their data at the end of a research project just before it is due to be published.

    You have a right to have your personal data deleted.

12. That the data subjects have a right to data portability, meaning they have a right to move their data from one controller to another in a readable format.

    You have a right to data portability, meaning you have a right to move your data from one data controller to another in a readable format.

13. Will there be automated decision making, including profiling? Profiling is any form of automated processing of personal data consisting of the use of personal data to evaluate certain personal aspects relating to the person, in particular to analyse or predict aspects of their performance at work, health or behaviour.

    This study will include profiling in the sense that we will be analysing the relationship between your responses to interview questions with respect to your demographic characteristics (Age/gender/Ethnicity/Continent of birth/Current year of study/ Medical speciality of interest).

14. That the data subjects have a right to object to automated processing including profiling if they wish.

    You have a right to object to automated processing including profiling if you wish.

15. You must inform the data subject if you intend to further process their personal data and provide the data subject with information on that other purpose.

    You must give consent if any further processing is to be done on your personal data beyond what is outlined above.

16. You must inform the data subject if you wish to transfer their data to a country outside of the EU or an international organisation and advise them of the safeguards you have in place to protect their data.

    This study will not include transferring your data to a country outside of the EU. You must be informed if your data is to be transferred to a country outside of the EU or an international organisation and you must be advised of the safeguards in place to protect your data.

RCSI

Where can I get further information?

If you have any further questions about the study or if you want to opt out of the study, you can rest assured it will have no negative effect on you, professionally speaking.

If you need any further information now or at any time in the future, please contact:

Name: Oisín Brady Bates
Address: oisinbradybates@rcsi.com

Appendix B - Clinical educator participant consent form



Participant Consent Form RCSI

Clinical Educator PARTICIPANT CONSENT FORM

Study title: *Exploring the barriers and facilitators to the integration of planetary health into the undergraduate medical curriculum: A mixed-methods study of the perceptions and attitudes among students and educators at the Royal College of Surgeons in Ireland and on the island of Ireland*

I have read and understood the **Information Leaflet** about this research project. The information has been fully explained to me and I have been able to ask questions, all of which have been answered to my satisfaction.	**Yes** ☐	**No** ☐
I understand that I don't have to take part in this study and that I can opt out at any time. I understand that I don't have to give a reason for opting out and I understand that opting out won't affect my future medical care.	**Yes** ☐	**No** ☐
I am aware of the potential risks, benefits and alternatives of this research study.	**Yes** ☐	**No** ☐
I give permission for researchers ask questions regarding my demographic characteristics, specifically: Age/gender/Ethnicity/Continent of birth/Medical speciality of interest. I have been assured that information about me will be kept private and confidential.	**Yes** ☐	**No** ☐
I have been given a copy of the Information Leaflet and this completed consent form for my records.	**Yes** ☐	**No** ☐
I consent to take part in this research study having been fully informed of the risks, benefits and alternatives.	**Yes** ☐	**No** ☐
I give informed explicit consent to have my data processed as part of this research study.	**Yes** ☐	**No** ☐
I consent to be contacted by researchers as part of this research study.	**Yes** ☐	**No** ☐



Participant Name (Block Capitals) Date	Participant Signature
Translator Name (Block Capitals) Date	Translator Signature
Legal Representative/Guardian Name Date	Legal Representative/Guardian Signature

To be completed by the Principal Investigator or nominee.

I, the undersigned, have taken the time to fully explain to the above patient the nature and purpose of this study in a way that they could understand. I have explained the risks involved as well as the possible benefits. I have invited them to ask questions on any aspect of the study that concerned them.

Name (Block Capitals) Signature	Qualifications Date	

Appendix C - Example of interview transcript

Record-007.aac (Educator number 7)

Interviewer [00:00:05] Do you believe that climate change and environmental instability have any negative health effects for human beings?

Participant [00:00:17] Well, I suppose, yes. I mean, I think we've all kind of all kinds of negative health effects in terms of climate change, in terms of, you know, [00:00:32]pollution, particulate air quality. [2.3s] And I supposed to associate it, you know, economic aspects of it. [00:00:43]I mean, the link between climate change and the people that are most adversely affected by climate change are often already people that are vulnerable to health problems. [12.6s]

Participant [00:00:58]it just compounds all the problems in society. [3.0s] So I suppose the simple answer is yes. And in many different ways.

Interviewer [00:01:11] Yeah, perfect. So the kind of direct health effects you mentioned, like air pollution. And then, as you say, things that might exacerbate kind of determinants of health that would most negatively affect people who would be maybe lower socio-economic class statuses, that kind of thing. Would that be a fair assessment?

Participant [00:01:36] OK. Plus, as well I suppose, [00:01:39]people that are through no fault of their own having to work in environments that are more negatively affected by climate change. [10.6s] [00:01:52]So this particular group of people like miners and you know , [6.9s] [00:01:59]anybody that's associated with industries that are that are polluting, industries that are dirty. [7.5s]

Interviewer [00:02:11] Do you know - just touching on air pollution that you mentioned - any kind of specific detrimental health effects of air pollution itself?

Participant [00:02:22] Well, obviously, just good [00:02:28]evidence, I think, of the prevalence of respiratory conditions generally, you know, asthma, bronchitis, all kinds of lung conditions, a predisposition to cancer, carcinogens, fumes from traffic, et cetera, et cetera. [20.3s] Even in Dublin And I've noticed that myself indeed since I moved to RCSI

Participant [00:02:57] I work based in Cavan and I retired from clinical work three years ago. And I've been working in Spofford Building since then.

Participant [00:03:04] And so I commute across the city every day from a small apartment in Sandymount out over to Beaumont using the dart and the bus. [00:03:14]So you really become acutely aware of the, the air quality is visibly poor, at times when you walk into places. I noted walking into Connelly station; [10.6s] you can literally see the fumes as the diesel trains are waiting. You have to walk through that area to get to the Dart. [00:03:32]You're actually conscious

of the air that you breathe. Even standing at the bus stop you can literally almost feel that the poor air quality coming into your lungs.[12.3s]

Partipant [00:03:51]Yeah. I also worked in in Malaysia for three years as head of … out in Panang and I suppose I became very conscious of the issue of climate out there because, you know, the level of pollution, is even worse in Third World countries. You know, that they have, I suppose, especially countries with a lot of recent economic growth where they've had, a surge in industry and the economies of improved, but they don't have the history of managing waste. [37.2s] [00:04:29]And so where in Penang, where I worked the air quality was poor, was even worse in major cities like Kuala Lumpur. You know it got so bad at times you have to warn people, stay indoors and warn people that with asthma or anything. [18.0s] [00:04:47]And you know that the sea is polluted and it looks nice from a distance. You can't even swim in the sea. So, yeah. But, you know, you become, become more aware of the extent to which we're destroying our planet. [18.0s]

Interviewer [00:05:08] Yeah, it certainly seems to be the case that that kind of pollution and the health effects of that kind of pollution would affect more resource poor areas as well. And aside from the health effects of pollution, could you foresee any other health effects linked to environmental instability or climate change?

Participant [00:05:30] [00:05:30]Well, I suppose the whole issue of oh, of the use off of land and, you know, as we destroy, the agricultural base probably impacts on nutrition and availability of fresh food. [22.5s] [00:05:53]And also, I think that is that's obviously got broader health implications, heading into the future. And again, it's likely to be more impacted in poorer countries. [18.4s]

Participant [00:06:12] And even within countries,, [00:06:18]from a kind of a medical training point of view, I see a big link between, the green agenda and the whole issue of health care disparities and that idea. [9.7s]

Participant [00:06:29] I think that's a useful way of thinking, as a medic I've an interest in social justice.

Participant [00:06:38] And, [00:06:39]I have a concern that, our medical students, they're not getting enough, if you like, education or role modeling, perhaps in in in the bigger picture of health care. [20.6s]

Participant [00:07:02] and [00:07:02]gap between rich and poor and how and how that impacts health care disparities and how that is inherently linked with climate change as well. [13.9s] [00:07:16]And I suppose the fact that, especialling in RCSI, there is a bit of a arguably a certain conflict there, because so many of our own our student body come from countries that have economies which have expanded hugely on the back of a fossil fuel industry and whose future will. [27.3s]

Participant [00:07:44] So I think there's there's a certain, professionalism issue there that, you know, that's linked with climate change. [5.6s] In other words, [00:07:53]some of our students are coming from countries that are arguably benefiting most from the whole fossil fuel industry and the petrochemical industry in particular. You know, we think of the Middle East and even places like Malaysia whose wealth, is almost totally, derived from dirty industries. [29.0s]

Participant [00:08:25] So, I think that from the medical education point of view, I think we have,, [00:08:35]we have a challenge to find that balance. And I know I do. I really don't think we are choosing to face up with it. [12.2s] we make a model that's anodyne statements about producing a particular type of doctor.

Participant [00:08:57] [00:08:57]But, you know, we're very good at talking about professionalism with a small P.. I don't think we're very good at talking about professionalism with a big P because it encroaches on politics. It encroaches on big issues like social justice, health care disparities, the gap, you know, increasing gap between rich and poor and the huge health consequences that, even in terms of, some of the work that's been done. [33.5s]

Participant [00:09:49] We promote the RCSI as having high-tech simulation [facilities] and fancy new buildings. [00:09:58] But you know who's that going to benefit ultimately? It's probably going to benefit mainly people with money, you know? [8.5s]

Participant [00:10:22] [00:10:22]I think you can't separate climate change agenda from those other big agenda. [7.2s]

Participant [00:10:29] [00:10:29]And I think if one cause, one that's not really facing up to it, it's easy to talk about climate change and kind of in the abstract. [11.9s] [00:10:43]But I think unless you link it with what some of the other big issues. No, I'm not sure we're really going to influence change in a positive direction. But I'm thinking from my medical education. [12.7s]

Interviewer [00:10:57] So it sounds to me like from medical education perspective, you think that it's the responsibility of the curriculum to produce the graduate who has a bit of a social conscience and who has the social awareness at the very least. Kind of a global awareness and social issues. Do you that kind of awareness is inherently political? And if it is, How do you navigate that in terms of, not politicizing the curriculum, as well as, as you say, these kind of issues, the environmental issues are linked with issues of agenda, policy, social structure, and how would you how would you navigate that in curriculum?

Participant [00:11:36] Well, I think, [00:11:38] there is a movement, to build it into the curriculum. So I think, you can't avoid the reality of some of the things we're talking about so [16.8s]

Participant [00:11:56] [00:11:56]You can't really skirt around the reality of health care disparities and, the issue of, the choices that our graduates are going

to make. [13.3s] [00:12:10]So where where are our graduates going to choose work in? You know, when they graduate and what is going to influence those choices?[8.6s]

Participant [00:12:22] I think it's not enough to talk about, , leading the world in health care as we do the mantra that if you ask your side, you [00:12:37]know, if you're going to lead the world in health care, you're not going to do it by doing microsurgery and high tech, simulated inductively. [11.3s] [00:12:51]It may be leading the private health care industry and leading people to career paths on which they can make a lot of money, but it's certainly not going to be the world in health care. [11.6s] [00:13:04]If you're gonna do that, I think you need to have a much more public health ethos within the curriculum. [6.3s] Not only that, but you have to you have to walk, talk for the students.

Participant [00:13:17] You can't just expose students and attract students on the basis of "look at us, We've got the most fancy surgical techniques and technologies available".

Participant [00:13:29] "And we, we can we can treat the most challenging individual conditions. "

Participant [00:13:35] [00:13:35] I mean, there's pretty good evidence that medical students choices are actually quite influenced by the experience they have as undergraduates. [10.0s] So if you're going to be if you're only going to be exposing your medical students to, or attracting to medicine on the basis of technology, on the basis of highly resourced teaching hospitals.

Participant [00:14:01] [00:14:01]And if that's what they learn as undergraduates - you can't be surprised if if they gravitate towards highly resourced centers when they graduate and seek out opportunities and avoid opportunities to engage with the bigger issues of health care. And what would improve the health of society? Conversely, I think there's also good evidence that if students have rewarding experiences during the undergraduate years, [31.5s] I mean, I'm speaking from the perspective of psychiatry, there's pretty good evidence for example, there's a link with psychiatry and a sense of stigma because it's stigmatised, especially within [00:14:44]medicine. And so, you know, this there's good evidence that, for example, if medical students have a good experience of psychiatry, clerkships, it makes a difference, to career choice and to lifelong attitudes towards mental illness for yourself. [19.1s] Conversely, if they have a very negative or bad experience, they're more likely to continue to see psychiatry as kind of irrelevant, mental health as irrelevant to their day-to-day practices as clinicians. [00:15:16]So In terms of climate change, I think, well, I'm not an expert in that area. [7.2s]

Participant [00:15:24] [00:15:24]I think the same holds true that, if you if you really wanted to change the future behaviour of our doctors that we graduate, I think it has to start in the early undergraduate years. [15.3s] [00:15:40]All the evidence which would suggest that you need to integrate these elements into the

curriculum in a clinical sense, not just in an academic sense terms, but in terms of the hidden curriculum. [11.6s]

Interviewer [00:16:02] Thanks, Prof. I'd like to come back to that in a second, because there's a lot to touch on there. But before we do, just and I wanted to just touch on psychiatry again for a second. So in respect to health-effects, again, as someone from the field of psychiatry and having lots of experience teaching psych; do you think that the health effects of climate and health issues, environmental instability topics? Does that fall into the remit of psychiatry as well?

Participant [00:16:35] Yeah, I mean, I think it falls into the remit, particularly because, again, because of where we're already dealing with a marginalized patient group.

Participant [00:16:47] [00:16:47]In other words, that, you know, people with mental disorders are much more likely to be poor, they're much more likely to be unemployed, are much, much more likely to be living in adverse, you know, environmental situations and much more likely to be exposed to it. [23.3s] [00:17:12]You know, I think the cumulative effects of environmental hazards, on their health and their lifestyle are more likely to be smokers more. [12.3s] So you get this interactive effect across the board. [00:17:31]So, I see it as particularly poignant for psychiatry in that sense. You know, we already know the lifespan of somebody. If you've got a major mental illness you're likely to die 20 years younger than the average person. [21.2s] So if you've got schizophrenia or bipolar disorder, usually from you know, usually from multi-system diseases as a consequence of things like smoking or obesity, metabolic syndrome, et cetera, et cetera.

Participant [00:18:09] So, so that, again, I think, the way I try to look at it is to see the linkages, and conversely I think if you if you address a lot of these, [00:18:25]economic disparities and social disparities, they dovetail with the climate change agenda. [8.4s] [00:18:35]In other words, the more we destroyed our planet, you know, the more it's likely to affect people that are already vulnerable. [7.1s]

Interviewer [00:18:45] OK. Perfect. So all these kind of negative social determinants of health kind of amplify and weave in with each other. And that applies to morbidity associated with mental health issues and psychiatric issues.

Interviewer [00:19:00] And that the fact this those people tend to come from a cohort that are influenced by the negative effects of climate change as well. Perfect.

Interviewer [00:19:11] And so go back to the point you made previously about the importance of nurturing and fostering a positive attitude among students and positive experiences among students towards a topic in order to promote their professional interest in that topic and I know you touched on this already and you were saying that it could be sown through the undergraduate

curriculum and in a clinical sense as well to put it there. I suppose that's the "why" of the question. So I'm gathering that you do think that these topics should be in medical curriculum. And correct me if I'm wrong in saying that. I suppose my question to follow from that is, how do you think these topics should best be introduced into medical curriculum?

Interviewer [00:20:01] I know it's a big question.

Participant [00:20:04] And I think t like a lot of things, I think it's probably relatively little benefit from, , [00:20:16]bringing in a guest speaker to give a lecture to students once a year or twice a year. I think things like that tend to be cosmetic [7.2s] in the same way as, you know, for good heavens, the average doctor going to a conference, comes back usually very little apart from social benefit.

Participant [00:20:36] Whereas, in other words, [00:20:39]any intervention around a big issue has to be clinically meaningful. It [5.9s] has to be, what I'm going to do as a doctor rather than what people say I should be doing. Now, this is a great thing you should be doing. We should be doing that now.

Participant [00:20:57] So I think context is everything.

Participant [00:20:59] So I think if you were to say - I come from a community mental health background - so [00:21:11]there's pretty good evidence that if you place a student in a different context, then that influences things hugely. [8.0s]

Participant [00:21:20] In other words, if you have - for example, when I was in Penang, I brought the students in to local health centres, to learn psychiatry in primary care.

Participant [00:21:30] [00:21:30]And by simply by changing the context from a teaching hospital situation into a community clinic, public primary care setting, you're hugely changing the influence on the student. And, you're also offering an opportunity for the student to identify with an ethos that is different, an ethos that is more community oriented. [27.7s]

Participant [00:21:59] And you also expose them to interactions with other people of the world - [00:22:10]it's promoting a more cooperative approach. In other words, instead of a paternalistic doctor knows best approach, anybody who does community work knows that there is interdependency. [10.6s]

Participant [00:22:22] That's another key issue there, that any agenda around climate - they provide opportunities for students to learn interdependency and collaboration with people outside of your own frame of reference. [11.6s]

Participant [00:22:43] [00:22:43]And people that are passionate about some of these bigger issues, whether it's, health disparities, a public health ethos, or climate change. So I think context is a big factor and it's not rocket science. You know? [18.8s]

Interviewer [00:23:04] Perfect. So in terms of realizing the context and allowing students to feel that interdependency and to associate these environmental factors with their immediate setting or their futures setting as practitioners, how would you practically create that experience in curriculum, do you think?

Interviewer [00:23:29] What teaching methods or tools, do you think would work best to do that?

Participant [00:23:34] Well, the first thing I think you need leadership. [00:23:37]You need leadership on the part of faculty, especially senior faculty, but it has to come down from the it can't just be cosmetic, it has to be meaningful. [13.7s]

Participant [00:23:52] But, you have to have leadership in terms of, you can't expect the students find these contexts I'm talking about on their [00:24:00]own. So it does require leadership on the part of faculty to get out of the institution, engage with the multiplicity of players that are already involved in these areas of agenda. [18.4s] [00:24:19]You know, for example, in the area of, volunteer groups that are that are actually doing work in the community, whether it's in the area of working with marginalized people, or indeed, [17.5s] [00:24:37]people that are working in a real way with addressing climate change agenda, to look at the opportunities to collaborate, but also for the students to contribute - I think one thing we need to do better generally is seeing the students as a resource, not just as passive. [25.2s]

Participant [00:25:03] That's [00:25:03]one of the problems, especially in the RCSI, where we have this large group of students that we sort of parachute into settings and it's expected to influence them in a rather, passive way. [16.9s] And then they sort of parachute out again. And so I think we've a long way to go.

Participant [00:25:28] [00:25:28]We should really be seeing our students as people who have skills and resources and something that they can actually do meaningfully to be helpful, to be agents, that agency. [13.3s]

Participant [00:25:46] Having more, learning experiences in which the student actually contributes to quality care. You know, whether it's in in trusted clinical approaches. And there's a big literature of research on that. [00:26:06]I think certainly in psychiatry, we don't do enough of that. We don't know that the students don't get enough opportunities to feel useful. I think that a key learning issue is where if a student has exposure to a situation where they feel they're being helpful, they feel they're being useful in their field, [20.9s] [00:26:28]they're contributing to the quality of care for individual patients or for groups of patients. That's obviously going to attract them then to do more of that. [9.2s] When they have the opportunity in the future career.

Participant [00:26:42] And[00:26:43]we have graduate students, a significant percentage of graduate students that have sometimes very interesting educational backgrounds that are mature adults by the time they come into us.

And, it seems a shame not to, exploit that opportunity generally. [21.7s] [00:27:05]So I think that, to have, meaningful experiences that as a student can actually contribute, in feeling useful, I think, and interact in an interactive way. [16.5s]

Participant [00:27:22] I mean, a broad community setting, those are key elements and, of course, leadership from role models.

Participant [00:27:31] You know, the I mean, that's often a challenge when you're introducing change and you know that you have to have a generation that are going to teach the change or role model the change. That's a challenge, I think, for older faculty.

Participant [00:27:55] [00:27:55]You as a young man are interested in this as a research topic because it's going to , in a very concrete way, impact hugely on your generation, my children's [11.5s] [00:28:07]generation. So the question is, who's going to be among the faculty that we have at the moment? Are people sufficiently sensitive? [9.2s]

Participant [00:28:18] And, motivated by the climate change agenda to actually do [00:28:25]something meaningful in terms of leadership and even do they have the skills? Who's going to train the trainers in the institution on the climate change agenda?[18.0s]

Participant [00:28:54] [00:28:54]But maybe the role models need to come from, actually people that are passionate about it. [9.5s]

Participant [00:29:04] So maybe, you know, in each faculty, in each department, maybe from your point of view in terms of climate change agenda, [00:29:12]it might be useful to think about, you know, champions within a department that, you know, identify faculty members that are genuinely excited by the prospect of bringing these changes in. [13.7s] And then they in turn, provide leadership. There's good research literature we could do more in the curriculum generally, [00:29:38]that there's good evidence that students are influenced by role models within faculty and by also putting an attitude of humility,, there is an increasing trend now towards humility on the part of teachers, , humility on the part of people like me as being important ingredient in more modelling education, but also professionalism, as opposed to this grandiose, you know, moralistic, doctor knows best, paternalistic, [36.1s], if you're a role model, that when you can't be surprised that our students that are just like and are not particularly interested in some of the things we're talking about.

Participant [00:30:26] [00:30:26]So I think we need to be looking for faculty that have those qualities and, that may well largely come from the younger faculty. But it shouldn't. It needs to be supported by senior faculty. [17.6s]

Interviewer [00:30:46] I really like that idea of having these climate champions within faculty that would then, I suppose, disseminate these kind of issues within the educator circles and within different departments. Do you think this kind of

teaching should be the realm exclusively of these singular, passionate individuals? Or do you think that the idea is that obviously they champion and then that all educators, should have an awareness of this? Or do you think it should be confined to a more specific niche areas within teaching, within curriculum?

Participant [00:31:31] [00:31:31]I think there has to be a top-down element to it. I think you could be very hard working and passionate, but you could be a voice in the wilderness within the department. [10.7s] If you're a department head is sceptical or cynical about your activities, then you're not going to get anywhere. [00:31:50]So I think it needs to be you can't just have champions of change in a particular direction within any given department. There has to be a coherence. It has to be visibly enacted. [13.6s] There has to be recognition of its importance, , right from the start of school, the term down.

Participant [00:32:20] [00:32:20]In other words, you have to walk tall from that, from the top down. I think otherwise you will you will find that people will burn out.

Participant [00:32:45] For the [00:32:46]average medical educator, they're not going to keep hammering away at some change agenda if they feel that it's not being supported. [9.5s] So, I do think it actually has to, there has to be a Top-Down process as well as the more grassroots.

Interviewer [00:33:15] So that's obviously a barrier that you would foresee potentially to achieving and getting these topics into curriculum is that there might not be the top-down buy-in that would be needed in order to keep the energy going and to keep the relevance high for educators within different departments within the school as a whole. Is that a barrier that you think is likely or unlikely to occur at RCSI?

Participant [00:33:47] [00:33:47]I think it's likely. I think, especially maybe at the moment in the sense the big, big challenge in RCSI is to find the balance between recruitment of students and everything else. [18.7s]

Participant [00:34:06] In other words, that the [00:34:08] the dominant agenda, especially now with COVID, is on economic survival of the institution. [9.6s]

Participant [00:34:19] And you notice that the preoccupation is with ensuring sufficient numbers of students to keep [00:34:29]the show going and to keep all the activities and the research and the faculty and all the staff paid, et cetera, anything that threatens that agenda is likely to be avoided. [20.0s]

Participant [00:35:04] The fact that, you know, [00:35:06]RCSI has 70 percent I think it is foreign students in membership so that, again, we're largely recruiting from countries in which, it's probably fair to say that, but it's not foremost on their minds. [24.8s] And so there are parallels, I think, again, speaking as a psychiatrist, when we're trying to deliver psychiatry.

Participant [00:35:43] [00:35:43]I mean, the content of students who are coming from countries in which mental health is way down , health care services delivery agenda, and there are particularly high levels of stigma. So, that does increase the challenges we face in psychiatry. [20.2s]

Participant [00:36:03 It's going to be hard, but on the other hand, I think it can be reframed. I mean, the other reality is that if we if we don't address climate change, we're all going to lose anyway. So that, that can be turned around as well. An if RCSI was clever and taking a longer-term view, you [00:36:41]could see potential in exploiting the climate change agenda. I think actually they could do the same when it comes to these social disparities' agenda. That the gap between rich and poor and so on, because you know that all the evidence would be that, if you're serious about leading the world in healthcare, [29.8s] you have to get serious about public health issues and you have to take a public health perspective. [00:37:19]If you're serious about public health, you have to be serious about the climate change agenda. You know, it is the arguably the dominant agenda. [8.9s] And it's what's driving people like you and your generation in politics.

Participant [00:37:33] When we saw a turn out for, people in the Greens recently and, again, among young people and older people, [00:37:47]there is a generally generational issue there that, newer generation and younger people are much more aware of them than[9.8s]

Participant [00:37:58] [00:37:58]people of my age. Because the stakes are higher. Because the stakes are so high. [5.1s]

Interviewer [00:38:05] So there are a couple of facilitators you mentioned there to counterbalance a couple of the barriers - you mentioned perhaps that there wouldn't be educated buy in: a facilitator here that you mentioned would be to incentivise RCSI buy-in in terms of getting recognition as an institution, a forward-thinking institution that supports social justice, to make that part of the kind of identity of the University. They could get recognition for that.

Participant [00:38:49] And even the green agenda? I mean, let's face it, it sounds trite but I mean, the university also, [00:38:57]already I think the RCSI has really brought in a higher level, the level of CEO, especially in the dean they've brought in. They've bought into this lifestyle change agenda. They're bringing these guest speakers who talk about, about mental, wellness and positive psychology. [00:39:38]They obviously want to identify with that and promote that as part of the RCSI brand. If you want. And that's fine. But, yeah, I think the green agenda would fit nicely with that. [16.2s]

Participant [00:39:56] Personally, [00:39:57]I would like to see them go farther in in the area of social justice and health care disparities. [7.3s] [00:40:06] I think that's where it gets a little bit more political. I mean, again, from North American students, the preoccupation seems to be, how can our North American students get into the top residency programs in North America? [19.4s] You know, we

want everybody to work in the Mayo Clinic. [00:40:30]Do we want all our graduates to work in the Mayo Clinic or do we want our graduates to work in resource constrained settings that are actually going to do an awful lot more for health care in the world in the future? [15.0s]

Participant [00:40:45] There was a GP, Rhodes Scholar who gave a talk last year as a doctor and gave a public lecture and he was talking about one clinic in the states where they do nothing but colonoscopies. [00:41:00]So they do a thousand colonoscopy a week and they don't do anything else so that, , they make an awful lot of money just doing these. And there's no evidence base for the colonoscopies. There's absolutely no evidence base as opposed to FOB. But give that as an example of the choices that some doctors are going to make. So that's what you get. That's what it is. You know, do we want to produce doctors that are going to go into a clinic to do a thousand colonoscopies if we can? Nothing else, because that's where they can make most money? [35.5s]

Participant [00:41:37] I think it's you know; these are some of the trickier aspects of it.

Interviewer [00:41:44] Yeah, whether the underlying motivations are, I suppose compassionately motivated, or are financially and fiscally motivated. And definitely it's a cultural thing and it's a cultural decision on the part of institutions that often fosters those perspectives from the graduates as well. And another barrier you mentioned I suppose was that; the RCSI has its mind on economic viability. And as you said, a lot of the students are foreign students and there is an idea that something like climate issues - you make a comparison to mental health issues - might be seen as less relevant to the students and maybe a softer subject in that way. And if RCSI were to lean more into that, it might make RCSI a less attractive curriculum for those foreign students to come and buy their education at RCSI. And a kind of a counterbalance that you mentioned was that the students - you think that in general, in general, the younger generation is more aware of these issues. And you see it kind of a paradigm shift in how young people are addressing and are kind of engaging with these issues.

Interviewer [00:43:10] I suppose overall in RCSI, what's your sense of the student cohort? Do you think that they are a cohort that do see the relevance of these topics?

Interviewer [00:43:21] And if not, how would you promote the relevance? I know you've touched on this a lot already, but I suppose in terms of specific ways, how to you promote the relevance of these topics to the student body as well. Like, you mentioned, things like engaging in a community and trying to make students useful in terms of their, possibly volunteering with something in the line with green issues or environmental activism, I suppose. Are there any other ways you'd make this more relevant to students?

Interviewer [00:44:04] Do you even think it needs to be made more relevant. There's a third prong to this question a third prong to that question. This is a

long-winded question, a three-pronged attack question. I know a lot of students are quite exam motivated and Mark's motivated.

Interviewer [00:44:24] So how would you assess the knowledge of these students then? If they are being taught, if that was a way to make it more relevant, how would you envision assessing these students? Would you assign marks to it or would you make it more a voluntary basis?

Participant [00:44:41] Yeah, I think you would have to assign marks to. [00:44:44]I mean, if you're if you're serious about building it into the curriculum in a meaningful way, I think you have to build it into the assessment. [6.2s] And the same goes for the other things we're talking about.

Participant [00:44:56] I mean, if the schools don't know anything about health care disparities, by the time they come out Uni, I see it as a sign then that we have failed them, you know? [00:45:08]And so, you know, it has to be meaningfully incorporated in into the curriculum. [6.3s] I think you're [00:45:16]right. I mean, that the candidates claim that the students are preoccupied with their marks. It's very hard to get them. I know that from an educator. [8.2s] You know that your students are pragmatic. [00:45:28]They're goal directed and coming from, either backgrounds or families who have spent a lot of money to support them, paid huge fees. And, I think we're not going to change that. [18.4s] So. [00:45:49]So, yes, certainly I think that it's hard to sell something to students that has some kind of a remote long-term benefit, you know, on our purely altruistic grounds. [14.0s] [00:46:06]I'd do teaching with reflective learning, for example. And, , that's a job. That's part of the challenge. You know, you're asking them to project themselves forward. This is this is a situation you might face as a doctor on the ward in three years' time. [17.8s]

Participant [00:46:25] For example, with some dilemma, an ethical dilemma or an actual dilemma, a professional dilemma. How would you behave?

Participant [00:46:33] You know, [00:46:33]get them to reflect and be proactive. And that's a challenge because what percentage of the marks do you know are reflective writing? How much is it worth? What do I have to do to get better action learning assignments? [18.9s] And you're never going to change that. So I think that, any of these things we're talking about, I think, you can't just have them as an ancillary.

Participant [00:47:07] [00:47:07] If you if you if you approach them as ancillary to the main, they're going to be treated that way by the students. [11.2s] And you can't blame, the students. You know, people are people, and that's not going to change.

Participant [00:47:28] There's no point in teaching or having learning opportunities without putting it into any assessment evaluation.

Participant [00:47:50] You know, projects, whatever it is, there has to be incentives and rewards for student to engage. But, it can be influenced. Certainly.

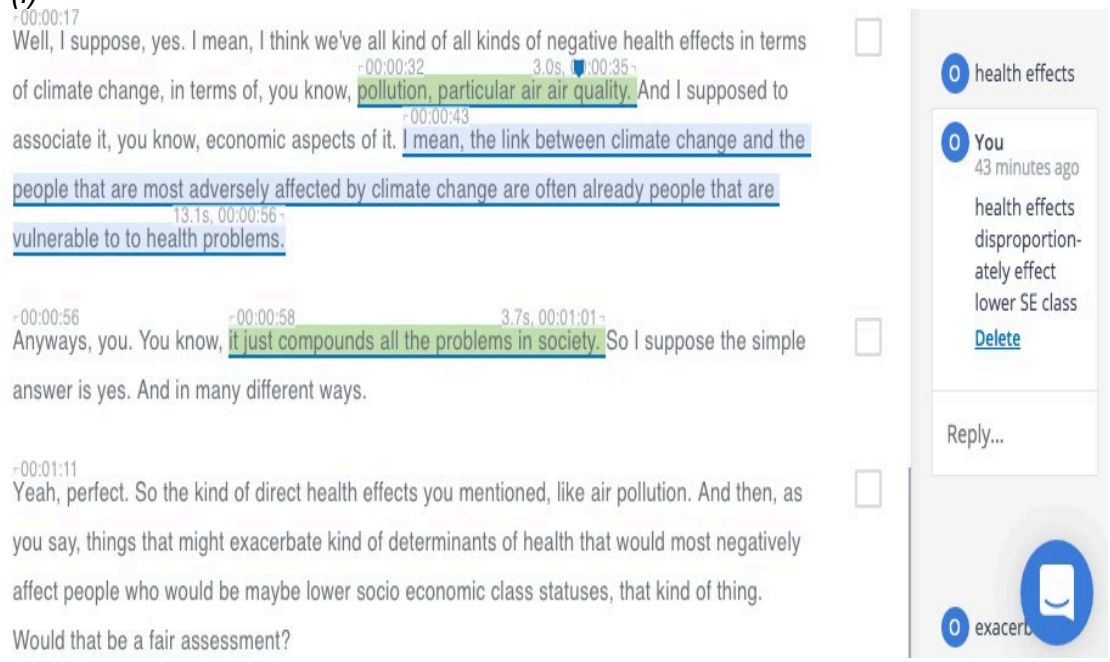
Certainly. You can have students energised. I mean, you might have students starting out quite sceptical. [14.5s] But in psychiatry, we get this all the time and students say, oh, I came into psychiatry, afraid that everybody with mental illness is going to be violent and so on. And it's nothing like I thought it would be.

Participant [00:48:31] And, people getting out into community settings and interacting with patients and other disciplines, thinking it can be [00:48:44]transformed. So there's no reason why that couldn't be the principal, that that experience couldn't be replicated. [15.4s] You know, in other areas of activity. But, it has to be interwoven with the clinical agenda not being there can't be something that cause in parallel with clinical experience, it has to be clinically relevant. [12.8s] I think maybe the clinical relevance of climate change needs to be interwoven convincingly into the curriculum.

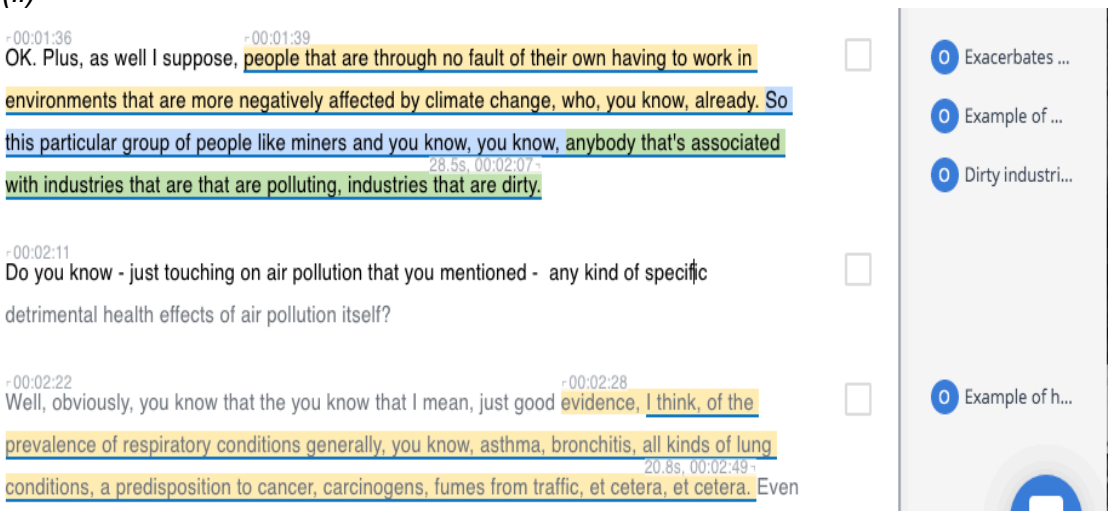
Interviewer [00:49:33] Mm hmm. Mm hmm. Thanks very much, Prof. and that's great to get your insight.

Appendix D - Example of line-by-line coding of qualitative interviews in Trint web-app

(i)



(ii)



Appendix E - Example of line-by-line coding table in word

Data Extract (Educator No. 7)	Early descriptive coding
"Well, obviously, you know that there [00:02:28]is good evidence, I think, of the prevalence of respiratory conditions generally, you know, asthma, bronchitis, all kinds of lung conditions, a predisposition to cancer, carcinogens, fumes from traffic, et cetera, et cetera. [20.3s] Even in Dublin And I've noticed that myself indeed the last since I moved to RCSI..	- **Health effect: Respiratory disease** - **Health effect: cancer** - **Detrimental effects of pollution (environmentally mediated health effects)**
Participant [00:03:04] And so I commute across the city every day from a small apartment in Sandymount out over to Beaumont using the dart and the bus. [00:03:14]So you really become acutely aware of the, you know, the air quality is visibly poor, you know, at times when you walk into places. I noted walking into Connelly station; [10.6s] you can literally see the fumes as the diesel trains are waiting. You have to walk through that area to get to the Dart. [00:03:32]You're actually conscious of the air that you breathe. Even standing at the bus stop you can literally almost feel that the poor air quality coming into your lungs.[12.3s]	- **Detrimental effects of pollution (environmentally mediated health effects)** **- Health effects related to increased urbanization (environmentally mediated health effects)**
Partipant [00:03:49] Yeah. So it's. [00:03:51]Yeah. I also worked in in Malaysia for three years as head of psychiatry out in Panang and I suppose I became very conscious of the issue of climate out there because, you know, the level of pollution, you know, is even worse in Third World countries. You know, that they have, I suppose, especially countries with a lot of recent economic growth where they've had, a surge in industry and the economies of improved, but they don't have the history of managing waste. [37.2s] [00:04:29]And so where in Penang, where I worked, the air quality was	- **Resource poor countries worst effected** - **Poor infrastructure = worse health effects**

poor, was even worse in major cities like Kuala Lumpur. You know it got so bad the times you have to warn people, stay indoors and warn people that with asthma or anything. [18.0s] [00:04:47]And you know that the sea is polluted and it looks nice from a distance. You can't even swim in the sea. So, yeah you become, become more aware of the extent to which we're destroying our planet. [18.0s]	- **Health effect: Respiratory disease** - **Detrimental effects of pollution (environmentally mediated health effects)** - **Ecosystem and habitat destruction** - **Belief that humans are negatively affecting the environment globally**

Appendix F - Sample of the broad initial themes from the early descriptive codes/categories

Early descriptive codes/categories	Broad initial theme
- Resource poor countries worst effected - Poor infrastructure = worse health effects - Belief that humans are negative effecting the environment globally - Ecosystem and habitat destruction - Health effects related to increased urbanization (environmentally mediated health effects) - Detrimental effects of pollution (environmentally mediated health effects)	- Social and cultural context - Global impact - The interlinking nature of health effects
- Health effect: Respiratory disease - Health effect: cancer - Health effect: Respiratory disease	- Listing of Individual health effects

Appendix G - Example of the development of final themes and overarching concepts through category development

Category Development	Final themes	Overarching concepts
• Health-effects disproportionately affect resource-poor countries • Air pollution/Respiratory illness • Infectious Disease • Weather events/changing climate/food and water security • Healthcare costs and inefficiencies • Mental health • Ecosystem instability • Cancer • Skepticism • Global doctors • Doctors with a social conscience/ awareness of social and cultural context • Encourage new skills in graduates • Skepticism	- Knowledge of health effects - Relevance to medical education	• The link between planetary health and medical education
• Clinically relevant • Framework for educators • Expert/external education experience • Involve students in the teaching • Case-based and small-group learning • Overt module/didactic teaching • Embed into all teaching	- How it should be taught - When it should be taught	• The practicalities of content delivery

methodologies • **Epidemiology and public health** • **Spiral throughout the years** • **Earlier vs. later**		
• **Perceived lack of relevance among students** • **Perceived lack of relevance among staff** • **Lack of knowledge amongst educators** • **Overcrowded curriculum** • **Lack of support from policy-makers** • **Lack of evidence base** • **- Demand from students** • **Demand from physicians and faculty** • **Buy-in from university policy makers** • **Green champions/committee** • **Opportunity with an already changing curriculum** • **Enhances the University brand** • **Evidence base** • **COVID-19 pandemic**	- **Barriers** - **Facilitators**	• **Barriers and facilitators**

Appendix H - The quantitative survey

Section 1: Environmental attitudes of respondents (NEP)

Listed below are some statements. Please indicate to what extent you agree or disagree with each opinion. There are no right or wrong answers.

1. We are approaching the limit of the number of people the Earth can support.
   a. Strongly agree ☐
   b. Mildly agree ☐
   c. Unsure ☐
   d. Mildly disagree ☐
   e. Strongly disagree ☐

2. Humans have the right to modify the natural environment to suit their needs.
   a. Strongly agree ☐
   b. Mildly agree ☐
   c. Unsure ☐
   d. Mildly disagree ☐
   e. Strongly disagree ☐

3. When humans interfere with nature it often produces disastrous consequences.
   a. Strongly agree ☐
   b. Mildly agree ☐
   c. Unsure ☐
   d. Mildly disagree ☐
   e. Strongly disagree ☐

4. Human ingenuity will ensure that we do not make the Earth uninhabitable.
   a. Strongly agree ☐
   b. Mildly agree ☐
   c. Unsure ☐
   d. Mildly disagree ☐
   e. Strongly disagree ☐

5. Humans are seriously abusing the environment.
   a. Strongly agree ☐
   b. Mildly agree ☐
   c. Unsure ☐
   d. Mildly disagree ☐
   e. Strongly disagree ☐

6. The Earth has plenty of natural resources if we just learn how to develop them.
   a. Strongly agree ☐

b. Mildly agree ☐
c. Unsure ☐
d. Mildly disagree ☐
e. Strongly disagree ☐

7. Plants and animals have as much right as humans to exist.
a. Strongly agree ☐
b. Mildly agree ☐
c. Unsure ☐
d. Mildly disagree ☐
e. Strongly disagree ☐

8. The balance of nature is strong enough to cope with the impacts of modern industrial nations.
a. Strongly agree ☐
b. Mildly agree ☐
c. Unsure ☐
d. Mildly disagree ☐
e. Strongly disagree ☐

9. Despite our special abilities, humans are still subject to the laws of nature.
a. Strongly agree ☐
b. Mildly agree ☐
c. Unsure ☐
d. Mildly disagree ☐
e. Strongly disagree ☐

10. The so-called "ecological crisis" facing humankind has been greatly exaggerated.
a. Strongly agree ☐
b. Mildly agree ☐
c. Unsure ☐
d. Mildly disagree ☐
e. Strongly disagree ☐

11. The Earth is like a spaceship with very limited room and resources.
a. Strongly agree ☐
b. Mildly agree ☐
c. Unsure ☐
d. Mildly disagree ☐
e. Strongly disagree ☐

12. Humans were meant to rule over the rest of nature.
a. Strongly agree ☐
b. Mildly agree ☐
c. Unsure ☐
d. Mildly disagree ☐
e. Strongly disagree ☐

13. The balance of nature is very delicate and easily upset.
    a. Strongly agree ☐
    b. Mildly agree ☐
    c. Unsure ☐
    d. Mildly disagree ☐
    e. Strongly disagree ☐

14. Humans will eventually learn enough about how nature works to be able to control it.
    a. Strongly agree ☐
    b. Mildly agree ☐
    c. Unsure ☐
    d. Mildly disagree ☐
    e. Strongly disagree ☐

15. If things continue on their present course, we will soon experience a major ecological catastrophe.
    a. Strongly agree ☐
    b. Mildly agree ☐
    c. Unsure ☐
    d. Mildly disagree ☐
    e. Strongly disagree ☐

Section 2: Acknowledgement of climate change & ecological instability
This next set of questions is about your opinion in regards to environmental change and human health. Please read each question carefully and fill in the appropriate response that best represents your opinion.

1. Which one of the following five statements below best represents your understanding of how the climate system works?
    a. Climate is stable within certain limits. If the changes are small, climate will return to equilibrium, if they are large, there will be abrupt and catastrophic impacts ☐
    b. Climate is random. We do not know what will happen. ☐
    c. Climate is slow to change. Climate change will gradually lead to dangerous impacts. ☐
    d. Climate shows a delicate balance. Small changes will have abrupt and catastrophic impacts. ☐
    e. Climate is very stable. Climate change will have little to no impact. ☐

Please indicate your opinion on the following statements:

2. Climate change is a completely natural phenomenon, uninfluenced by human behaviour.
    a. Strongly agree ☐
    b. Somewhat agree ☐

c. Mildly agree ☐
d. Neither agree nor disagree ☐
e. Mildly disagree ☐
f. Somewhat disagree ☐
g. Strongly disagree ☐

3. Climate change is ultimately harmful.
   a. Strongly agree ☐
   b. Somewhat agree ☐
   c. Mildly agree ☐
   d. Neither agree nor disagree ☐
   e. Mildly disagree ☐
   f. Somewhat disagree ☐
   g. Strongly disagree ☐

4. Environmental change will have negative health effects for human beings.
   a. Strongly agree ☐
   b. Somewhat agree ☐
   c. Mildly agree ☐
   d. Neither agree nor disagree ☐
   e. Mildly disagree ☐
   f. Somewhat disagree ☐
   g. Strongly disagree ☐

5. Please indicate to what extent you feel addressing the potential health-related impacts of climate change through medical practice is worthless or valuable (the numbers two - six between "Worthless" and "Valuable" represent a scale on which you would rate your opinion, with two being the closest to worthless and six being the closest to valuable).
   a. Worthless ☐
   b. Two ☐
   c. Three ☐
   d. Four ☐
   e. Five ☐
   f. Six ☐
   g. Valuable ☐
6. Please indicate to what extent you feel addressing the potential health-related impacts of climate change through medical practice is harmful or beneficial (the numbers two - six between "Worthless" and "Valuable" represent a scale on which you would rate your opinion, with two being the closest to harmful and six being the closest to beneficial).
   a. Harmful ☐
   b. Two ☐
   c. Three ☐
   d. Four ☐
   e. Five ☐
   f. Six ☐
   g. Beneficial ☐

7. On a scale of 0-100, 0 being no knowledge at all, and 100 signifying knowledge of everything there is to know about the subject, what would you say is your level of knowledge about the potential health-related impacts of climate change?

   0-100

8. Using the same scale of 0-100, 0 being no knowledge and 100 signifying knowledge of everything there is to know about the subject, what level of knowledge do you believe medical students should have about the potential health-related impacts of climate change?

   0-100

Section 3: Climate change health effects and medical curriculum

Please indicate your opinion on the following statements:

1. It is important to make environmental change and its health-effects a part of medical curriculum
   a. Strongly agree ☐
   b. Somewhat agree ☐
   c. Mildly agree ☐
   d. Neither agree nor disagree ☐
   e. Mildly disagree ☐
   f. Somewhat disagree ☐
   g. Strongly disagree ☐

2. I feel that students at RCSI get enough teaching about the health effects of environmental change
   a. Strongly agree ☐
   b. Somewhat agree ☐
   c. Mildly agree ☐
   d. Neither agree nor disagree ☐
   e. Mildly disagree ☐
   f. Somewhat disagree ☐
   g. Strongly disagree ☐

3. The following are a list of direct and indirect health-effects which may be associated with climate change.

Please think about whether each of these issues:

A. Has already increased due to climate change
B. Will increase in the next 20 years due to climate change
C. Poses a significant health-risk to human beings, globally
D. Is on the medical curriculum here at RCSI
E. If not, should this be included in the curriculum at RCSI

Please indicate your opinion on each of these issues by selecting “Yes”, “No” or “Don’t know” for each of columns A,B,C and D.

	Has already increased due to climate change & ecological instability	**Will increase in the next 20 years due to climate change**	**Poses a significant health-risk to human beings, globally**	**Is on the medical curriculum here at RCSI**	**If not, should this be included in curriculum at RCSI**
Heat-related illness	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐
Extreme weather events	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐
Vector-borne Infectious diseases	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐
Air pollution	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐
Cold-related illness	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐
Drought	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐
Famine	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐
Deterioration in mental health	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐
Loss of	Yes ☐	Yes ☐	Yes ☐	Yes ☐	Yes ☐

biodiversity	No ☐ Don't know ☐	No ☐ Don't know ☐	No ☐ Don't know ☐	No ☐ Don't know ☐	No ☐ Don't know ☐
Migration	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐
Increasing global conflict	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐	Yes ☐ No ☐ Don't know ☐

Please indicate how you think the topics of climate change and ecological instability would best be integrated into curriculum at RCSI (you may write as little or as much as you like)?

Section 4: Demographics

4. What age are you?
    a. Years
5. What is your gender?
    b. Male ☐
    c. Female ☐
    d. Non-binary ☐
6. What is your ethnicity?
    e. Asian ☐
    f. Arab ☐
    g. Black/African-American ☐
    h. Caucasian ☐
    i. Hispanic ☐
    j. Caribbean ☐
    k. Pacific Islander ☐
    l. Prefer not to say ☐
7. What is the continent of your birth?
    m. Asia ☐
    n. North America ☐
    o. South America ☐
    p. Europe ☐
    q. Africa ☐
    r. Australia ☐

s. Prefer not to say ☐

8. What is your current year of study?
    t. Foundation year ☐
    u. Year 1 ☐
    v. Year 2 ☐
    w. Year 3 ☐
    x. Year 4 ☐
    y. Final year ☐
9. What medical speciality do you think you would most like to pursue in your career e.g. cardiology/general practice/vascular surgery/orthopaedics etc.?

    Speciality:

End of Survey

Appendix I - Participant information leaflet (undergraduate medical students)



Information Leaflet RCSI

Participant Information Leaflet (Undergraduate Medical Students)

Study title: *Exploring the barriers and facilitators to the integration of planetary health into the undergraduate medical curriculum: A mixed-methods study of the perceptions and attitudes among students and educators at the Royal College of Surgeons in Ireland and on the island of Ireland*

Principal investigator's name: **Dr. Oisín Brady Bates**
Principal investigator's title: **Clinical educator/MSc Scholar**

Telephone number of principal investigator: **014022100**

Supervisor/co-investigator's name: **Dr. Debbi Stanistreet**

Supervisor/co-investigator's title: **Dr. Aisling Walsh**

Data Controller's/joint Controller's Identity: Royal College of Surgeon's in Ireland

Data Controller's/joint Controller's Contact Details: 014022100

Data Protection Officer's Identity: Donall King

Data Protection Officer's Contact Details: 014028554

You are being invited to take part in a research study to be carried out at RCSI, Stephen's green, Dublin by Oisín Brady Bates.



Before you decide whether or not you wish to take part, you should read the information provided below carefully and, if you wish, discuss it with your family or friends. Take time to ask questions – don't feel rushed and don't feel under pressure to make a quick decision.

You don't have to take part in this study. If you decide not to take part it will not impact negatively in any way on your professional standing.

Why is this study being done?

Global warming and the climate crisis are among the defining issues of the 21st century. It is predicted that, in the coming years, these issues will have a damaging impact on the health of the everyday person. Across the world – there have been calls to introduce these topics into the curriculum for undergraduate medical students.

This project aims to investigate factors which might prevent or aid in the introduction of these topics into medical curriculum. This will be done through an investigation of medical student and clinical educator attitudes and perspectives towards these topics.

It is hoped that a thorough investigation of these factors will inform the development of and delivery of medical curricula in the future.

Who is organising and funding this study?

This study is being conducted as part of an MSc by research. This study is self-funded and no external interest-groups are involved.

Why am I being asked to take part?

In order to plan for the integration of climate change topics into medical curriculum, it is crucial to explore the attitude of undergraduate medical students towards the topic.

You have been asked to participate in this study because you are an undergraduate medical student with first-hand, current experience of medical curriculum. As such, your opinion and insights are extremely valuable.

How will the study be carried out?

RCSI

This collection of data for this component of the study is in the form of an online questionnaire.
You may complete this questionnaire online, at a time convenient to you. The questionnaire will be completed using the Surveymonkey online survey tool (https://www.surveymonkey.com/).

A link to the questionnaire will be sent to you in an e-mail. It should not take more than 20 minutes to complete.

What will happen to me if I agree to take part?

If you are happy that you understand the information provided to you about this study you may complete the online questionnaire.

What are the benefits?

There will be no individual benefit to you from taking this study. Your responses in this survey will be anonymised and completely confidential. Participation in this survey is voluntary: it holds no bearing on your current academic curriculum and will not influence your grades in any way.

There may be a benefit to others; undergraduate medical students could benefit from the information gleaned from this study. We hope that it will inform and guide the development and delivery of medical curriculum at RCSI/other institutions in the future. This survey is being conducted as part of an academic qualification and as such the principal investigators will benefit from the survey in that it will aid this.

Your answers in this survey will be completely anonymised by the Surveymonkey online survey tool. The investigators in this study will not be able to link your individual answers to you, specifically. The Surveymonkey online data will not retain any information about you, including your IP address/cookies and Surveymonkey does not support external tracking software such as Google Analytics on their online surveys. Information on the anonymisation of data by the Surveymonkey survey tool can be found here: https://www.surveymonkey.com/curiosity/surveymonkey-committed-to-gdpr-compliance/

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Your anonymised data will be kept in a password-protected and encrypted file on a secure RCSI server.

Your data will be used to inform the results of the study. Exploring the attitudes of undergraduate towards the topics of climate change and environmental instability is a key component of the project.

As part of the study we are also interested in analysing broad themes amongst participant answers with respect to demographic characteristics, specifically: Age/gender/Ethnicity/Continent of birth/Current year of study/ Medical speciality of interest.

Results will be used as part of the submission of the principal investigator's MSc by research thesis at RCSI. The results may also be used as part of poster or slideshow presentations in the future e.g. at an academic conference. We will also seek to have the study and its results published in a reputable peer-reviewed journal.

Data Protection

1. The purpose or reason for processing your personal data.

We will be using your responses in the questionnaire to assess broad themes amongst the attitudes and demographic characteristics of undergraduate medical students with respect to the integration of climate change topics into medical curriculum.

2. The legal basis under which your data is being processed

Legitimate interest and for scientific research purposes – see Article 6 and 9 of the General Data Protection Regulation 2016.

3. Who are the recipients of the data?

There are three data processors involved in this study who will have access to your data in its anonymised form.

4. How long will the data be stored for and, if it is not possible to say, please give the criteria which will be used to determine that period.

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As per RCSI data protection guidelines data may need to be stored for up to 5-7 years. https://www.rcsi.com/dublin/research-and-innovation/research/resources-and-facilities/research-ethics/data-protection-and-storage

5. You should inform the data subject of any risks and/or implications that might arise for the data subject as a result of the data processing

There is no risk associated with participating in this study.

6. That the data subjects have a right to withdraw consent.

At any stage of the questionnaire you may withdraw from this study. When you have submitted your answers in the online questionnaire it will not be possible to withdraw, as the investigators will have no way of linking your responses to you, specifically.

7. That the data subjects have a right to lodge a complaint with the Data Protection Commissioner.

You have a right to lodge a complaint with the Data Protection Commissioner.

8. That the data subjects have a right to request access to their data and a copy of it, unless their request would make it impossible or make it very difficult to conduct the research.

You have a right to request access to your data and a copy of it, unless your request would make it impossible or make it very difficult to conduct the research. However, in the case of this study, data will be anonymised and there is no way for the investigator to link your data to you.

9. That data subjects have a right to restrict or object to processing, unless their request would make it impossible or make it very difficult to conduct the research e.g. the data subject doesn't want their data shared but doesn't mind having it collected and stored.

You have a right to restrict or object to the processing of your data.

10. That the data subjects have a right to have any inaccurate information about them corrected or deleted, unless their request would make it impossible or make it very difficult to conduct the research.

    You have a right to have any inaccurate information about you corrected or deleted.

11. That the data subjects have a right to have their personal data deleted, unless their request would make it impossible or make it very difficult to conduct the research. e.g. they wanted to delete their data at the end of a research project just before it is due to be published.

    You have a right to have your personal data deleted.

12. That the data subjects have a right to data portability, meaning they have a right to move their data from one controller to another in a readable format.

    You have a right to data portability, meaning you have a right to move your data from one data controller to another in a readable format.

13. Will there be automated decision making, including profiling? Profiling is any form of automated processing of personal data consisting of the use of personal data to evaluate certain personal aspects relating to the person, in particular to analyse or predict aspects of their performance at work, health or behaviour.

    This study will include profiling in the sense that we will be analysing the relationship between your responses to interview questions with respect to your demographic characteristics (Age/gender/Ethnicity/Continent of birth/Current year of study/ Medical speciality of interest).

14. That the data subjects have a right to object to automated processing including profiling if they wish.

    You have a right to object to automated processing including profiling if you wish.

15. You must inform the data subject if you intend to further process their personal data and provide the data subject with information on that other purpose.

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You must give consent if any further processing is to be done on your personal data beyond what is outlined above.

16. You must inform the data subject if you wish to transfer their data to a country outside of the EU or an international organisation and advise them of the safeguards you have in place to protect their data.

    This study will not include transferring your data to a country outside of the EU. You must be informed if your data is to be transferred to a country outside of the EU or an international organisation and you must be advised of the safeguards in place to protect your data.

Where can I get further information?

If you need any further information now or at any time in the future, please contact:

Name: Oisín Brady Bates
Address: oisinbradybates@rcsi.com